THE CHANNEL FERRY.

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ADVANTAGES AND FEASIBILITY
OF A
TRAIN-FERRY
BETWEEN ENGLAND AND FRANCE.

COMPILED BY
ERNEST DE RODAKOWSKI.

WITH PLANS AND TABLES.

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PREFACE.

THE information and statistics contained in this book were originally collected and compiled in order to meet Parliamentary enquiry into the merits of the Channel Ferry Bill, presented on behalf of the Intercontinental Railway Company, Ltd., in the Session of 1905. The subject having attracted considerable attention on more than one occasion in the past, publication of the Scheme in book form was suggested from various quarters.

It is believed that the whole question of unbroken railroad communication between this country and the Continent is presented in a more complete form than hitherto, and that the trade and traffic figures may be of somewhat general interest, owing to their being an attempt at calculating the weight of the whole trade of the United Kingdom.

I wish to thank the Statistical Department of the Board of Trade and Sir W. G. Armstrong, Whitworth & Company, for the information and assistance they have given me, and especially Mr. H. W. Ashley (of the Ann Arbor Railroad) for the courtesy with which he has put his great experience and knowledge on the subject of train-ferries at my disposal.

E. DE RODAKOWSKI.

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CHAPTER I.

UNBROKEN COMMUNICATION BETWEEN ENGLAND AND FRANCE.

Stages of development of intercommunication across Nature's obstacles—Fords, boats, tunnels, bridges—Reasons for successive substitutions—Development a function of the volume of traffic—Intercommunication across the English Channel still primitive—Purpose of present book—Advantage to passengers of uninterrupted railway communication across the Channel—Reason why Railway Companies run through-carriages—Advantages to merchandise from uninterrupted railway communication across the Channel—Avoidance of double handling—Disadvantage of breaking bulk—American meat train, Southampton-London—Abolition of broad gauge, and substitution of standard gauge—The cost of transhipment—Reduced charges for packing—Some opinions expressed before Select Committee which considered question of Channel Tunnel in 1883—Attention attracted to problem of intercommunication for more than a century—Problem to be solved either by train-ferry, tunnel or bridge—Advantages and disadvantages of the three alternatives—Questions of public policy and national security—Train-ferry possibly a precursor of tunnel or bridge.

In the development of communication across a river there are three well-marked stages. To begin with, men search out a place where the water is so shallow that they can wade or drive a horse and cart across, and so establish a ford; this method is at once the earliest and the most primitive, for its possibility is rigidly determined by the natural formation of the river-bed and banks, and it implies no mastery whatsoever over the forces of nature. The next stage consists in the employment of boats, whether they be rafts of the rudest construction or large vessels fitted with powerful propelling machinery.

These constitute an enormous advance over the ford inasmuch as they are more independent of natural conditions and can be contrived at a far larger variety of points, though even they are subject to the limiting factors that a certain depth of water is required and that the current must not be too strong. But compared with a ford they are expensive to build and to work, and have the further disadvantage of involving transhipment of passengers and goods at both sides of the stream, unless they are built of such size as to be able to transport loaded vehicles, when in fact they become floating roadways. The most perfect solution of the problem of communication across a river is reached in the third stage where a bridge or tunnel annihilates the obstacle altogether, and, forming a fixed continuous roadway, permits passengers and vehicles to pass from one side to the other, as if the water-barrier were non-existent.

On analysing the reasons which lead men successively to substitute boats for a ford and a bridge or tunnel for boats, we find that they may all be summed up in the phrase "economy of time and trouble," or still more compendiously as " economy of money." Fords cost little or nothing, but they are only possible here and there, and the would-be crosser of a stream may have to make a detour of many miles in order to find one, with consequent loss of time and waste of energy—in other words, sacrifice of money. Ordinary boats are more expensive than a ford and entail disadvantages of their own, such as exposure to wind and weather and delays in embarkation and disembarkation—all expressible in terms of money—but, on the other hand, they may save many miles of travel and thus justify their existence from the economical standpoint. Similarly a balance of advantages over costs determines the substitution of steamers for row-boats or sailing vessels, and of ferry-boats carrying vehicles for boats which involve transhipments.

Again, a steamer or ferry service will only give place to a bridge or tunnel, when one of the latter can be constructed at a cost which does not outweigh the solid advantages to be gained in the way of convenience and rapidity of transport. In general, these will be a function of the volume of traffic, and so it happens that for railways it has been found worth while to spend huge sums on bridges and tunnels in thousands of places where such expenditure would be sheer madness had only the accommodation of ordinary road traffic to be considered.

Examples of all the stages in the development of communication across water outlined above exist, or have existed, in our own country, but we have now reached the final stage of bridge or tunnel in the case of almost every river or arm of the sea that offers interruption to any trade-route of importance. There is, however, one striking exception. We are separated from the continent of Europe by a narrow strait of sea only some 23 miles wide, and there, in spite of the magnitude of the traffic that has to pass in passengers and goods, we are still content to rely on the most primitive method of communication possible in the circumstances, namely boats, and to suffer the disadvantages of double transhipment from train to boat and boat to train. It is true that the boats employed have for years been undergoing a continuous process of improvement, until now, in point of size, speed and comfort, they are among the best of their kind in the world. But the fact remains that, whatever the advances in degree, the only means of communication at present available across the English Channel is in essence the same as it was some two thousand years ago when the Romans first landed in these islands.

On the principles advanced above, this state of arrested development can only be justified on the supposition that the advantages to be derived from uninterrupted physical communication between the two sides of the Channel are outweighed by the cost and difficulty attending its establishment. The abstract desirability of passengers being able to cross without change of carriage, and goods without transhipment or breaking of bulk is, we think, undeniable; the question is, can those advantages be practically realized without prohibitive expenditure? The purpose of the present book is to answer this question in the affirmative, and to show that, as a sound commercial proposition, they can be secured with the existing volume of traffic, quite apart from the increase which always follows extended facilities. This object would, it is claimed, have been fully attained by the plan of a train-ferry brought before Parliament in the Session 1905. In subsequent pages this scheme will be described in full detail, but meantime it will be well to consider briefly the main advantages that would result from uninterrupted railway communication across the Channel, by whatever means it be established.

To take passengers first. The great benefit they would secure is travelling from London, and possibly other large British cities, to important centres on the Continent, without change of carriage. It is easy to belittle through carriages in theory, and to say that it is absurd to spend large sums of money, merely that people may be saved the trouble of moving their hand-baggage from a train to a boat or *vice versâ*, but experience shows that as a matter of fact through carriages are an institution highly appreciated by the travelling public. If this were not the case, it would be impossible to understand why British railways should have troubled themselves with the remarkable extension of through services that has taken place in recent years. That passengers should be able to travel without change between London and such commercial centres as Manchester, Leeds, or Glasgow, might be taken as a matter of course, in view of the extensive business relations involved between such places, but for many of the cross-country through services now in daily operation, justification of this kind can scarcely be alleged. When we consider such complicated services as that from Newcastle to Bournemouth (established by the Great Central in 1902, and involving the co-operation of four or five different Companies), or notice how the through service started in 1904 by the London & North-Western and Brighton Companies, between Lancashire and holiday resorts on the south coast, has now been imitated by the Great Northern, Midland, and London & South-Western Companies, it is impossible to resist the conclusion that in the opinion of railway managers, who, after all, are probably best qualified to judge in this case, there is a very great demand for the convenience afforded by through carriages. It is not as if such services were simple matters to arrange; on the contrary, they require most careful planning in order to make the running times meet the exigencies of the traffic on the different lines concerned, and suit the convenience of travellers; they involve complicated arrangements for the interchange of rolling stock, and they by no means conduce to economy of operation.

If there is a keen demand for through passenger communication by land, the case is even stronger when the continuity of a journey is broken by a strip of water that obliges passengers to transfer themselves to a steamer and back again to a train. The change from one train to another at a junction on land may usually be performed in fair comfort, with some protection at least from wind and weather. But in our arrangements for embarking on a Cross-Channel steamer we have not as yet reached such a degree of refinement, and the operation in most cases—and Dover is unmistakably among the number—involves complete exposure on an open pier to whatever unpleasantness the weather is indulging in at the moment. Those who pretend that in such circumstances through carriages are not a thing worth troubling about, may be invited to contemplate the spectacle afforded by a man carrying a dressing-bag in one hand, a bundle of rugs in the other, and longing for a third with which to hold on his hat, as he stumbles in a storm of wind and rain down a steep gangway from the Admiralty Pier at a time when the tide is low and the deck of the steamer is ten or twelve feet below the level of the quay. If they still persist in the opinion that there is no call for some improved method of communication that would avoid such disagreeables, or suggest that passengers would not be ready to welcome and pay for relief, they will find few people to agree with them, least of all the victim just pictured.

But even in perfectly fine weather the change from the train to the boat is not without personal discomfort. In the daytime, indeed, it may sometimes be found a pleasant interlude; but at night it is nothing but a nuisance which, by depriving passengers of their sleep, adds seriously to the fatigue of travelling. The traveller going to Paris leaves London about nine at night, reaches Dover about eleven, departs from Calais about two, and arrives in Paris at six in the morning. It is too early for most people to sleep on the train between London and Dover, there is no time on the boat for anything more than an uneasy doze, and the only time when a proper sleep is possible is during the four hours between Calais and Paris. On the return journey the passenger's discomforts are even greater. He is turned out of the train at Calais at half-past one, spends the next two hours between Calais and Dover, and finally arrives in London at the hideous hour of 5.30 in the morning. Could anything be more barbarous? And will anyone suggest that if a passenger could get a berth in a sleeping-car, or the corner of a third-class carriage, in which he could remain without disturbance from the beginning of his journey to the end of it, he would not embrace the opportunity with enthusiasm and gladly pay a reasonable sum for the extra convenience.

This is what through physical communication between England and the Continent would do for the mere bodily comfort of passengers, whose number, there can be no doubt, would be enormously increased by the removal of the discomforts at present inseparable from crossing the Channel. It would also do much to expedite the journey, and it seems to be a generally accepted axiom that everyone who travels is filled with a burning desire to get to his destination as rapidly as possible. Under the present system much time is necessarily wasted while luggage is being transferred from the train to the boat or *vice versâ*, while still greater delay is occasioned by the transfer of the mails. In the case of luggage some attempt is made to hasten the process by the aid of mechanical devices. But all that can be said for the method adopted for handling the mails is that it has the charm of primitive simplicity and inefficiency; for this age of invention has been able to devise nothing better than the employment of a swarm of men who take the mailbags by twos and threes from the postal van, carry them across the pier, and shoot them down into the mail-room of the steamer. If through communication were established, the time consumed in the transfer of luggage would be saved, because it would not be transferred at all but would simply remain in the van in which it was placed in London until taken out at Paris. Similarly the mails would be conveyed in a through sorting car or cars, which would be transferred bodily, and the additional advantage would be gained that more time would be available for sorting *en route*—a fact which might possibly permit of later collection or earlier delivery.

In regard to goods, the advantages resulting from any form of unbroken communication consist of the possibility of carrying truck-loads of merchandise undisturbed across the Channel, and avoiding the double handling otherwise necessitated at two ports.

The first objection to such transhipments is their expense. Passengers transfer themselves from one railway carriage to another, or from a railway carriage to a steamer, at no expense to the company which is undertaking their transportation; but goods cannot move of themselves, and therefore have to be transferred by means of expensive machinery or possibly still more expensive manual labour. The cost of such transfer naturally varies with the character and volume of the traffic and with the perfection of the appliances employed; with a commodity like coal or iron-ore, it may be expressed in pence per ton, whereas with bulky, fragile, or perishable articles it may be a question of several shillings. Transhipment of articles of the latter class, and often of articles of any class, indeed involves a violation of the principle that to operate cheaply you must operate on a large scale. For instance, a waggon-load of bales of wool or a van full of cases of eggs is comparatively speaking a wholesale quantity, but when it becomes necessary to "break bulk", and to lift each bale or case

FIG. I.—AMERICAN MEAT TRAIN : SOUTHAMPTON DOCKS TO LONDON.

[*To face page* 6.

separately out of the railway vehicle and transfer it separately to the hold of a ship, you are at once dealing with retail quantities and necessarily incurring the expenses implied in operating on a petty scale.

By way of illustration reference may be made to the methods adopted by the London & South Western Railway for conveying American meat from Southampton to London. At Southampton the meat is not loaded into railway trucks, but into ordinary road vehicles, as will be seen from Fig. 1. These, placed in pairs on railway trucks, are conveyed up to London, and, on their arrival, horses are attached to them and they are driven off to their destinations. In this way a considerable addition is made to the dead weight of the trains, for each pair of road vans weighs between three and four tons ; but the extra cost thus involved for haulage is more than counterbalanced by the saving of expense effected by the avoidance of the additional handling which the meat would otherwise have to undergo. Again, the reason which led the Great Western to spend large sums of money in abolishing the broad gauge and substituting the standard gauge all over its system was merely the desire to save the expense and inconvenience of transhipping goods at points where its lines touched those of companies using the standard gauge ; and it is the same expense of transhipment that constitutes the great objection to a mixture of gauges, such as is the bane of Australian railways.

The precise amount of the cost of transhipment at Dover and Calais at the present time is not a matter of public knowledge, but according to a statement made in 1883 before the Select Committee on the Channel Tunnel,* by Mr. J. Staats Forbes, the actual cost involved in the shipment of the London, Chatham and Dover Railway Company's goods business at Dover and Calais worked out to *2s. 6d.* a ton at the former port, and to *2s. 7d.* a ton at the latter. Even when allowance is made for the contingency that the methods now employed mark some advance over those used twenty-two years ago, this statement at least warrants the conclusion that the expenses of transhipment still constitute an important item in the whole cost of transporting goods across the Channel.

* Report from the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, Question 1,671.

But the out-of-pocket expenses entailed by the mere movement of the goods do not exhaust the total cost incidental on the operation. There is loss of time to be taken into account. Even in the most favourable case, when the steamer is waiting ready to receive the contents of the trucks, or *vice versâ*, the transfer of the goods involves delay in despatch. If there is no correspondence between trucks and steamers the delay is obviously accentuated, and may lead to consequences out of proportion to its duration. For instance, it may cause the consignors to lose their market, and, apart from the specific damage thus arising in any particular case, the knowledge that such an accident is liable to happen is quite sufficient to divert traffic to another route where regularity of transit seems more assured, or even to stop it altogether.

Another serious disadvantage of transhipment is that it means double handling of the goods conveyed, and this in turn means two extra chances of damage to fragile and delicate articles. A waggon load of slates, properly packed, may travel for hundreds of miles over a railway without damage, but the result of transferring them to a cart, and unloading them at a builder's yard, may easily be a considerable percentage of breakages. Through communication, by abolishing two handlings, would *pro tanto* increase the likelihood of safe transit, and this consideration becomes the more important when it is remembered that most of the articles now passing through Dover and Calais, on their way to or from the Continent, are of a kind especially liable to damage in this way. Indeed it seems probable that the risk of damage consequent on double transhipment has deterred traders from even attempting to send certain classes of goods across the Channel.

A great deal of evidence bearing on these points was presented to the Select Committee which considered the question of a Channel Tunnel in 1883. For instance Sir Jacob Behrens, who was especially concerned with the trade in woollen and worsted goods, gave it as his opinion* that an unbroken line of rails connecting every part of Great Britain with all parts of the Continent—a result which it may be remarked is attainable as well by a train-ferry as by a tunnel—would have a more powerful effect upon the development of our export

* Report from the Joint Select Committee of the House of Lords and the House of Commons, on the Channel Tunnel, Question 4,455.

trade than upon our import trade. "What the trade mostly would "be benefited by, is the closer and more frequent personal inter-"course between producer and consumer, and by the quicker and "more certain transport of goods. It is the long time now required "for goods reaching their destination on the Continent which "prevents many purchases which otherwise would be readily made, "particularly by retail houses who are accustomed to supply their "daily wants from the wholesale dealers in their own neighbour-"hoods." He also said that he thought there would be a considerable saving in respect of the hindrances to trade occasioned by transhipment, loading and unloading.* Mr. Henry Lee, M.P., a manufacturer of fancy cotton goods, said† that his method of packing goods intended for France was more expensive in consequence of the transhipment than if they were sent direct by train; they had to be packed in stronger boxes, and the more they were handled the more they were liable to be injured. Mr. Godfrey Wedgwood‡ detailed the saving that would be effected if pottery could be packed in bulk into a through truck instead of into crates, and expressed the belief § that that saving would enable him to compete with Continental pottery wares to an extent to which he could not compete in existing conditions. Similar opinions, expressed by many other witnesses fully competent to judge, all point to the conclusion that the establishment of through railway communication between Great Britain and the Continent might confidently be expected, not only to increase the volume of the present trade, but also to develop entirely new branches. (Some further extracts from opinions expressed by or before Parliamentary Committees dealing with the question of intercommunication will be found in the Appendix.)

After this brief account of the advantages to be derived from the establishment of unbroken communication across the Channel, we may devote a few words to the problem of its practical realization. If, in place of the Straits of Dover, there had been land of the character existing on both sides of them, or even if there had been a

* Report from the Joint Select Committee of the House of Lords and the House of Commons, on the Channel Tunnel, Questions 4,460 and 4,461.

† *Ibid.*, Question 1,112.

‡ *Ibid.*, Question 1,412.

§ *Ibid.*, Question 1,413.

mountain barrier like the Alps, there can be no doubt that nothing would have prevented the laying of railway lines across the intervening space, in order to link up the railway system of Great Britain with that of the Continent, and that long ago London would have been a centre from which express *trains de luxe* would have radiated to almost every capital in Europe. But a geological accident having caused a break of continuity in the land, this solution is out of the question, and consequently we must look to other devices which the resources of engineering science place at our disposal.

As will be seen from the following chapter, the problem has been engaging attention for more than a century, and the extraordinarily large number of detailed solutions that have been put forth in the course of that period, bear witness to the attraction which it has exercised on thoughtful minds. Some of the suggested plans are, it is true, little more than the vain imagining of uninstructed amateurs, but a considerable proportion represent the sober and well-reasoned conceptions of responsible engineers, and, as such, are entitled to respectful consideration. Naturally, they differ widely in detail, but nearly all of them may be classified under three main types—train-ferries, tunnels, and bridges. All are quite competent to do what is required, namely, enable the same railway vehicles with their loads to be run at will on the lines both of Great Britain and of the Continent, and in the long run the choice between them must be determined, on the one hand, by considerations of engineering practicability, cost of construction, and relative efficiency when made, and, on the other, by regard for extrinsic inconveniences, if any, to which each may be subject.

The practicability of building large steamers to carry trains of railway vehicles on their decks is amply demonstrated by experience. The particulars given in Chapter III. show that many such vessels are now at work in various parts of the world, successfully performing the services for which they were designed, and there are no peculiarities affecting such a service between Dover and Calais which are not paralleled by available experience. The distance between those ports is much shorter than many of the routes over which train-ferries are already plying; the problem of lifting or lowering the railway vehicles so that they may be run directly upon the railway lines laid on the ship's decks, whatever the difference of level occasioned by the tides, is one which has been encountered and solved in other train-ferries ; the stormy weather occasionally met with in the Channel is not worse than that which has to be provided against in the case of the train-ferries on Lake Michigan ; and as to navigation in fog, the ordinary steam packets plying between Dover and Calais find their way across with little delay even in very thick weather, and it will scarcely be contended that the train-ferry boats will be any less able to do the same merely because they are loaded with railway vehicles.

In regard to a bridge between Dover and Calais, the first remark that suggests itself is that engineers have no experience of building a similar work of equal magnitude on land, and still less over a deep arm of the sea, affected by strong tidal currents and swept by violent storms. That fact, however, by no means warrants the conclusion that it could not be made. Bridges are in existence with piers laid in waters as deep as those of the Straits of Dover, and with spans as long and as far elevated above the sea as the advocates of a Channel bridge think necessary; and when an engineer of the eminence of Sir Benjamin Baker commits himself to the statement that, as an engineering proposition, such a bridge is feasible, the practicability of constructing it may be admitted.

There is a similar lack of experience in regard to a submarine tunnel of such great length, but that has not deterred many distinguished engineers from believing that its construction is perfectly possible. Probably, however, none of them would deny that there are grave elements of risk and uncertainty involved, owing to the impossibility of obtaining exact information as to the strata through which it would be bored, and to so eminent an authority as the late Sir John Fowler this aspect of the matter appealed with such force that he pronounced the tunnel to be " not a proper mode " of providing the through communication of which he was an ardent advocate, and regarded the proposal as passing from " practical business into the region of dangerous speculation."

If, however, we admit that from an engineering standpoint either a tunnel (or its variant, a submerged tube resting on the sea-bottom), or a bridge, is as practicable as a train-ferry, the next question which arises is that of cost. Here the advantage is definitely on the side of the ferry. The estimate for the cost of the ferry steamers and necessary works on both sides of the channel put forward by the promoters of the International Communication Bill, in which Sir John Fowler was a moving spirit, and which all but received the sanction of Parliament in 1872, was £2,200,000, and this estimate was reduced by more than one-half in the closely similar proposals of the Intercontinental Railway Company, which were brought before Parliament in 1905. Some of the estimates for bridge and tunnel schemes will be found in Chapter II. One of the lowest ever suggested for a tunnel, including the connecting lines and other subsidiary works at each end, was £8,000,000 (Sir John Hawkshaw*); and this estimate was made subject to no unexpected contingency arising in the course of construction. But he would be a rash man who made his calculations on the assumption that no accident would happen; if, for example, the sea gained access through a fissure in the chalk the cost of finishing the work would be immensely enhanced, and it might not improbably be found necessary to abandon the undertaking altogether. The cost of a bridge would be still greater than that of a tunnel; the project of the Channel Bridge and Railway Company (1892) was estimated to cost £32,740,000,† and a single winter-storm might easily do such damage to the half-completed works as to add millions to the total cost of completion.

Another important point in relation to cost is that, in the case both of a tunnel and of a bridge, the works would have to be fully completed, and therefore practically the whole of the required capital expended, before a farthing could be earned by the carriage of goods or passengers; that is to say, the capital expenditure could not in any degree be regulated by the amount of traffic obtained. With a train-ferry, on the contrary, it would be possible to begin almost in an experimental way, and to a large extent to proportion the capital outlay to the amount of revenue, since additional boats, and if necessary extra landing places, need only be provided as warranted by the development of the traffic. In consequence, a train-ferry scheme would not have to struggle in its initial stages with a heavy load of unproductive capital such as would almost of necessity have to be borne by a tunnel or a bridge.

* Report from the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, Question 462.

† "Channel Bridge," page 81.

But, granted that initially a train-ferry would be much cheaper to establish than communication by tunnel or bridge, it may be argued that its advantages in this respect would be more than counterbalanced by its relative deficiencies as a means of transporting traffic. A bridge, it may be said, being a piece of railway with wide curves and easy gradients, would afford unrivalled facilities for carrying a dense traffic, and, subject only to the limitations entailed by fog, long trains could be run at a high average speed (40 and 50 miles an hour or more), and at very frequent intervals, according to the number of block signal stations it was thought desirable to instal. The same would be true of a tunnel, though perhaps in a less degree owing to the gradients unavoidable at both ends, and to the fact that trains could not be run quite so frequently in view of the awful consequences of a collision in the dark. On the other hand, it may be argued that the capacity of a train-ferry would be limited, and its speed not more than half that attainable on a bridge, so that the amount of traffic that could be moved in a given time would be very much less.

The superiority thus claimed for a bridge or tunnel is subject to certain limitations in practice, but, without entering into a discussion of these, it may be pointed out that the mere provision of a very large capacity is of no advantage unless there is a chance of its being practically utilized. For a man with no likelihood of ever possessing more than a hundred sovereigns to build a strong room capable of holding a million would be mere waste of money. Similarly there would be no advantage in incurring the outlay necessary to construct a bridge or tunnel capable of accommodating 100 or 200 trains a day, when all the traffic actually passing could be carried in 10. As will be seen from figures adduced later in this book, the total goods traffic passing between Dover and Calais amounts to about 55,042 tons annually, or say 150 tons a day, which could be taken by two or three trains. Again, three passenger trains are now run daily from London to Dover in connexion with the boats for Calais. Hence, if we say that eight trains would be required to accommodate the traffic at present carried between Dover and Calais, we shall be allowing a liberal margin. Of course the establishment of unbroken railway communication between England and the Continent, with consequent abolition of the "dreadful break" which competent authorities have long recognised as exercising a curb on the development of the traffic, would undoubtedly stimulate the passage both of passengers and goods; but he would indeed be a sanguine man who could expect that increase to amount to twenty-fold or even ten-fold, as would be necessary to give full employment to the capacity which has sometimes been assigned to the tunnel and bridge. Sir John Fowler asserted that a train-ferry service would be perfectly competent to deal with any conceivable amount of traffic passing between England and France, and when it is remembered that the number of ferry-boats in use, and, if necessary, of landing places also, can be multiplied indefinitely, as required by the exigencies of increased business, this assertion appears to be thoroughly justified. The vast amount of goods carried by the Père Marquette Ferry, which, as will be seen in Chapter III., amounted to about 1,300,000 tons in 1904, is further evidence in favour of Sir John Fowler's opinion.

Finally we may ask whether, apart from economic considerations, there are reasons of public policy which may be held to operate against all or any of the methods suggested for securing unbroken communication. The answer is in the affirmative as regards both the tunnel and the bridge. The Select Committee on the Channel Tunnel, in 1883, heard evidence from numerous distinguished soldiers to the effect that its construction would, in a military sense, convert this country from an insular into a Continental power, and would expose us to new risks of invasion from which in present conditions we are held inviolate by the sea. The fear that a few men might come through unseen, seize the approaches, and thus permit the passage of a larger force, may to some minds appear exaggerated or even imaginary; but, however that may be, the view that a tunnel involves new dangers of this kind, and that its construction is therefore inadvisable, is the official one to which at present the Government of this country stands committed;* and its reversal will be indispensable before

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* In the House of Commons on 20th of July 1905, in answer to Lord Edmond Fitzmaurice, who asked the Secretary to the Board of Trade whether any communication had recently taken place in regard to the construction of the Channel Tunnel between the British and French Governments; and whether it was proposed by His Majesty's Government to continue the prohibition which had for so many years prevented the further progress of the works on the British side of the Channel, Mr. Bonar Law replied, "I am not "aware that any communications have recently taken place, or that anything has "happened to alter or modify the position which has been assumed with regard to this "matter."

the tunnel can be regarded as coming within the range of practical politics.

As to the bridge scheme, it has not yet run the gauntlet of official criticism, but, if ever it does, it would not be surprising to find it also condemned on account of the facilities it might offer for smuggling through a small band of invaders. It has already met with decided objections from sailors, who allege that it would constitute an intolerable obstruction to navigation in one of the busiest waterways in the world. These objections are not likely to be overcome by promises of elaborate lighting arrangements and danger signals on every pier of the bridge, for the sailor is not yet born who would willingly exchange an unobstructed sea for one strewn with obstructions, no matter how well lighted; and if ever a bridge is sanctioned it will be in the teeth of opposition from the maritime interests, not only of Great Britain, but also of all countries whose shipping uses the Straits of Dover.

On the other hand, no one has seriously suggested that train-ferry boats would provide any greater facilities for invasion than the ordinary steamers now running, or that they would in any way constitute a greater hindrance to navigation.

To sum up, the desideratum of uninterrupted railway communication across the Channel would be secured either by a train-ferry, a tunnel or a bridge. Regarded purely as a means of through communication, without reference to cost or any other consideration, either of the two latter would in some respects be superior to the former, which, however, in present circumstances, is perfectly adequate to do all that is wanted. It may be that in time the traffic will grow to such an extent as to justify the huge expenditure required for a tunnel or a bridge; but that time is not yet even within sight. Pending its arrival, common sense suggests the advantage of following the ordinary course of development of communication across a wide belt of water, of adopting the cheapest method available for attaining the end in view, and of exhausting the possibilities of water communication before turning to grandiose schemes which certainly cannot pay their way at present, whatever may be the case in the dim future, and which, moreover, carry with them grave objections from the standpoint of public interests.

CHAPTER II.

Previous Attempts at Solving the Problem.

History of former proposals for intercommunication, classified as tunnels, bridges, and ferry boats—Tunnels under the sea bed—Mathieu, 1802—Thomé de Gamond—William Lowe—Lord Richard Grosvenor—Sir John Hawkshaw—International Committee, 1867—George Remington's oval tunnel in 1865—The Channel Tunnel Company's Act, 1875—The Submarine Continental Railway Company and Sir Edward Watkin—Joint Select Committee of the House of Lords and House of Commons, 1883—Parliamentary sanction of tunnel considered inexpedient—Tunnels through the sea—Cast-iron tube at bottom of sea, 1803—Victor Horeau, 1851—Payerne, 1855—Favre—Nicholl—Vacherot—Numerous tube schemes in 1869—Zerah Colburn's scheme for dragging tube into sea by means of 100 ships—Bunau Varilla's tube scheme—Bridges over the Straits—Thomé de Gamond, 1836—Charles Boyd's marine viaduct—Vérard de Sainte Anne, 1870—The Channel Bridge and Railway Company, 1884—Submarine bridges—Train-ferries—Evan Leigh, 1862—Sir John Fowler, 1865, 1867, 1870 and 1872—Dupuy de Lôme and Scott Russell, 1870—General remarks on historical sketch—Train-ferry the best solution.

A large number of proposals for effecting unbroken communication between England and France have been brought forward from time to time, as described in the preceding chapter. These may be classified as (1) *tunnels*, either of the ordinary kind pierced through the earth under the sea, or consisting of built-up structures resting on the bed of the sea or floating some distance below its surface; (2) *bridges*, either elevated high enough above the water to clear the masts of ships, or submerged sufficiently to be unaffected by their keels, and forming pathways for the passage of tall moving chariots on which trains could be carried beyond the reach of the waves; and (3) *ferry boats* so large as to be able to transport trains of goods or passenger vehicles bodily—in fact, floating railways. The present chapter is devoted to an account of these various plans, grouped under the headings just enumerated.

Tunnels under the sea-bed.—It was more than a century ago, in 1802, that a French mining engineer named Mathieu brought to Napoleon's notice a proposal to connect Great Britain and the

Continent by a submarine tunnel passing under the Straits of Dover. It appears that he proposed to utilise the Varne shoals, which lie nearly half way between Folkestone and Boulogne, and are in some parts covered by only 1½ fathoms at low water of spring tides, and there his imagination pictured a grand international town and harbour of refuge rising in the midst of the sea and communicating by his tunnel with the mainland on either side. There were, in fact, to be two tunnels, one above the other, the lower of which was intended to collect any water that might find its way in, and conduct it to drainage reservoirs at the French and English ends, while the upper one was to form the roadway for the accommodation of carriages. Ventilation was to be effected by iron shafts rising at intervals above the surface of the sea.

More than a generation later, another Frenchman, A. Thomé de Gamond, at one time chief engineer to the department of the Pas de Calais, began to attack the problem of cross-Channel communication in a scientific manner. As far back as 1838, this engineer had considered several of the plans which have since engaged public attention—the tube lying on the bottom of the sea, the bridge, the ferries plying between piers—and, for one reason or another, had dismissed them all as unsuitable. The solution he favoured was that of a tunnel, but the extensive geological enquiries which he prosecuted, both in England and in France, ranging from Warwickshire on the one side to the plain of Fiennes on the other, led him to fear that the nature of the ground under the Straits was such as to offer grave engineering difficulties. Instead of a tunnel, therefore, he put forward, in the years 1839 and 1840, a proposal which, without possessing countervailing advantages, seems to have been open to many of the criticisms that could be urged against those he rejected. He suggested the construction of a sort of masonry isthmus across the Straits, with three large openings to admit of the passage of ships. One of them was to be in English waters, close to the South Foreland, another on the French side, near Calais, and the third on the Varne bank, and they were either to be crossed by floating bridges or pontoons, or submarine passages were to be constructed beneath them. Objections were urged against this remarkable conception by sailors, who pointed out that the isthmus would form a serious obstacle to navigation, and who viewed with natural alarm the prospect of having to steer their ships in the currents which must have eddied through the openings; but the question of expense was decisive against it, for its cost was estimated at something near £35,000,000.

For some years after this effort, Thomé de Gamond devoted himself to other matters, but he was recalled to the problem of cross-Channel communication by the Great Exhibition of 1851, when a larger number of people than usual had to complain of the discomforts of the crossing. Returning to his geological enquiries, he formed a more favourable judgment of the conditions, and came to the conclusion that no serious faults or dislocations were to be expected in the line which he selected from Eastware Bay, near Folkestone, to Cape Grisnez,—greensand near the English coast being followed by impermeable beds of Oxford and Kimmeridge clays. He proposed to make thirteen artificial islands, sink a shaft in each, and then drive headings from them in both directions. By 1856, his plans were so far matured that they were submitted to the French Emperor, who handed them to a scientific committee for examination. In England they won the approval of Brunel, Locke, and Robert Stephenson; the Prince Consort is said to have regarded the proposal with "truly enthusiastic sympathy"; and Cobden saw in it "the true arch of alliance between the two countries." Palmerston, however, was against it; but even his hostility was slackening when the attempted assassination of the Emperor, in January, 1858, and the revelations which followed, created a state of public feeling in which it was thought well to refrain from pushing the scheme until better times.

With the Commercial Treaty and the Exhibition of 1867, Thomé de Gamond thought his opportunity had come, and therefore produced plans, shown in the Exbibition, which, somewhat modified from those on which he had relied in 1856, made the same use of the Varne bank as had been proposed by Mathieu sixty-five years before. He, too, proposed to form on the shoal an artificial island with a harbour and quays, whence winding roadways would lead down to a submarine railway station, and he saw further that it would afford him the advantage of a site for workshops, and enable the construction of the tunnel to be begun at four points simultaneously —two on the island and one each on the French and English coasts.

But by this time he had ceased to monopolize the problem of Channel communication, and many other men had come upon the scene to advocate either alternative tunnel schemes or solutions by other means. Among them was Mr. William Lowe, of Wrexham. From his own geological studies he formed the opinion that, on a line joining Fanhole (a point half-a-mile west of the high light of the South Foreland), and another point, Sangatte (four miles west of Calais), the lower or grey chalk (*craie de Rouen*) was continuous from side to side, and that it would be advantageous to pierce the tunnel wholly in this material, dispensing with all intermediate shafts between the two ends, at least as far as the portion under the sea was concerned. He was also the originator of the suggestion that as a preliminary two small parallel driftways, joined at intervals by transverse passages, should be driven right under the Channel; these experimental driftways were to be subsequently enlarged to full-sized tunnels, each containing a single pair of rails, should their construction be successfully effected. His plans, like those of Thomé de Gamond, were brought to the notice of the French Emperor in 1867, and then the two engineers combined their forces. Lowe submitted his scheme, christened "The Channel Tunnel Railway," to Lord Richard Grosvenor in the same year, and it was also approved by James Brunlees, who gave his co-operation. Soon afterwards they were joined by Sir John Hawkshaw, who from 1865 had been taking soundings in the Channel, and examining the character of the bottom, and under whose direction trial shafts had already been sunk at St. Margaret's Bay and near Sangatte.

These three Englishmen, Lowe, Brunlees and Hawkshaw, with the three Frenchmen, Paulin Talabot, Michael Chevalier and Thomé de Gamond, became the engineers to the International Committee which was formed in 1867 at Napoleon's suggestion, with Lord Richard Grosvenor at its head, to promote and popularize the idea of a tunnel. The programme of this Committee, as described in a circular issued by it in 1868, in order to obtain signatures to an address to Napoleon urging the construction of the tunnel, was to drive the experimental driftways advocated by Lowe, and to this end it desired to secure from the French and British Governments a guarantee of the interest on the amount of one or two millions sterling, which the borings were estimated to cost. In 1868, the six engineers reported to the effect that there was a reasonable prospect of the operation of making the tunnel being successful, though it would be "improper to deny" that there was a certain amount of risk from the irruption of sea water; that the cost would not exceed ten millions sterling and the work could be completed in ten or twelve years; and that the question of risk could be solved by sinking land shafts and driving preliminary driftways. In the same year, the International Committee had an audience with the Emperor, when it presented copies of its plans with an address signed by many peers, Members of Parliament and other distinguished persons, in favour of the tunnel, and also asked for an Imperial guarantee of the interest on the money to be expended in making the trial driftways. The matter was referred by the Emperor to the Minister of Public Works, who appointed a special commission of enquiry. In March, 1869, this commission reported that the project had reasonable chances of success, though subject to the contingencies of meeting treacherous ground or of a sudden influx of water; but on the financial side its attitude was less satisfactory, for it did not see its way to advise the grant of the guarantee desired. However, the Committee proceeded with negotiations for a concession, and was in a fair way to obtain one when matters were brought to a standstill by the outbreak of the Franco-German War. After the conclusion of peace, the British Government intimated that it had no "objection in principle" to the tunnel, and on January the 15th, 1872, the "Channel Tunnel, Limited," was registered in London, its purpose being to make a trial shaft and driftways through the grey chalk from the English side.

After this, progress was as slow as it usually is when a question is bandied about from one official enquiry to another and has become the subject of high diplomatic attentions. Moreover, there was a split in the English camp. The project of the Channel Tunnel Company was modified, and, instead of two tunnels each with a single line of rails, a single tunnel with a double line of rails was decided upon. Lowe disagreed with this alteration, which he thought would involve difficulties in ventilation, and, separating from Hawkshaw, assisted in the formation of a new company, the "Anglo-French Submarine Railway Company," to carry out his original scheme. Nor was there universal belief that the grey chalk was the best for the enterprise. An engineer so experienced as Sir John

Fowler had declined Lord Richard Grosvenor's invitation to associate himself with the tunnel scheme on the ground, among others, that all the chalk formations with which he was acquainted had not only "fissures and dislocations but depressions of the surface, including pot-holes of considerable extent." Sir Joseph Prestwich, not less distinguished as a geologist, in a paper read before the Institution of Civil Engineers in 1873, also doubted the feasibility of the proposed tunnel because of the fissures that he thought might be met with in the chalk, but he suggested that a tunnel might be safely made in the Palaeozoic rocks or through the London clay. These suggestions were not very comforting to the advocates of a tunnel, because in the former case the gradients at the entrances would have to be five times the length of the tunnel, and in the latter the tunnel itself must be some 80 miles long. There were, however, projects in existence which avoided the chalk, and yet were not of such prohibitory length. Mr. George Remington, for instance, who had published a plan for an oval tunnel in 1865, was in 1874 urging the advantages of the Wealden formation, and proposing the route from Dungeness to Cape Grisnez; for this plan he worked out the cost, with singular exactness, to £6,698,200. Another plan which avoided the chalk was that of Mr. W. Austin, who had been engaged on the problem for twenty years. He selected the "pure gault clay which crosses from the English to the French coast in a continuous range from Eastware Bay, Folkestone, to a point between Wissant and Cape Grisnez." This he regarded as the only safe and trustworthy stratum, and, scoffing at the notion that a single tunnel with two lines of railway would be sufficient for the traffic, proposed a triple arched tunnel, at an estimated cost of £17,500,000, with six lines, so as to effect a separation of trains travelling at different speeds.

But the scheme of the Channel Tunnel Company received the most serious consideration of all the rival tunnel proposals, and in August, 1875, an Act was passed authorising the undertaking of preliminary works at St. Margaret's Bay, though with certain conditions attached, as the Government was still negotiating with France in regard to the right to block the tunnel, the management, the rates and charges, etc. Early in the same year the allied French Company had been granted a concession by its Government. It undertook to spend, within five years at the most, on French territory, a minimum sum of two million francs in making investigations. At the end of the five years it had the right either to retain or abandon its concession. If it chose the former alternative, it was under the obligation to come to an understanding with any English Company furnished with the necessary powers for construction; its works had to be completed in 20 years, and the concession was to expire in 99 years. The French Government for its part pledged itself to permit no other tunnel between England and France until 30 years after the date of opening.

In accordance with the terms of this concession, the French Tunnel Company did a good deal of work, taking over 8,000 soundings, which enabled the bed of the channel to be mapped out with considerable accuracy, and starting a heading from the shaft at Sangatte. The English Company, on the other hand, failed to raise the money it required, either because of financial depression or for other reasons, and its Parliamentary powers expired in 1880. But soon there was another company on the field, the Submarine Continental Railway Company, of which Sir Edward Watkin was the leading spirit. This in a sense was the offspring of the South-Eastern Railway, which, in 1874, had obtained an Act authorizing it to sink experimental shafts between Folkestone and Dover, and in 1881 a further Act permitting the acquisition of lands for experimental works with a view to the construction of a Channel tunnel. In 1882, this Submarine Continental Railway Company applied to Parliament to sanction a tunnel starting from the Shakespeare Cliff, at Dover, and at the same time the revivified Channel Tunnel Company asked powers to make one starting from Fan Hole, not St. Margaret's, as it had formerly proposed. The cost of the former Company's plan was put at £3,000,000 for two single-line tunnels, exclusive of sidings, terminals, and junctions at the two ends; that of the latter Company's, for a single tunnel with two lines of rails, at £7,500,000 or £8,000,000—this sum, including, in addition to the tunnel proper (21 miles long), approaches about nine miles in length, as well as pumping and ventilating machinery, and interest on capital during construction.

These two applications produced a deluge of official letters, memoranda and reports, the history of which is written in the blue books; but they were finally disposed of by a Joint Select Committee of the House of Lords and House of Commons, which sat on sixteen occasions between April 20th and July 10th, 1883. By a majority this Committee decided, largely on military grounds, that it was "inexpedient that Parliamentary sanction should be given to a submarine communication between England and France"; but there was considerable difference of opinion among its members, and of seven draft reports proposed, not one received the entire approval of a majority. This decision meant the end of any tunnel scheme—at least, for the time—and in the following year the Government ordered the discontinuance of the 7-ft. trial driftway which then extended over 2,000 yards under the sea from a shaft sunk immediately to the west of the Shakespeare Cliff, on the ground now occupied by the Dover Colliery. The two rival companies amalgamated, and the united Channel Tunnel Company is still in existence, awaiting an occasion when it may be able to accomplish its purpose.

Tunnels through the Sea.—Proposals for structures placed on the bed of the Channel began to make their appearance almost as soon as those for tunnels proper driven through the ground beneath it. In 1803-04 Tessier de Mottray and Franchot suggested a cast-iron tube at the bottom of the sea, large enough for wheeled vehicles, and Thomé de Gamond's first idea, in 1833, was of the same nature, though he quickly abandoned it on account of the cost; he estimated that £6,400,000 would be required for the structure itself and the necessary approaches, and £12,000,000 for preparing the sea-floor to receive it. After 1850 there was a perfect epidemic of tube schemes. Victor Horeau, in 1851, proposed an iron tube to take two lines of railway for the modest sum of £87,000,000. In 1855, Payerne thought of a masonry tunnel constructed on a foundation of concrete by means of diving bells; Favre of a tunnel supported on iron piers filled with brickwork; and Wytson of a floating tube. Next year Nicholl imagined a submerged iron tube; Vacherot a "tunnel made or formed of concrete so as to form when completed a monolith" resting on the bottom, the different sections to be constructed on shore and drawn down to their places; and Turner a semi-circular tunnel in iron. The floating tube, a sort of iron corridor weighted to remain about 45 feet below the surface and steadied by moving chains, was mooted again in 1861 by J. F. Smith; and in the same year Chalmers first produced his plan for a tube composed of cast-iron rings. His arrangements were elaborately thought out.

The rings were to be bolted together to form sections of 300 or 400 feet in length, and these were to be submerged by "endless chains passing round pulleys or drums attached to massive anchor-boxes on the bottom of the Channel," permanent connexions being then made between each section and with the bottom of the sea. He provided one ventilating shaft in the middle, and one about a mile from each end, and estimated the cost at £12,000,000.

After this, there was for a few years a slight slackening in the output of tube schemes, which, however, became very numerous in 1869. Among the designers who came forward in that year were Marsden, and Martin and Leguay; the latter advocated a cast-iron tube in concrete blocks, and their plan differed from some of the others, in that they proposed to let the water into their structure during construction, and pump it out afterwards. But the scheme of Bateman and Revy was probably the best elaborated, from an engineering point of view, of any that had so far been put forward. They proposed to employ a cylindrical tube of 13 feet clear inside diameter, built up of cast-iron rings 10 feet long and 4 inches thick, each composed of six plates or segments bolted together. These 10-ft. rings were to be put together from inside a horizontal chamber or "bell," sliding like a telescopic tube over the last half-dozen completed rings, with a water-tight joint. The chamber was to be about 80 feet long and of 18 feet internal diameter, and it was to be moved on by hydraulic machinery as each 10-ft. ring was fastened in place. In order to fix the structure in position, every third ring was to have a vertical pile passing through a stuffing-box and driven or screwed into the ground, while at every sixth ring there were to be two piles inclined at an angle of 30 degrees. The line selected was from near Dover to near Cape Grisnez, a distance of 22 miles, because along this line the bottom appeared most uniform in slope and free from hard rocks and broken ground; it was believed that the maximum depth to be encountered was about 200 feet, and that the gradients would never exceed 1 in 100. The cost was estimated at £8,000,000, including interest on capital during construction, and it was thought that the work could be completed in less than five years.

In the same year, Zerah Colburn proposed a more startling method of laying a tube. His plan was to build it in dry docks in long sections of 1,000 or more feet. When each length was finished, it was to be joined at its seaward end with the portion of the tube already completed (which projected through the dock gate), and at its landward end to be provided with a water-tight door. The sea was then to be admitted to the dock, the completed part of the tube drawn up by tackle clear of the bottom, where it rested between the launchings of each successive portion, and the whole thing dragged out to sea, like a huge sea-serpent, which would finally have been over twenty miles long, for a distance corresponding to the length of the section last added. A ball-and-socket joint was to be introduced between each section in order to give the flexibility required for these proceedings, and also to accommodate the irregularities of the sea-bed. The author gave calculations purporting to show that the towing of this elongated structure out to sea would not be so serious a matter as might be supposed at first sight, though he confessed that when the work was nearing completion he would require the aid of over 100 ships stationed at intervals of a quarter of a mile or so to raise and lower the tube. The cost he estimated at £6,000,000, exclusive of approaches, and he put the time required at two or three years. When the tube had been sunk for the last time it was to be lined with brick, weight alone apparently being relied upon to keep it in position.

About the time that Colburn propounded this scheme, Thomas Page, the engineer of Westminster Bridge, produced the outlines of another plan. From the experience he had gained as acting engineer of the Thames Tunnel, he had grave doubts of the possibility of an ordinary tunnel through the ground under the Straits, and estimated that in any case it would take fifty years to complete. His idea was to divide the channel into nine parts by eight conical shafts each composed of two concentric wrought-iron cylinders or cones with a space of ten feet between them. They were to be provided with cutting edges at the bottom so as to settle firmly in the bed of the sea, and they were to be weighted with concrete filled into the ten foot annular space, and moored by chain cables. After they had been sunk in position they were to be connected by tubes lowered into places previously prepared by divers on the sea bottom. Each piece of tube was to be a quarter of a mile long, and the different sections were to be connected by Williams joints, "by which the tube moving on circular points" could take up an "elastic position," and the joints be made on the surface. When all the tubes were in position they were to be covered with concrete. £8,000,000 was the sum mentioned as the cost of the work.

In another tube scheme advocated by P. J. Bishop, in 1874, it was proposed to use cast-iron rings each five feet long and four inches thick. Five of these were to be bolted together, and the 25-foot lengths thus formed were to be provided with movable water-tight doors at each end, and lowered in advance of the completed part by slings from pontoons. To make the connexion, the rings were to have flanges projecting twelve inches internally, and the new sections were to be drawn into position by means of chains from the pontoons passing round projections on the last ring of the completed part, inside which men were to screw up the flanges and caulk the joint. Then the bulkheads were to be removed, and the operation repeated with another section of twenty-five feet. As in Bateman's plan the anchoring of the tube was to be effected by screw piles passing through stuffing-boxes, three at each end of every 25-feet length. Finally, the inside was to be bricked up flush with the flanges and lined with boiler-plate, so that pneumatic propulsion might be used if desired. The cost was put at £22,000,000 for two tubes. Finally, mention may be made of Bunau-Varilla, who proposed to have a tube in the middle, with bridge approaches at each end.

The one great objection to all tunnels and tubes, apart from engineering difficulties of construction, that fixed itself on the English mind, was the danger of invasion, for it was argued that in the darkness of the underground passage a small body of troops might approach unperceived, gain possession of the exit by a *coup de main*, and cover the passage of an invading army. To meet this contingency, engineers were ready with all sorts of devices—sluices by which the tunnel could be flooded, double steel gates at the entrance so arranged that one at least must always be closed, high explosives kept in the tunnel itself and put in electrical connexion with Dover Castle, or even with the Horse Guards in London, so that by pressing a button the passage could be blown up, and communication across the Straits instantly destroyed. The opponents of the tunnel urged that all the devices might fail at the critical moment, and that the use of some of them would mean the total and irreparable loss of an exceedingly costly work; for engineers of eminence were obliged to confess that, when once a breach was made in the tunnel walls and the sea admitted, they knew of no means by which the water could be pumped out, and the damage made good. It was this fear of invasion which finally decided the British Government to prohibit the construction of any tunnel, and their veto naturally brought the idea of a bridge into prominence. Not only was it the one remaining means by which the advocates of absolutely through and unbroken communication between England and France could effect their purpose, but it apparently did away with any risk of a body of invaders gaining access to our shores unseen. A cynic might suggest that in a dense sea fog, such as is sometimes enjoyed by Dover, the outlook over the water is as limited as it would be in a tunnel; but, however that may be, so high a military authority as Lord Wolseley stated, in 1889, that the objections to a bridge were infinitely fewer than to a tunnel.

Bridges over the Straits.—The bridge idea was far from new, for, like most other means for cross-Channel communication, it had been considered by Thomé de Gamond. In 1836 and 1837, that engineer drew up five different plans for bridges—in stone, in iron, and in the two materials combined. The one which found most favour was for a structure in granite, with arches 162 yards wide. The piers were to be 52 yards long and 131 yards broad, resting on piles driven by manual labour from within air-tight chambers lowered to the bottom, and the arches, rising 57 yards above the water at their centres, would, it was supposed, be high enough to clear the masts of most ships, although, to meet the requirements of vessels demanding a still greater height, one movable arch was provided. The designer chose the short line between East Ness Corner and Calais, and put the cost at 160 millions sterling, though other engineers thought it would be 25 per cent. higher. The project was submitted to English engineers like Brunel, Locke, and Stephenson, but failed to gain their approval; acting upon their advice, Thomé de Gamond did not pursue this idea further, but turned for the time to the plan of big steam rafts or ferries passing to and fro between piers thrown out a long distance from the shore on either side.

Except for a remark by Combes and Elie de Beaumont, in 1849, that the floor of the Channel was composed of material singularly suited for the foundations of such a structure, the bridge project slumbered until about the time of the Exhibition of 1867. In the following year, the French Emperor, who must have had a remarkably varied experience of schemes for cross-Channel communication, visited the works established by Boutet on a site which had been granted by the French Government, and inspected his plans and models for a bridge which should cross from Dover to Cape Blancnez in spans of one-half or three-quarters of a mile in length. About the same time, Charles Boyd proposed a "marine viaduct," to cost £30,000,000, between Dover and Cape Grisnez, constructed with iron girders on 190 towers, 500 feet apart and 500 feet above the sea level. It is not surprising that with these proposals before him, Captain Tyler, as he said in his report to the Board of Trade on "Improvements in the Channel Passage between England and France" (1869), was unable to convince himself of the feasibility of any bridge scheme; for, if Boutet's huge spans were a sheer impossibility, at any rate for the engineers of that day, Boyd's 190 towers, apart from any other consideration, would have constituted an intolerable nuisance to navigation.

In 1875, there appeared in the *Annales de Génie Civil* a proposal by A. Mottier, which was evidently suggested by Stephenson's famous railway bridge over the Menai Straits. His plan was to form on the bed of the sea, from the South Foreland to a point between Capes Grisnez and Blancnez, a series of some forty huge cones of iron shells filled with concrete and about 110 yards in diameter at the base. The distance between these imposing masses would have been over 800 yards from axis to axis, or about 700 yards clear, which he thought would be ample for navigation. Upon them, about 55 yards above the water, a large iron tube 31 ft. in diameter was to be erected, strengthened, and supported by a sort of interlaced trellis-work composed of two series of smaller tubes. Inside the main tube there was to be a double line of railway, surmounted by a roadway for carriages and foot passengers; the latter were to be allowed access to the tops of the cones, where, in the plans drawn up by the engineer, they are to be seen taking the air on spacious promenades. The cones were estimated to cost £100,000 each, and the superstructure £5,400,000, or, with an allowance for contingencies and miscellaneous expenses, £12,000 000 in all.

In 1870, the International Railway Company was registered in England to prosecute a plan for a bridge emanating from Vérard de Sainte-Anne. It did a certain amount of work in educating public opinion and getting Chambers of Commerce and other bodies to pass resolutions in favour of a bridge, but that it never came within measurable distance of realising its aim is not surprising, as the structure which formed its base of operations required no less than 340 piers. It was succeeded, in 1884, by the Channel Bridge and Railway Company. By that time, thanks to advances in bridge design and still more in the strength of materials available for construction, responsible engineers were able to contemplate with equanimity a bridge with spans, if not of three-quarters of a mile like the vain imaginings of Boutet, at least of 500 or 600 yards—a length which it could be plausibly argued would afford reasonable sea-room to mariners. On behalf of this Company, Messrs. Schneider & Cie., of Le Creusot, and M. Hersent, with whom was associated Sir Benjamin Baker, the engineer of the Forth Bridge, proceeded to draw up preliminary plans, which were exhibited in the Paris Exhibition of 1889. The line adopted for the bridge, which was to terminate at Cape Grisnez, in France, and at Folkestone, in England, passed over the Colbart and Varne banks, and was chosen in preference to a direct course because it was thought that the additional length would be more than counterbalanced by the facility with which foundations could be laid in the shallow waters of these shoals. Up to the water-level the piers were to be of masonry; thence they were to be continued with two round steel piers of a minimum height of about 44 yards, and these were to support the main girders carrying the bridge nearly 59 yards above the water, the double line of rails being more than 20 yards higher still. To reconcile as far as possible economy of construction with the demand of navigators for wide openings, three types of construction were proposed—alternate spans of (1) about 325 yards and 540 yards, (2) of about 217 and 380 yards, and (3) of 108 and 270 yards, the longest spans being arranged over the deepest water, between the French shore and the Colbart bank. The total number of spaces was about 120. The cost was estimated at about 34 millions sterling, and the time for execution at ten or twelve years. A somewhat similar scheme, by d'Aulnoy, taking the same route over the Colbart and Varne banks, had been published in 1886. He proposed to have 89 spans, 83 of 434 yards and 6 of half that length, together with embankments on the English and French shores and on the Varne and Colbart shoals, aggregating over a mile in length. The cost of his structure, which was to carry four lines of rails, he estimated at about £30,000,000.

In 1890, a survey of the Channel bed carried out by Renaud indicated the advantages of making the bridge cross from Cape Blancnez in a straight line to a point a little north-west of the South Foreland, instead of laying it out in an irregular line over the Varne and Colbart shoals. Not only was the bottom in that region found to be composed of regular homogeneous beds of chalk particularly suitable for the reception of piles, but the depth at no point exceeded 56 yards, as against nearly 60 between the French coast and the Colbart bank, and, further, the length of the bridge was reduced by over three miles. These circumstances promised a considerable diminution in the cost of the structure, and the additional advantage was gained that, by employing alternate spans of 434 and 542 yards for the whole length of the bridge, the number of piers was reduced to 72 at the most. The cost of this new plan was put at £28,320,000, or, including interest during construction, at £32,720,000, and the duration of the work at seven years.

Submerged Bridges.—While the Channel Bridge and Railway Company considered that the large openings of the last-mentioned scheme, combined with the elaborate system of lights, fog-signals, &c., which it proposed to establish, should be sufficient to overcome the objections of sailors, it was not blind to the possibility that such would not be the case, and, accordingly, it studied another project which would not affect in any degree the passage of ships up and down the Channel. At Saint Malo there has long been a contrivance at work for conveying passengers across a deep dock which at high tide is full of water up to the quay edges, while at low water it is dry. This consists of a platform, level with the quays, supported by tall pillars on wheels, which move on rails laid on the floor of the dock, and by the aid of an engine is slowly hauled from one side of the dock to the other as required. Developing the idea of this apparatus, the Company suggested the construction of a submerged bridge across the Straits, rising to a uniform level of 45 or 50 feet below low water, and forming a roadway on which should travel an elevated chariot large enough to accommodate twenty or twenty-four railway waggons with a locomotive. Obviously the precise distance between its piles at this depth was not a matter of any moment to shipping, and for engineering reasons it was decided to place them 65 yards apart. The cost of this structure, with distinct roadways for traffic in each direction, was estimated at £10,000,000, and the time of construction at five or six years. But the objection was raised that a steel structure, such as was first proposed, would corrode away more or less quickly under the action of the water, and that to paint or repair it would be an impossibility. A modification was therefore worked out, according to which there would be two independent submerged viaducts, about 30 yards apart, constructed in armoured concrete; and by this alteration, which was estimated to save over a million sterling in the cost, it was thought that a permanent structure would be secured.

In regard to this proposal, it may be suggested that the task of propelling a cumbrous chariot weighing 4,000 tons at anything like a respectable speed is not a trifling one, and, if sufficient power could be applied to make the pace good, it is probable that, with the inevitable inequalities of the roadway, the going would be so bad as to produce effects not less unpleasant than those of a cross-Channel steamer. In that case the advantage of the plan seems small.

Practically the only point in which large train-ferry steamers would be inferior to a tunnel or elevated bridge, as a means of through communication across the Channel, is in regard to sea-sickness, although with big boats in a sea like that of the Straits that *contretemps* would probably be rare; and if the submerged bridge and rolling chariot involve—not occasionally in bad weather, but regularly in all weathers—sensations equally unpleasant, then there is no justification for them as compared with less costly floating railways or train ferries.

Train Ferries. — The establishment of train ferries began to attract serious attention about 1862. In the Exhibition of that year Evan Leigh showed models of vessels suitable for a ferry service, and about the same time Sir John Fowler took up the question of improving the communication across the Channel, soon reaching the conclusion that the solution of the problem was to be sought on the lines proposed by Leigh. To this conclusion he remained a steadfast adherent all his life, rejecting on the one hand all schemes for tunnels and bridges, and on the other viewing as insufficient any proposal which would do no more than enlarge and accelerate the existing packet boats, without providing for the through transit of passenger and goods vehicles. His plans had been reduced to concrete form by 1865, when indeed Parliamentary proceedings were begun; these, however, were discontinued owing to objections on the part of the Admiralty to the situation chosen.

Similar objections caused a second withdrawal of Sir John Fowler's proposals in 1867, and it was not until 1870 that the Bill, which was to authorize them, was actually passed in the House of Commons; it was, however, withdrawn by the promoters in the House of Lords because assent to the necessary works at Calais could not be obtained from the French Government, which at that time had graver matters claiming its attention. The application was renewed in 1872, when it again passed the House of Commons, but was thrown out in the House of Lords by the casting vote of the Chairman of Committee. The project was then practically dropped, apparently because Sir John Fowler declined to take any further part in it until the question of making a tunnel was settled one way or the other.

The vessels he proposed to employ were paddle-steamers, 450 feet long, with a beam of 57 feet (80 feet across the paddle boxes), and a draught of about 12 feet, and were to be provided with engines capable of propelling them at a speed of 20 knots. Railway lines were to be laid down on the decks, so that passenger carriages and goods waggons could be run directly upon them and be conveyed bodily across the Straits; they were in fact to be first-class moving stations, for the passenger coaches were to be housed under cover and stand beside platforms provided with saloons, refreshment rooms, &c., so that passengers could leave their seats if they were disposed to have a meal or take a walk. The first difficulty encountered was that neither on the French nor the English side was there a harbour which could accommodate ships of the size proposed. Far from regarding this as an objection, Sir John Fowler thought it would have the advantage of bringing about badly-needed improvements in the harbours on both sides of the Channel; and he proposed to construct special works at Dover (in 1868 on the west side of the Admiralty Pier, but in 1865, 1867, 1870, and 1872 on the east side), and an entirely new harbour at Andresselles, between Calais and Boulogne, connected by a short railway with the "Chemin de Fer du Nord." When made, these harbours—or at least a sufficient portion of them—were to be protected by glass roofs, under cover of which the trains were to be conveyed on board the steamers. For this purpose hydraulic lifts were to be employed, raising or lowering the trains to the level of the steamer decks, which would naturally vary with the state of the tide. Lord Armstrong was responsible for the design of the necessary hydraulic machinery, and he calculated that the time occupied in transferring a train to the upper deck would be five minutes. The total cost of the scheme—harbours and ferry boats included—was put by Sir John Fowler at £2,200,000, but it was estimated at £3,000,000 by the Board of Trade, without that department attempting to justify this advance of 45 per cent. on the estimate of a responsible engineer.

Although Sir John Fowler saw a blessing in disguise in the construction of new harbours necessitated by his scheme, that view did not gain universal acceptance. On the English side, the British Government was jealous of any proposition that might interfere with the Admiralty pier, while in France neither Calais nor Boulogne welcomed the idea of a competing harbour half-way between them. In fact, the Andresselles project was widely regarded in France as impracticable, and among those who shared this view was Admiral Dupuy de Lôme, who accordingly, in 1870, submitted to the French Department of Public Works a plan for a train-ferry in which he dispensed with the idea of a new harbour. His scheme, which was supported by Scott Russell in this country, was to form a maritime station at Calais about half-a-mile from the shore, with which it was to be connected by a railway bridge. This station was to present a semi-circular front to the sea, and behind there was to be an interior port opening towards the land, the whole being in such a depth of water that it could be approached by large ships at any state of the tide. The trains were to arrive at three different levels, according to the tide, and thence to be transferred to the ferry boats over movable inclined planes. The boats themselves were to be about 440 feet long, and about 50 feet beam, with a draught loaded of $13\frac{1}{2}$ feet, and a speed in fair weather of eighteen knots.

This brief sketch will serve to indicate the enormous amount of time and labour that has been expended on the problem of providing uninterrupted railway communication between England and the Continent, and to show how large is the body of weighty opinions holding that a solution is desirable if not urgent. Among European nations, France is England's best customer, and, in view of the ever-growing volume of traffic between the two countries, which cannot fail to be stimulated by the cordiality ot the friendly relations now subsisting between them, it may be hoped that in the near future we shall see the realization of an improvement, the need for which has been recognized by all who have studied the problem.

Of all the plans proposed, the train-ferry is the cheapest and, it may be added, the one which can be carried into effect with the least delay. Gigantic undertakings like a bridge or tunnel may appeal more forcibly to the imagination, but when the matter is examined in the light of cold reason, it is seen that a train-ferry will do all that is required at a comparatively small cost, and, moreover, is free from certain grave objections inseparable from other solutions of the problem. It is the simplest and most natural remedy for the admitted deficiencies of cross-Channel communication; and to refuse a solution which is immediately practicable and perfectly adequate in the bare hope that some day another solution, perhaps more imposing, but certainly not more effective, may become available is entirely opposed to the dictates of ordinary common sense. If ever the development of the traffic warrants the cost of a tunnel or bridge, then a tunnel or bridge can be made; but that development is more likely to be hastened than retarded by the existence of a train-ferry affording to traffic the facilities which it now necessarily lacks.

CHAPTER III.

Existing Train-Ferries.

Train-ferries not widely known—Some information concerning them is best proof of practicability—Weather conditions on Lake Michigan compared to those on English Channel—British train-ferries—Danish train-ferries—The Gjedser-Warnemünde Ferry—Italian train-ferries—American train-ferries—The New York, Philadelphia, and Norfolk train-ferry across Chesapeake Bay—The train-ferries on New York Harbour—The Southern Pacific Railroad Company's train-ferry—The Lake Michigan train-ferries—The Ann Arbor Railroad Company's train-ferries—The Père Marquette Steamship Company's train-ferry—The Detroit River train-ferry—Mr. Neville Priestley's opinion—Relative traffic figures.

The considerations advanced in Chapter I, have, it is hoped, demonstrated with sufficient clearness the advantages to be gained by the establishment of unbroken communication across the English Channel, and the numerous schemes described in the last chapter prove how widely those advantages have been appreciated, and how much time and thought have been devoted to proposals for their practical realization. Of the three principal methods proposed—tunnels, bridges, and train-ferries—the two first are perfectly familiar, and every one has sufficient experience of such matters to admit that, although the building of either of them across the Channel would be an engineering feat of unprecedented magnitude, still when once they were constructed they would be quite adequate to do the work required. But train-ferries stand on a somewhat different footing. Compared with tunnels and bridges they are exceedingly rare, and a man may have travelled extensively without even one example having come under his personal observation. On the converse of the principle that seeing is believing, the natural consequence of this lack of experience is an attitude of doubt, and the simplest way to combat scepticism is to resort to the logic of facts, and to show that, as a matter of history, train-ferries have long been in active operation in various parts of the world, without encountering any of the insuperable difficulties which lack of acquaintance with them may suggest as fatal to their employment.

The most striking instance of train-ferry operation under severe weather conditions is given on Lake Michigan. That lake, of an area of 22,450 square miles (nearly four times the size of Yorkshire) has a maximum length of 345 miles, a breadth of 84 miles, and a depth of 870 feet. The winds which reach it from the plains throw the water into waves that rival those of the ocean in size and destructive power, whilst ice, both in floes and solid form, and frequent fogs, add to the dangers of navigation. Beaches, sand-dunes, shore-cliffs, and the other familiar features of the meeting line of land and sea re-appear along the margin of this great freshwater lake.

Whilst waves seldom exceed 15 to 20 feet in height in the English Channel, those on Lake Michigan are computed as frequently reaching a height of 20 to 25 feet. The height and force of waves depend upon the breadth and depth of sea over which the wind has driven them; the longer the "fetch" and the deeper the water, the higher the waves.

A comparison of the maximum wind velocities on Lake Michigan and the English Channel may be of interest:—

MAXIMUM WIND VELOCITIES MEASURED ON LAKE MICHIGAN AND THE ENGLISH CHANNEL.

During October, November, and December, 1903 and 1904.

Lake Michigan.				English Channel.			
Date.	Station.	Velocity in miles per hour.	Direction.	Date.	Station.	Velocity in miles per hour.	Direction.
7 Oct., 1903	Chicago ...	50	S.	6 Oct., 1903	Dungeness ...	48	S.W.
6 Oct., 1903	Milwaukee ...	39	S.	5 Oct., 1903	Cape Grisnez	40	S.S.W.
12 Nov., 1903	Chicago ...	69	S.	23 Nov., 1903	Dungeness ...	40	W.
12 Nov., 1903	Milwaukee ...	41	S.W.	27 Nov., 1903	Cape Grisnez	48	S.S.W.
27 Dec., 1903	Chicago ...	52	S.W.	3 Dec., 1903	Dungeness ...	48	S.W.
27 Dec., 1903	Milwaukee ...	34	S.W.	3 Dec., 1903	Cape Grisnez	34	S.W.
4 Oct., 1904	Chicago ...	53	S.W.	3 Oct., 1904	Dungeness ...	40	E.
10 Oct., 1904	Milwaukee ...	41	S.W.	17 Oct., 1904	Cape Grisnez	34	S.W.
28 Nov., 1904	Chicago ...	47	S.E.	9 Nov., 1904	Dungeness ...	48	W.
28 Nov., 1904	Milwaukee ...	47	S.E.	9 Nov., 1904	Cape Grisnez	48	W.S.W.
27 Dec., 1904	Chicago ...	72	S.W.	6 Dec., 1904	Dungeness ...	56	S.W.
27 Dec., 1904	Milwaukee ...	48	S.W.	30 Dec., 1904	Cape Grisnez	40	W.S.W.
Mean of above maxima ...		49·4		Mean of above maxima ...		43·7	

From this it will be seen that the stress of weather encountered on Lake Michigan is greater than that on the Channel.

As regards fogs: taking the record of the United States Weather Bureau for 1901, we find that these occurred on Lake Michigan, between Frankfort and Manitowoc, on over 40 days during the period from May 1st to November 30th, 1901 (18·7 per cent.). In the English Channel (at Cape Grisnez), on the other hand, the number of days on which fog was experienced during the seven worst months of 1904 did not exceed 29 (13·5 per cent.).

From the publication of the United States Weather Bureau, we extract particulars concerning shipping losses on Lake Michigan during the season 1901:—

Number of Vessels.	Total Losses.			Partial Losses.			Number of Lives Lost.
	Number of Total Losses.	Due to Fog.	Due to Gale.	Number of Partial Losses.	Due to Fog.	Due to Gale.	
50	11	0	11	39	12	27	12

Various plates given in connexion with the Lake Michigan ferries, described in this chapter, will further illustrate the severity of the weather conditions met with on that lake.

British Ferries.—If the United Kingdom can at the present time show no examples of train-ferries, she was at least one of the pioneers in their introduction, for as far back as 1860 the North British Railway established two—one across the Firth of Forth from Granton to Burntisland ($5\frac{1}{2}$ miles), and the other across the Tay at Dundee ($\frac{7}{8}$ mile). The reasons that prompted these train-ferries were typical. It was found that the operation of removing goods from waggons, putting them into an ordinary ferry boat, and taking them out again involved much loss of time and great expense, besides often causing breakage and damage, and thus involving the railway company in litigation. On this account it was thought desirable to establish an unbroken line of communication between Edinburgh and the country north of the Tay. The mechanical arrangements were simple enough. The waggons travelled down to the level of the ferry steamer on a horizontal platform which ran on a slipway, having a slope of 1 in 6, and was controlled by a rope and a steam engine. The cost of the slipways and platforms on the Forth was £10,000. The steamer employed was the "Leviathan," which was 172 feet long, 54¼ feet broad over paddles, and had a draught of 6½ feet loaded and 4¾ feet unloaded; her cost was £16,226. Her capacity was 30 or 34 loaded waggons, and she often carried 240 a day; from February 1st to July 31st, 1860, she made 1,546 trips and carried 32,712 waggons, an average of 21·16 a trip. The time occupied on the trip was 26 minutes, and loading and unloading took from five to eight minutes. The cost of working, including 10 per cent. depreciation and interest, was put at £6,000 a year; thus if 60,000 trucks were conveyed annually, the cost for each was 2s., and if each carried on the average a load of two tons, the cost worked out at 1s. a ton, which was, in fact, the charge made for minerals and other heavy goods. On the Tay the charge was 7d. a ton. Passenger traffic was not conveyed across these ferries, though occasionally empty passenger coaches were dealt with.

The train-ferry across the Forth provided a striking illustration of the development of trade which may follow the introduction of improvements such as the abolition of transhipments, in that for the first time it enabled Fife coal to enter the Edinburgh market, where it had been unknown as long as it had either to travel by rail by a long detour *via* Larbert, or to bear the expense of a double transhipment to and from the ordinary ferry on the Forth. Both the Tay and the Forth ferries are now superseded by bridges, and therein again they are typical, since they represent what may be regarded as the normal course of development of a trade route interrupted by water—first, ordinary boats with transhipment, then train-ferries without transhipment, and finally, always supposing the traffic is great enough and the engineering cost not prohibitive, a bridge or a tunnel.

Table I.—Operating Results of Danish Train-Ferry-Boats (the Property of the Danish State Railways), April 1st, 1900, to March 31st, 1901.

Ferry Line.	Distance in Km.	Number of Ferry-Boats.	Total Km. Traversed.	Number of Double Journeys made.	Average Number of Double Journeys per Day.	Average Number of Passengers Carried per Double Journey.	Average Number of Tons of Goods Carried per Double Journey.	Total Number of Passengers Carried.		Total Number of Tons of Goods Carried.	
								1899-1900.	1900-01.	1899-1900.	1900-01.
Kopenhagen to Malmoe	30·1	1	47,903	795	2·2	17	77·9	18,300	27,700	109,364	123,910
Storabelt: Korsoer to Nyborg	26·4	5	214,196	4,062	11·1	61	34·5	443,300	496,400	259,497	280,773
Helsingoer to Helsinborg	6·5	2	31,877	3,078	8·4	47	15·6	269,300	287,400	92,672	95,884
Masnedoe to Orehoved	3·7	3	28,170	3,740	10·2	21	9·9	149,600	157,900	82,781	73,934
Sallingsund: Mors to Glyngoere	3·7	1	16,446	2,183	6·0	11	4·6	44,200	48,200	20,598	20,090
Oddesund: South to North	2·7	1	14,041	2,623	7·2	9	7·5	45,400	47,000	39,869	39,455
Lillebaelt: Strib to Fredericia	2·5	4	63,185	12,577	34·5	20	10·9	455,900	499,200	286,874	273,843

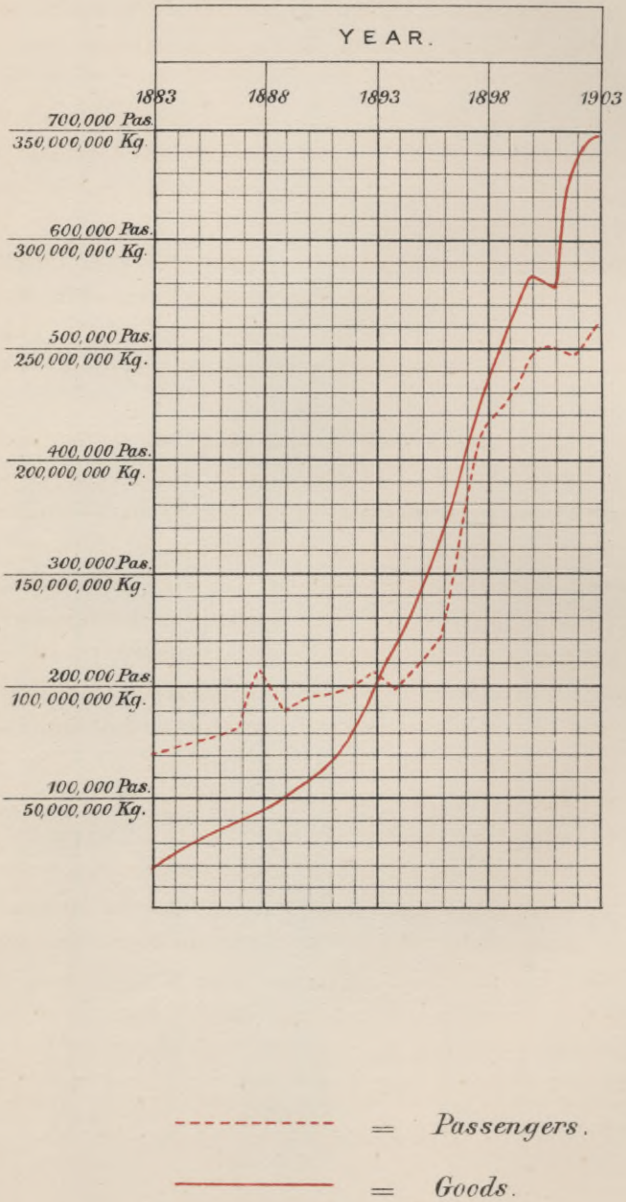
Table II.—Details concerning Danish Train-Ferry-Boats in use, Year 1900–01.

Ferry Line.	Name of Boat.	Year when Built.	S. Single or D. Double Track.	S. Screw or P. Paddle Wheel.	Displacement in Tons.	Nominal Horse-power.	Maximum Speed in Knots.	Length over all. Metres.	Width over all. Metres.	Draft Loaded. Metres.	Capacity of Boat: Number of Passengers in Railway Carriages.
Kopenhagen to Malmoe	Kjoebenhavn	1895	D	P	1,455	360	12·5	84·73	17·68	3·05	1,300
Storabelt ...	Myborg	1883	D	P	1,267	363	12·25	77·42	17·68	2·895	1,100
	Korsoer	1883	D	P	1,267	363	12·25	77·42	17·68	2·895	1,100
	Sjaelland	1887	D	P	1,267	360	12·25	77·42	17·68	2·97	1,100
	Storebaelt	1900	D	P	1,462	366	12·5	85·04	17·68	3·16	1,300
	Jylland	1894	D	S	1,048	179	11·3	56·08	14·63	4·98	600
Helsingoer to Helsingborg	Kronprincesse Louise ...	1891	S	P	534	144	10	54·865	13·375	2·59	800
	Kronprinz Frederik ...	1898	S	P	576	126	10	54·865	13·375	2·615	800
Masnedoe to Orehoved	Alexandra	1892	S	P	725	145	10	65·53	13·375	2·36	900
	Thyra	1893	S	P	725	145	10	65·53	13·375	2·36	900
	Waldemar	1886	S	S	550	112	10	43·89	13·105	2·745	540
Sallingsund ...	Lillebaelt	1872	S	P	...	101	8	42·825	13·565	2·44	450
Oddesund ...	Fredericia	1877	S	P	390	102	8	42·825	13·565	2·21	450
Lillebaelt	Hyalmar	1883	S	P	440	139	10·25	51·51	13·375	2·135	700
	Ingeborg	1883	S	P	440	139	10·25	51·51	13·375	2·135	500
	Dagmar	1889	S	P	...	139	...	63·78	13·105	...	...
	Marie	1890	S	S	...	112	...	60·96	13·105	...	...

FIG. 2.—

STORABELT FERRY.

TRAFFIC DEVELOPMENT FROM 1883 TO 1903.



Danish Ferries.—The kingdom of Denmark, cut up by sea-channels too wide to be conveniently bridged or tunnelled, affords a favourable field for the development of train-ferries, both to link up the separate portions of its own territory, and to provide through communication with Sweden and Germany. In consequence, the Danish Government, in connexion with the State Railways, operates no less than eight ferry lines. Some particulars of the traffic carried by these are given in Table I., while Table II. enumerates the boats which are employed on the services.*

The shortest of these ferry lines runs across the Lillebaelt, which is about 1½ miles wide, and the longest connects the German mainland with the island of Falster, crossing an arm of the Baltic between Gjedser and Warnemünde, a distance of about 26 miles. Two other important lines run between Copenhagen and Malmoe in Sweden, about 19 miles, and across the Storabelt, between Korsoer and Nyborg, about 16 miles. The last named is one of the oldest in Denmark, and Fig. 2 shows graphically the development of its traffic since 1883.

Of all the Danish ferries, and in fact of all those in existence, the one most similar in its aims and general establishment to the proposed Channel ferry is the line from Gjedser to Warnemünde, which secures uninterrupted railway communication between Continental Europe, one of the Danish islands, and ultimately Copenhagen. This line, which was opened as a train-ferry on October 1st, 1903, was visited by the writer in January, 1905.

Four through trains are run daily across this ferry from Berlin to Copenhagen, and *vice versâ*, there being a restaurant day train and a sleeping-car night train every day in each direction. The writer arrived at Warnemünde by the day train at 12.54 on January 19th. On this occasion, the train reached the ferry landing stage at 12.59 p.m., and the ferry steamer left at 1.5 p.m.; six minutes were thus occupied in transferring the train from the land to the steamer, and in getting the latter under way. The ferry steamer used was the "Friedrich Franz," a paddle-wheel vessel with four funnels, and a single line of rails on deck. The length of this boat is about 279 feet, width about 61 feet, draught with full load about 12 feet, total

* The period dealt with in Tables I. and II. is 1900–1901, when the Gjedser-Warnemünde Ferry line was not yet in operation.

length of rail on board about 259 feet, indicated horse-power about 2,500, and the average speed about 13½ knots. The builders were Messrs. Schichau, of Elbing. Fig. 3 shows the "Friedrich Franz" leaving Warnemünde loaded with a train, on the occasion of the opening of the line, whilst Fig. 4 shows the same steamer, seen sideways from the pier, shortly after leaving Warnemünde. Fig. 5 shows the same boat, viewed from the front, when approaching Gjedser.

The second train of which the transhipment was observed, was the day train from Copenhagen to Berlin, and was carried by the ferry steamer "Prins Christian." It reached Warnemünde at 4.32 p.m., and the train steamed out of the station on its way to Berlin at 4.44 p.m.; the time occupied for unshipping was thus twelve minutes, but it would seem possible to conduct the operation much more expeditiously. The "Prins Christian" was built by the same firm as the "Friedrich Franz," and is a screw steamer of the following dimensions: Maximum length about 282 feet, width about 58 feet, draught about 13½ feet, length of rail on board about 410 feet, indicated horse-power about 2,500, average speed 13½ knots.

As regards the night train from Berlin to Copenhagen, which reached Warnemünde about half-past three in the morning, particular attention was paid to the sleeping-car, and to the transfer of this car from the land line to the steamer. Although every berth was occupied, not a single curtain in the car was raised, and the passengers seemed quite undisturbed either on shipping at Warnemünde, during the crossing, or on unshipping at Gjedser.

The appliances used for the transfer of railway trains on the Danish ferries, and especially on the Gjedser-Warnemünde line, may be divided into: (*a*) the landing berth; and (*b*) the connecting link between the land railway line and the ship railway line.

The landing berth at Warnemünde consists of stone piers, lined with wooden piles to fit the shape of the ship. The wooden pile structure is connected with the stone piers by a series of iron spring buffers. On reaching land, the ship knocks against the wooden piles on one side; these yield, owing to the spring buffers, and ricochet her gently to the piles on the other side until she is gradually brought to rest, firmly embedded in the structure of the wooden piles. Figures 6 and 7 show this part of the arrangements at Warnemünde, and Fig. 8 of those at Gjedser.

FIG. 3.—TRAIN-FERRY STEAMER "FRIEDRICH FRANZ" LEAVING WARNEMÜNDE (GJEDSER–WARNEMÜNDE FERRY).

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FIG. 6.—LANDING BERTH, WARNEMÜNDE (GJEDSER–WARNEMÜNDE FERRY).
B, LIFT. **C**, ELECTRIC POWER-HOUSE.

[*To face page* 42.

FIG. 7.—LANDING BERTH, WARNEMÜNDE (GJEDSER-WARNEMÜNDE FERRY).

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FIG. 8.—LANDING BERTH, GJEDSER (GJEDSER-WARNEMÜNDE FERRY).

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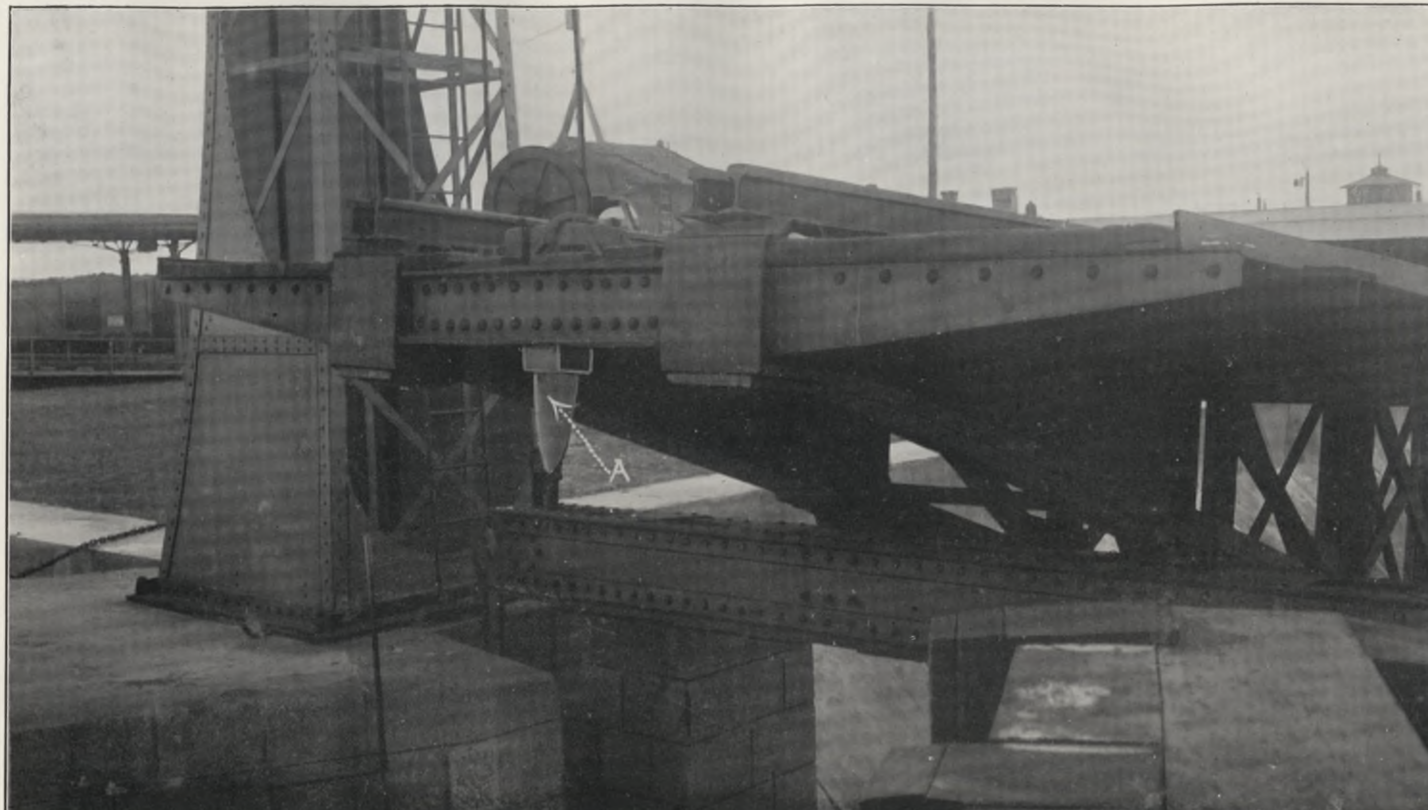

FIG. 9.—CONNECTING BRIDGE OF LANDING BERTH, WARNEMÜNDE (GJEDSER–WARNEMÜNDE FERRY).
A, STEEL BOLT SECURING ALIGNMENT.

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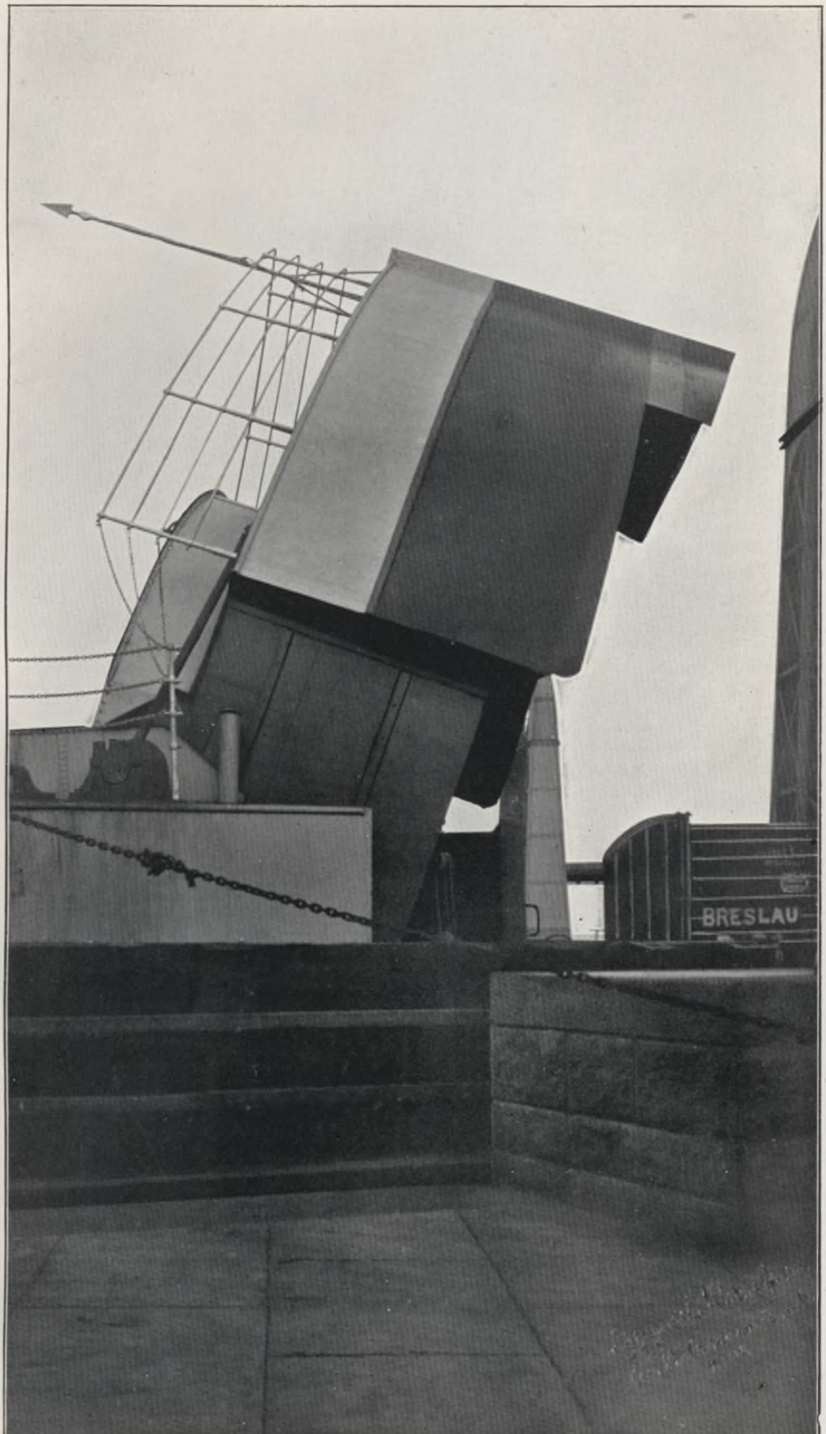

FIG. 11.—MOVABLE BEAK, TRAIN-FERRY STEAMER "PRINS CHRISTIAN" (GJEDSER–WARNEMÜNDE FERRY).

[*To face page* 42.

FIG. 12.—TRAIN-FERRY STEAMER "PRINS CHRISTIAN" MOORED AT GJEDSER (GJEDSER–WARNEMÜNDE FERRY).
A, BEAK. **B**, LANDING BRIDGE.

[*To face page* 42.

The connecting link between the land railway and the rails on the ship consists of a steel bridge, about 98 feet long, hinged to the stonework of the pier on the land side, and movable vertically on the sea side by an electric hoist, allowing of a variation of level of about fifteen feet. The electric hoist works in a steel arch, with counter weights. In addition to the hinges on the land side, permitting the vertical motion, the whole of the bridge is provided with hinges parallel to the direction of the railway lines, allowing it to be tilted horizontally, so as to follow the lateral movements of the ship, and especially to allow for the list which takes place when one half of a train is unshipped from a ferry-boat provided with two lines of rail.

At the sea side the bridge is provided with a large steel bolt, which fits into a hole in the bow of the ferry-boat, and thereby rigidly maintains strict alignment between the land rails and the ship rails. Fig. 6 shows this connecting bridge in its lowest, and Fig. 9 in its highest position. In the latter the large steel bolt is shown, marked "*a*"; the former shows the arched structure of the lift, marked "*b*," and the electric power-house, marked "*c*." The time occupied by the hoist in raising the bridge from its lowest to its highest point (15 feet) was 2 minutes 40 seconds, and the time occupied in lowering it the same distance was 30 seconds. When no ships are in the berth, the bridge is maintained at its highest point, so as to be ready for lowering on to the bows of the ship when she enters.

There being no tide of any importance in that part of the sea, the transhipments observed took place on an entirely horizontal bridge.

The shipping of trains both at Warnemünde and Gjedser is effected from the stern, whilst the unshipping takes place from the bows. For this purpose the stern of the ship is equipped with hinged doors, whilst the bow is fitted with a movable beak, which lifts up like a drawbridge. Fig. 10 shows this beak beginning to rise on the approach of the "Prins Christian" to Warnemünde, and Fig. 11 gives a close side view of the beak entirely raised when the ship was moored, and the train in course of removal (the railway trucks can be seen passing under the beak). Fig. 12 shows the same steamer moored to the Gjedser landing-stage, the raised beak and the landing-bridge being seen from the commander's bridge. The raised beak is marked with the letter "*a*" and the landing-bridge with the letter "*b*." The trucks and railway cars are shipped and unshipped by means of a shunting engine.

When the train is on the ferry-boat, hinged spring buffers are thrown into position behind the last car; the hinged doors at the stern are closed, and the beak lowered. This operation takes place while the ship is steaming out. During the progress of the ship's departure, each railway carriage is fixed to the rails by hooks and turnbuckles, in addition to which jacks are placed under the sides to prevent rocking on the springs. All this fixing is exceedingly simple, and appears to be very efficacious. The trains are sheltered from wind and weather in the middle, where they are under the upper deck; but at the bow and stern they are protected solely by the raised bulwarks, consisting, at the back, of the hinged doors, and in front, of the beak.

The doors of the passenger cars are locked during shipment and unshipment, but are unlocked immediately the boat is under way, when the passengers can alight and walk about. Opportunity is given them, in the day train, to partake of a good and substantial repast in a saloon below deck; smoking and sitting accommodation is provided on the upper deck.

During the whole period of operation, between October 1st, 1903, and December 31st, 1904, four trips only had to be abandoned, owing to tempestuous weather. The dates on which these four trips had to be cancelled were November 22nd, 1903, and December 21st, 1904.

Fig. 13 gives a sketch map of the various ferry lines in Denmark.

Italian Ferry.—A ferry service crossing the Straits of Messina, from Messina to Reggio, and from Messina to Villa San Giovanni, was started on November 1st, 1899, and at present employs four boats, particulars of which are as follows:—Length about 177 feet, width about 27 feet, tonnage about 300, horse-power about 950, maximum speed 11½ knots, carrying capacity loaded railway trucks weighing about 142 tons. These boats have one rail track each. They transfer on each trip one mail van, one luggage van, and one through carriage (either of the ordinary kind, or a sleeping car), besides two or three other cars.

The number of crossings made in 1902-03 was 2,532; in 1903-04

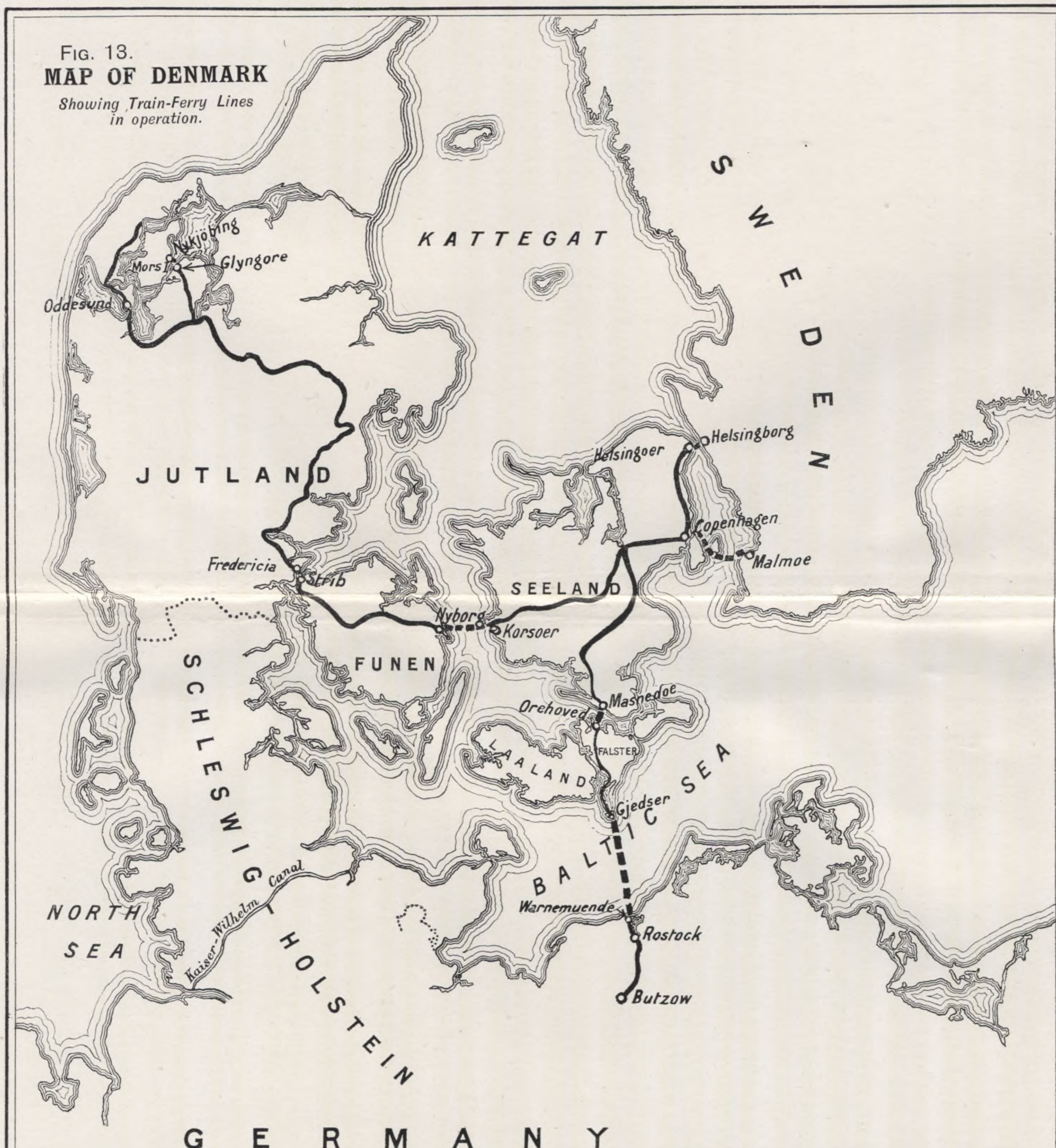

FIG. 13.
MAP OF DENMARK
Showing Train-Ferry Lines in operation.

[*After page* 44.

it was 3,396; and in the first half of 1904-05 it amounted to 2,008. The number of passengers transported in the railway cars during 1902-03 amounted to 150,068, and in 1903-04 to 168,467. The weight of goods carried in trucks during 1902-03 amounted to 34,036 metric tons, and in 1903-04 to 54,936 metric tons.

There is a bi-weekly service of two sleeping cars to Palermo, and from February to the end of April there is a *train de luxe* service from Berlin, transferring restaurant car and luggage van, and a *train de luxe* service from Paris, transferring the same carriages. In winter there is an additional sleeping-car service to Giardini Taormina.

Lake Baikal Ferry.—No information concerning the traffic on this ferry line has been obtainable, but photographs of the steamer "Baikal" in use on the line have been supplied by Sir W. G. Armstrong, Whitworth, & Co., and are reproduced in Figs. 36 and 37, whilst the model of the steamer is shown on the cover of this book, and in Fig. 38.

American Ferries.—In America, train-ferries date from a somewhat later period than in Denmark, but since their introduction they have been developed with characteristic American energy. Like everything else in American railroad practice, they were forced on the railways of that country by competition, but now that train-ferries have been established, railway officials are surprised that they were ever able to manage without them; they are considered to be much more economical than the old methods of transhipment, to involve less labour and to save a great deal of damage and loss to goods.*

It is believed that in all, some 78 different train-ferry lines are operated in America; the more important of these, leaving river-ferries out of account, may be sub-divided into (A) Sea Ferries, and (B) Lake Ferries.

* Mr. Neville Priestley's Report on the Organisation and Working of Railways in America, 30th December, 1903, pages 39 to 41.

A. To take *Sea Ferries* first, the following are worthy of notice :—

(1.) On Chesapeake Bay, the *New York, Philadelphia and Norfolk Railroad Company* operates a train-ferry from Cape Charles to Norfolk, a distance of some 36 miles. This ferry line owns three passenger steamers and six cargo floats, of which two are fitted with three rail tracks and the remaining four with four tracks each. The average quantity of goods carried annually during five years amounted to 723,232 tons, whilst the average number of cars ferried annually during the same period amounted to 61,194. The steamers on this line are all fitted for carrying cargo, two of them carry it on deck and in the hold, whilst the others carry it on deck only. The car floats are towed to and fro across the Bay by tug boats, each towing one barge at the end of an 800-foot steel hawser about an inch in diameter, the tension on which is regulated according to the state of the seas by an automatic steam towing machine.

Upon arriving at the terminals, the barges are secured to bridges, which are carried on wooden water-tight pontoons, rising and falling with the tide. These bridges are fitted with four toggle bars which engage in four toggle eyes on the ends of the barges, for the double purpose of centering the barge with the bridge, so that the rail ends on each may fit together, and of maintaining its height. The barges are held to the bridges by steel mooring cables, attached to large mooring eyes on the decks, and drawn taut by winding machinery on the bridges. The bridges, in addition to being carried on pontoons, are provided with hand-power hoisting machinery to raise them when necessary. The cars are drawn off by a locomotive.

The cars are secured to the barges by means of iron chains placed around convenient and solid parts of the body of the car, and connected to eyes in the deck by screw turn-buckles, thus permitting the cars to be held down tight. In addition to this, the wheel brakes are sometimes applied. The ends of the several lines of cars are secured and prevented from running over board by wedge-shaped chocks.

The barges are steel throughout, 310 feet long by 47 feet wide, fitted with 18 water-tight compartments, and provided with a large steam pump and two steam steering engines. The latter are operated from a pilot-house, located on a platform supported by steel columns and framework, extending from side to side, far above the roofs of the cars. It is here also that the living and sleeping quarters are provided for the crews, and from this platform they have an unobstructed view of the cars, barge, and tug towing them. As the ends of the barges are alike, and each provided with a rudder and a fastening pin, it is unnecessary to turn round. Each barge will carry thirty of the regular American service cars loaded to their full capacity, on a draught of 6 feet 3 inches, against a lighter draught of 3 feet 3 inches.

The steamers make daily round trips regularly, and during some of the busiest freight seasons make as many additional trips as the business requires. As they are all manned and officered for double watches, it is possible to keep them going continuously. The tug boats and barges have, as a rule, no regular time of leaving the terminals; for a short period during the summer season, however, they leave Norfolk at a given time daily, to make railroad connexion for Northern destinations. The tugs and barges are operated in an almost continuous movement, the intervals being at the terminals during the process of loading and unloading, or in the event of coal having to be supplied for the bunkers. As an offset to this continuous movement, the crews and complement of officers are so arranged that each person is relieved once a week from duty for 24 hours, during which he is free to remain on shore. The tugs are laid off one day in each month for washing boilers, and for making such repairs as are needed and can be done at that time. It is necesssary to clean and paint the bottoms of all the boats twice in each year—in the late spring to provide a covering of anti-fouling composition paint, and in the autumn to preserve the hulls wherever the paint may be rubbed off. Repairs are made at such times according to requirements, each boat or barge being taken in turn, and docked or hauled out on marine railways.

As so much of the route of this ferry is across Chesapeake Bay, which at times is as rough as the seas encountered by an ocean service, it is necessary to have everything as well cared for and as secure as if the boats were going to sea, and constant vigilance is required to keep everything up to the standard condition.

(2.) The *Chesapeake and Ohio Railway Company* operates a train-ferry between Norfolk and Newport News—a distance of thirteen miles.

(3.) The *Canadian Pacific Railway Company* runs a train-ferry service on the Gulf of Georgia from Vancouver, B.C., to Ladysmith, connecting the Canadian Pacific system with the Esquimalt and Nanaimo Railway on Vancouver Island—a distance of forty miles. This ferry transfers trains, of a gross weight of from 600 to 750 tons, on barges having a capacity of twelve and fifteen cars, towed by powerful steam tugs.

(4.) The *Atchison, Topeka and Santa Fé Railway Company Coast Lines* operate a train-ferry on San Francisco Bay, from Point Richmond to three landing stages in San Francisco, distant respectively about seven, eight and nine miles from Point Richmond. The company owns four car floats, each provided with three rail tracks, and of a carrying capacity of sixteen cars 36 feet in length.

The total weight of goods carried by this ferry in the year 1900 amounted to 149,703 tons; in 1901, to 218,951 tons; in 1902, to 338,821 tons; and in 1903, to 410,829 tons. The number of cars ferried was as follows:—17,966, in 1900; 25,240, in 1901; 37,473, in 1902; and 43,149, in 1903.

The average number of single trips made per annum (during the five years from May 1st, 1900, to April 30th, 1905) amounted to 3,051.

(5.) The *New York, Newhaven and Hartford Railroad Company* operates a ferry on New York Bay, between Harlem River, New York and Jersey City, New Jersey, a distance of twelve miles. It owns two large ferry-boats, provided with three rail tracks each, and of 1,500 and 1,200 horse-power respectively; the carrying capacity of these boats is some ten passenger cars, 65 feet in length, or some 19 goods trucks, 34 feet in length. The total number of cars ferried in 1902 amounted to 64,583. The variation of water-level to be overcome in the embarkation of trains, amounting to about 6½ feet, is dealt with by means of inclined planes. The freight trains are conveyed in sections, whilst the passenger trains are embarked a whole train at a time.

(6.) Another train-ferry line on New York Bay is the *River and Harbour Transportation Company*, owned by the Long Island Railroad Company. This ferry operates four services, viz.:—

(*a*) From Long Island City to Pennsylvania Railroad, Harismus Cove Station—7 miles.

(*b*) From Long Island to Greenville Station—8½ miles.

(*c*) From Long Island to Central Railroad of New Jersey terminal, at Jersey City—6½ miles.

(*d*) From Long Island to Pier 32, East River—4 miles.

This line owns twelve car floats and six tug bots. The capacity of the floats is from 15 to 24 cars, of a length of 35 feet each.

The number of single journeys in 1904 was 4,905, as compared with 2,945 in the year 1899. The total number of cars ferried in 1904 was 83,507, as compared with 44,175 in 1899. The traffic increase, from 1899 to 1904, represents about 89 per cent. The variations of water level due to tidal conditions range over an average of 6 feet.

(7.) A further ferry on New York Bay is the *Delaware River Transfer*, operated by the Philadelphia and Reading Railroad Company. This ferry runs between Port Richmond, Philadelphia, and Camden, New Jersey—a distance of about four miles. The line was opened in 1878, and has 26 ferry-boats in operation. All the floats, or barges, are towed by steam tugs. The mean range of variation of water-level is 6 feet, and the extreme range 10 feet. The car capacity of each float is four passenger coaches and eight goods trucks. The traffic development of this line has been remarkable, as it rose from 580,300 tons in 1891, to 703,000 tons in 1895, to 1,668,500 tons in 1900, and to 2,010,600 tons in 1904. The number of journeys made in the year 1904 amounted to 10,189, whilst the number of cars ferried in that year was 80,425.

(8.) A fourth ferry on New York Bay is that of the *New York Dock Company*, which runs from and to Brooklyn, over distances of two to five miles each way. This line was opened in 1896, and owns seven car floats, which are towed by steam tugs. The average goods traffic transported during the last five years amounted to 220,000 tons per annum, 22,000 cars being ferried in 1,250 journeys.

(9.) On San Francisco Bay, the *Southern Pacific Railroad Company* operates a train-ferry which runs two lines—one from San Francisco to Oakland, a distance of four and a half miles, and the other from Benicia to Port Costa, a distance of one mile. Three steamers effect the service, one of them (the "Solano"), although an old boat, being one of the largest existing ferry-steamers. Her tonnage is 3,459, with a length of 424 feet, and a width of 64 feet; she can carry, on four rail tracks, 27 passenger cars or 42 goods trucks. The average number of cars ferried annually by this line is some 56,000 passenger cars and some 115,000 goods trucks.

Figs. 14, 15, and 16 show the ferry-steamers operated on these two lines.

B. Of *Lake Ferries* the following may be mentioned; the first six are on Lake Michigan, a map of which showing the various ferry lines is given in Fig. 17.

(1.) The *Ann Arbor Railroad Company* operates four ferry lines, viz.:—

Frankfort to Manistique	... ...	90 miles.
Frankfort to Manitowoc	... ...	80 "
Frankfort to Menominee	... ...	78 "
Frankfort to Kewaunee	... ...	60 "

This company owns three ferry-boats of four-rail tracks each. Their carrying capacity is about twenty-two cars of 36 feet in length. The total number of cars ferried in 1901 was 27,240, and the total goods ferried in that year amounted to about 415,600 tons. Operations were commenced on this line in 1892, when the Company built two train ferries, the original route being between Frankfort, Michigan, and Kewaunee, Wisconsin. The boats were built of wood, sheeted with iron at the water line.

Fig. 18 shows the Ann Arbor ferry steamer "No. 3" leaving Frankfort, and Fig. 19 shows a car ferry at the landing-stage with a railway train visible on board.

The cars are loaded and discharged over the stern only, and locomotives of the standard type are used for the purpose of placing them upon, and removing them from, the tracks on the deck of the boat. Figs. 20 and 21 give two views of the landing-stage and movable apron. Turnbuckles are used both to secure the ferry-boat in perfect rail alignment to the landing-stage, and to secure the cars to the boat.

During transit the wheels of the cars are blocked with a chock, and oscillation on the springs is prevented by means of diagonal jacks. In rough weather the last car on each track is sometimes further secured from moving on its wheels by a cable worked on a steam winch. The extent of the use of these devices depends,

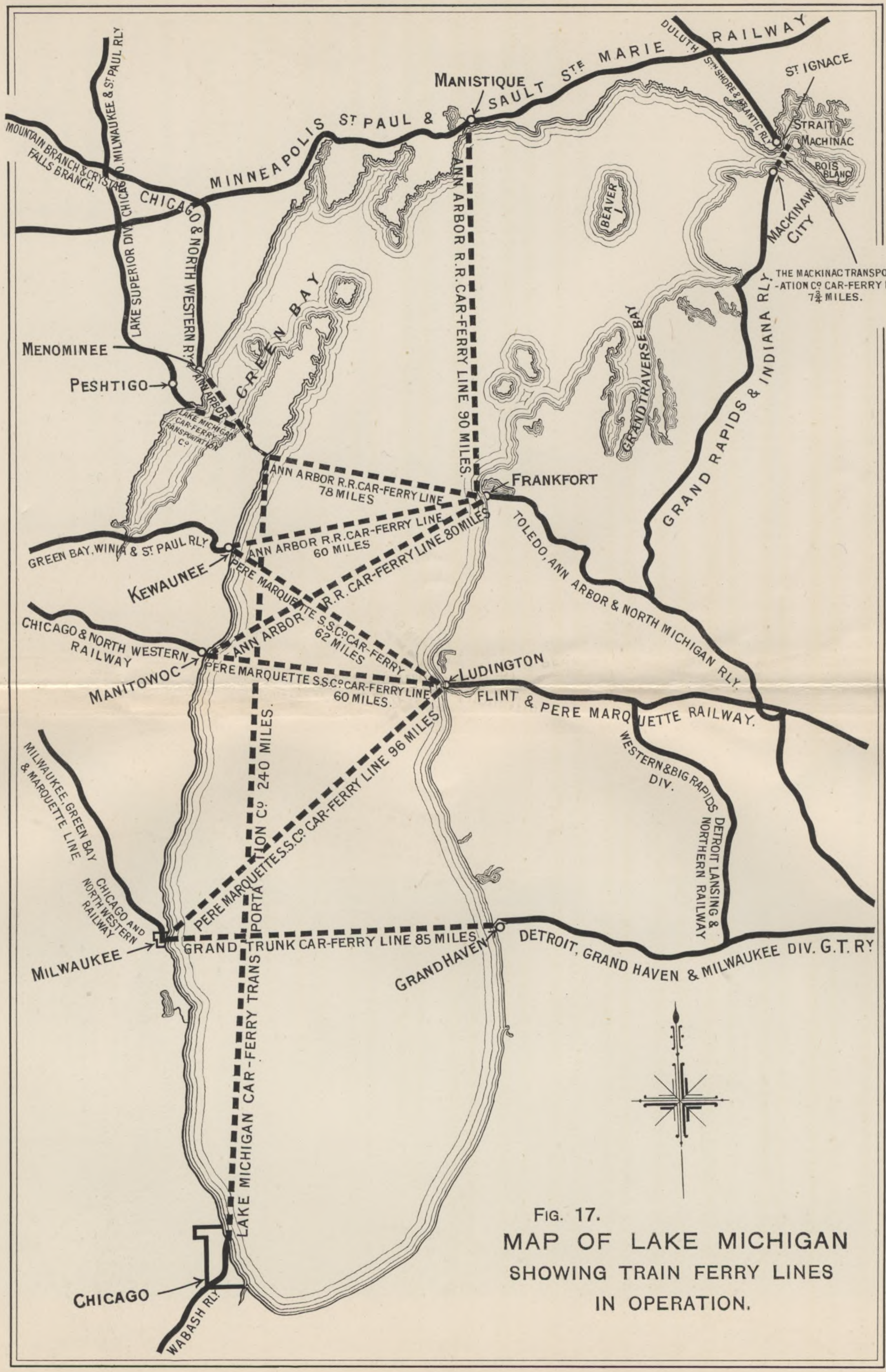

FIG. 17.
MAP OF LAKE MICHIGAN
SHOWING TRAIN FERRY LINES
IN OPERATION.

(After page 50.)

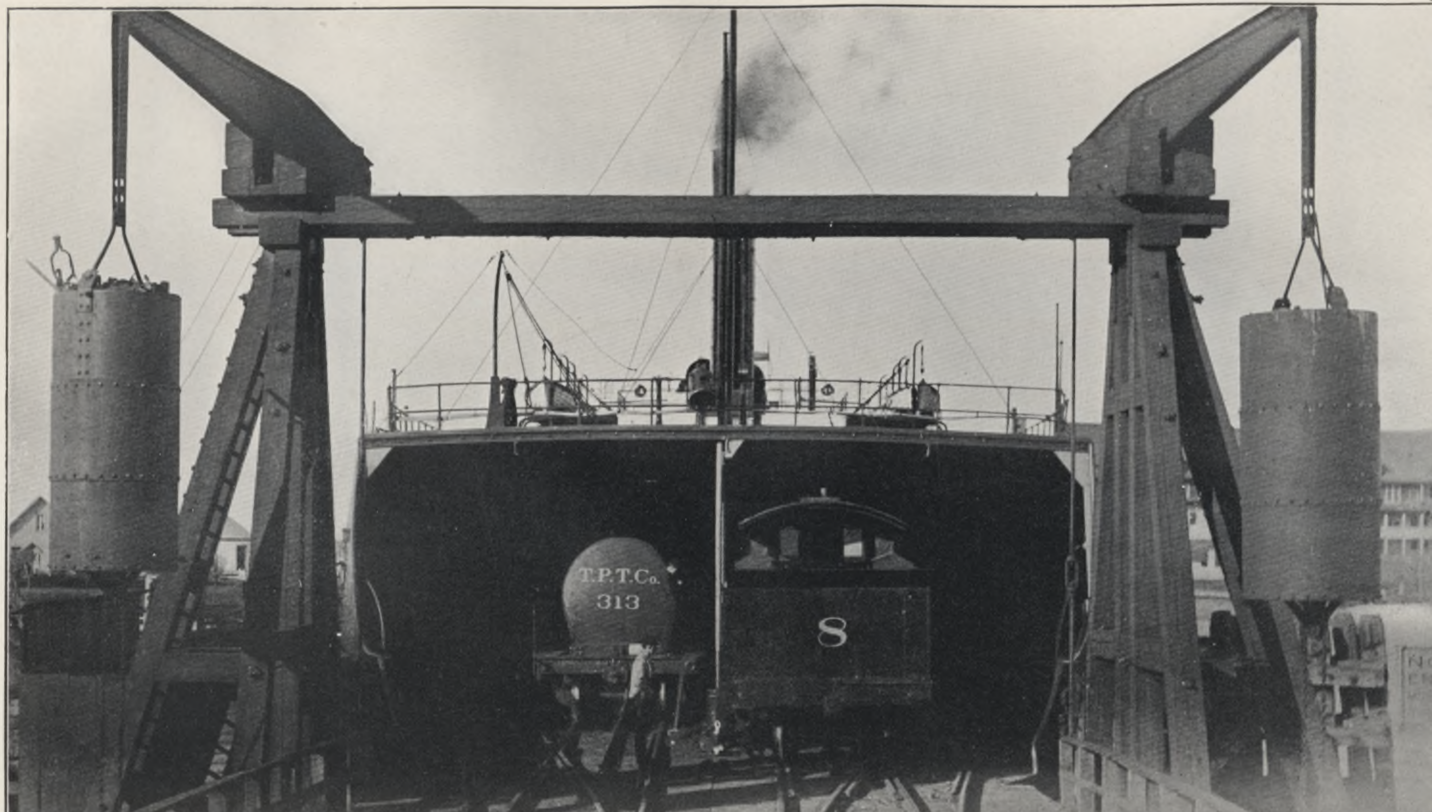

FIG. 19.—TRAIN-FERRY STEAMER BEING LOADED AT FRANKFORT (FERRY LINE OF THE ANN ARBOR RAILROAD CO.).

To face page 50.

FIG. 20.—LANDING BERTH, FRANKFORT (FERRY LINE OF THE ANN ARBOR RAILROAD CO.).

[*To face page* 50.

FIG. 21.—LANDING BERTH, FRANKFORT (FERRY LINE OF THE ANN ARBOR RAILROAD CO.).

[*To face page* 50.

in practice, upon the weather, and the several means of securing the safe transportation of the load are adjusted whilst the boat is leaving the harbour, and thus cause no delay.

The Ann Arbor line is worked on an exceedingly profitable basis, as the average percentage of total expenses to total earnings during the last four years amounted to only 26·8 per cent. This ferry is deserving of close attention, because it has shown a striking and constant development, and its earnings, which only amounted to $80,000 in 1894, rose to $618,021 in 1903.

Table III. gives the comparative operating results for the years 1900, 1901, 1902 and 1903, and the average for those four years.

Table III.—ANN ARBOR RAILROAD TRAIN-FERRIES.

OPERATING RESULTS.

	1900.	1901.	1902.	1903.	Average for Years 1900, 1901, 1902, 1903.
Earnings—	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
Freight	525,051·76	532,034·13	605,754·45	598,975·27	565,454·00
Passengers ...	18,948·24	20,965·87	17,895·60	19,046·21	19,214·00
Total	544,000·00	553,000·00	623,650·05	618,021·48	584,668·co
Expenses—					
(*a*) Maintenance...	64,275·00	35,046·00	49,531·00	60,998·00	52,462·00
(*b*) Transportation	88,579·00	95,583·00	94,590·00	115,256·00	98,503·00
(*c*) General ...	5,812·00	5,282·00	6,216·00	6,908·00	6,054·00
Total	158,666·00	135,911·00	150,337·00	183,162·00	157,019·00
Profit	385,334·00	417,089·00	473,313·00	434,859·00	427,649·00
Percentage of total expenditure to earnings	29·17	24·58	24·11	29·64	26·856
Total number of single journeys made	1,484	1,530	1,531	1,581	1,531·5
Total number of cars ferried ...	25,977	27,240	27,625	27,644	27,121·5
*Total number of passengers ferried	10,746	11,995	10,329	10,264	10,833·5
Average number of cars ferried per journey	17·5	17·8	18·1	17·4	17·7

* Calculated by dividing passenger earnings by passenger rate per mile, multiplied by average distance (77 miles).

Table III.—Ann Arbor Railroad Train-Ferries.

Operating Results—*Continued.*

	1900.	1901.	1902.	1903.	Average for Years 1900, 1901, 1902, 1903.
Average receipts per journey—	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
(*a.*) Passengers	12·77	13·70	11·69	12·05	12·55
(*b.*) Goods ...	353·81	347·73	395·66	378·86	369·22
Total receipts	366·58	361·43	407·35	390·91	381·77
Average expenses per journey ...	106·92	88·83	98·19	115·85	102·53
Average expenses per car ferried ...	6·11	4·989	5·442	6·626	5·789
Average expenses per mile of journey (average distance 77 miles)... ...	1·39	1·1536	1·275	1·504	1·3316
*Total number of tons of goods carried	410,149	415,603	473,191	467,895	441,709
Average cost per ton per mile (average distance 77 miles)	Dollars. 0·005024	Dollars. 0·004247	Dollars. 0·004126	Dollars. 0·005084	Dollars. 0·004617

* Average rate per ton is 1·280149 dollars. Tonnage has been calculated by dividing earnings for freight by average tonnage rate.

The boats are equipped to carry passengers on deck, 17 feet above the rail tracks. This Company does not regularly carry passenger cars, although the steamers are capable of doing so, and on several occasions trains of such cars have been ferried; they were circus or soldier trains, and the passengers remained in the cars.

Figs. 22, 23, 24, 25 and 26 show some of the ferry-steamers belonging to this line subjected to the very severe weather which was experienced in the month of February, 1905.

The weather conditions shown in these plates appear to have been exceptionally severe, but Mr. Ashley (Assistant President of

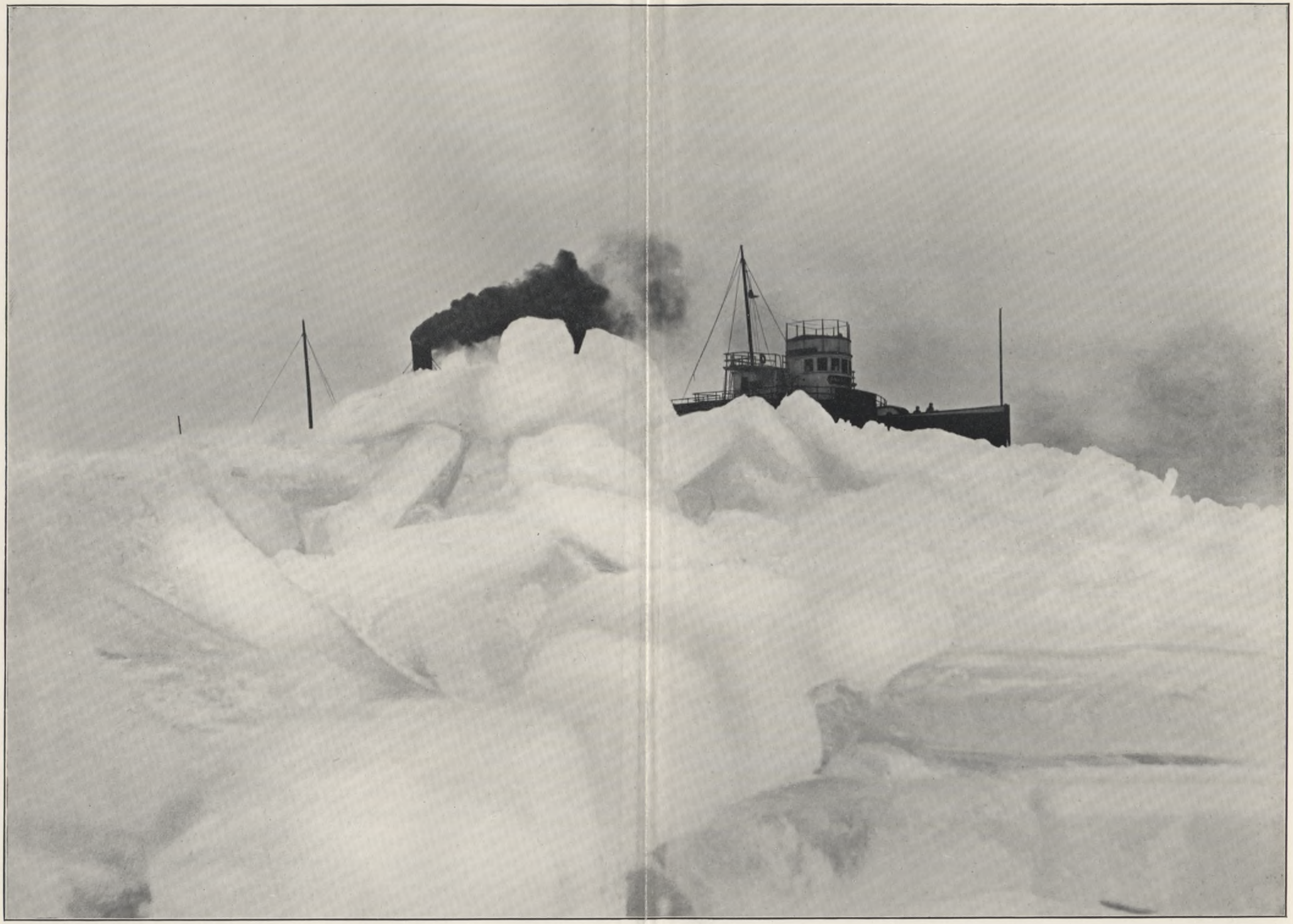

FIG. 23.—TRAIN-FERRY STEAMER OF THE ANN ARBOR RAILROAD CO., TWO MILES N.-W. OF FRANKFORT PIER, 11TH FEBRUARY, 1905.

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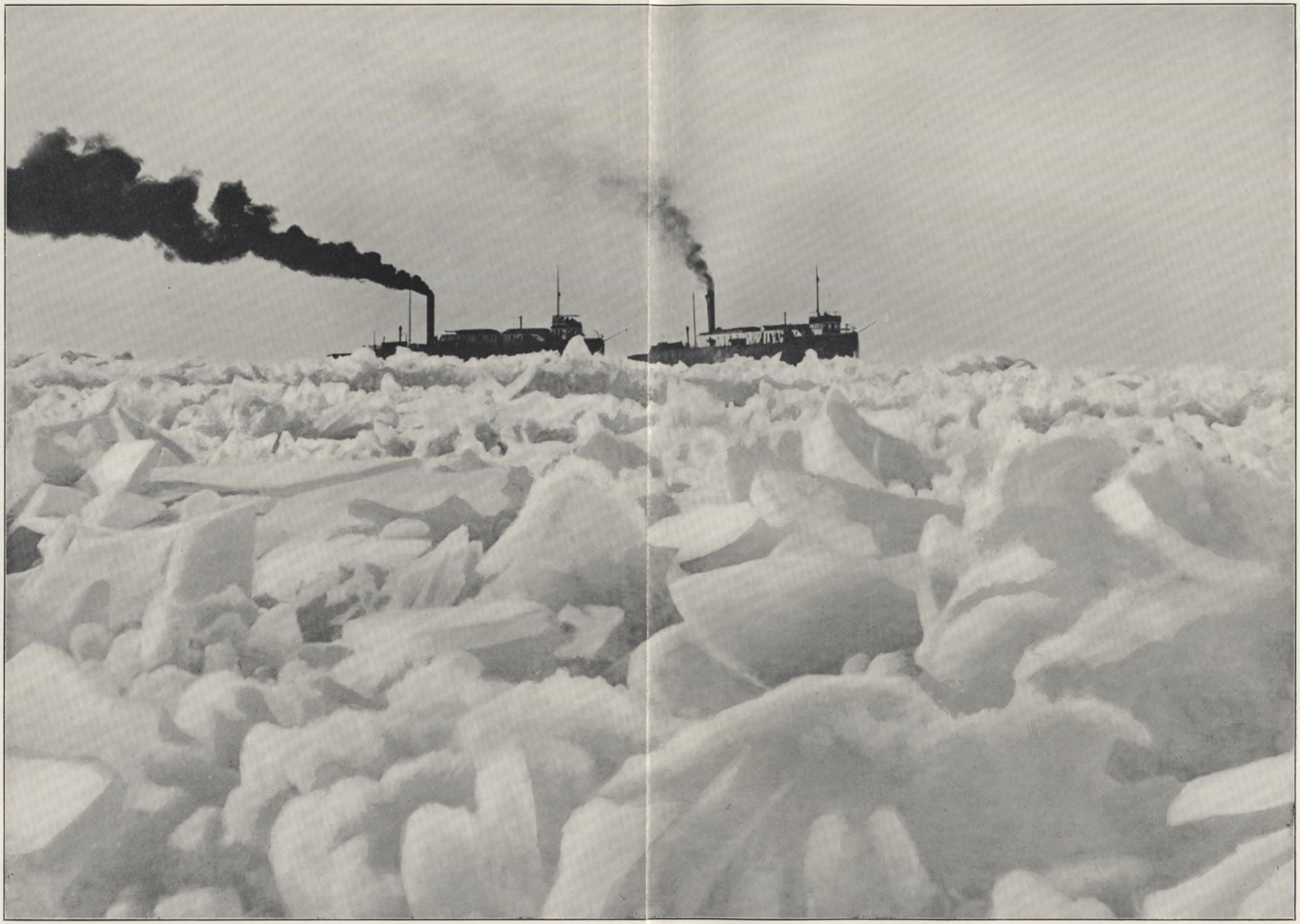


FIG. 26.—VIEW OF TWO TRAIN-FERRY STEAMERS BELONGING TO THE ANN ARBOR RAILROAD CO., AS SEEN FROM FRANKFORT SOUTH PIER ON 22ND FEBRUARY, 1905. [*After page* 52.

the Ann Arbor Line) assures us that similar conditions are by no means uncommon. Mr. Ashley, who has been described by several prominent American railway men as one of the greatest authorities on car-ferry operations, considers that the Ann Arbor train-ferry line "*has demonstrated that in the territory of this operation, freight (or goods) can be transported* 60 *miles for about the labour cost of transferring it from cars to boat on one side of the lake, and from boat to cars on the other side. In the* 12 *years during which this Company has operated by this system, cars have been lost on one voyage only, and this was the direct result of bad judgment.*"

(2.) The *Grand Trunk Car Ferry Line* operates between Milwaukee, Wis, and Grand Haven, Wis, a distance of eighty-five miles. It owns one ferry-boat, and started operations on September 27th, 1903. The boat is provided with four rail tracks, and has a capacity of 26 to 30 cars. The length is 330 feet, the width 56 feet, the draught 17 feet, the gross tonnage 2,320, and the estimated horse-power 2,354. It is a twin-screw steamer, of an average speed of 17 miles per hour. The cost of the ship was some $375,000. In the year 1904, this line transferred about 10,500 cars. Fig. 27 gives a photograph of the above-mentioned steamer, the "Grand Haven."

(3.) The *Mackinac Transportation Company* operates between St. Ignace and Mackinaw, a distance of about eight miles. It owns two ferry-boats, provided with three rail tracks each, with a carrying capacity of 11 cars, 65 feet in length, or 18 trucks, 34 feet in length. The total number of cars ferried in 1902 amounted to 36,211. This line is operated under peculiar difficulties, as the boats have to contend with ice sometimes more than 4 feet in thickness. Owing to the location of the Straits of Mackinac, which form a connecting link between Lake Huron and Lake Michigan, the current is very strong, and sets in either direction, East or West as the case may be. The result is that not only have the boats to contend with very thick ice, but also with the closing up of the channel, due to the flow of ice caused by the strong current. The steamers of this ferry line, and their method of operation, were the subject of a thorough inspection some years ago by the late Admiral Makaroff, and it was owing to his inspection of the line that the Russian Government decided to build an ice-breaking steamer for Lake Baikal.

(4.) The *Père Marquette Steamship Company* operates three ferry lines, viz.:—

Ludington (Mich.) to Kewaunee	... ...	62 miles.
Ludington (Mich.) to Manitowoc	... ...	60 „
Ludington (Mich.) to Milwaukee	... ...	96 „

It owns five ferry-boats, provided with four rail tracks each, and capable of carrying 30 cars of a length of from 34 to 40 feet. The boats are 350 feet in length, 57 feet 10 inches in width, with a draught of 16 feet, and an estimated horse-power of 2,500 to 3,000. The total number of cars carried in 1904 amounted to 74,229, and the total weight of goods transported in that year to 1,295,631 tons, as compared to 510,657 tons in 1900. The total number of single trips made in 1904 was 2,879.

The ferry-boats, when carrying passenger vehicles, run to scheduled time, and take 11 hours 20 minutes on the journey, that is, they travel at an average speed of 8½ miles an hour, and the train starts ten minutes after the arrival of the steamer.

Fig. 28 shows the ferry-boat "Père Marquette," which started running in December, 1896, between Manitowoc and Ludington. It is a steel twin-screw boat, with two compound vertical direct-acting jet-condensing engines developing a maximum of 3,500 indicated horse-power. It is capable of a speed of about 15 miles per hour, is fitted with complete electric light installation with search-light, and with cabins and state-rooms for passengers. It has a carrying capacity of about 30 cars. Fig. 29 gives cross-section of train-ferries of the "Père Marquette" Line, Nos. 18, 19, and 20.

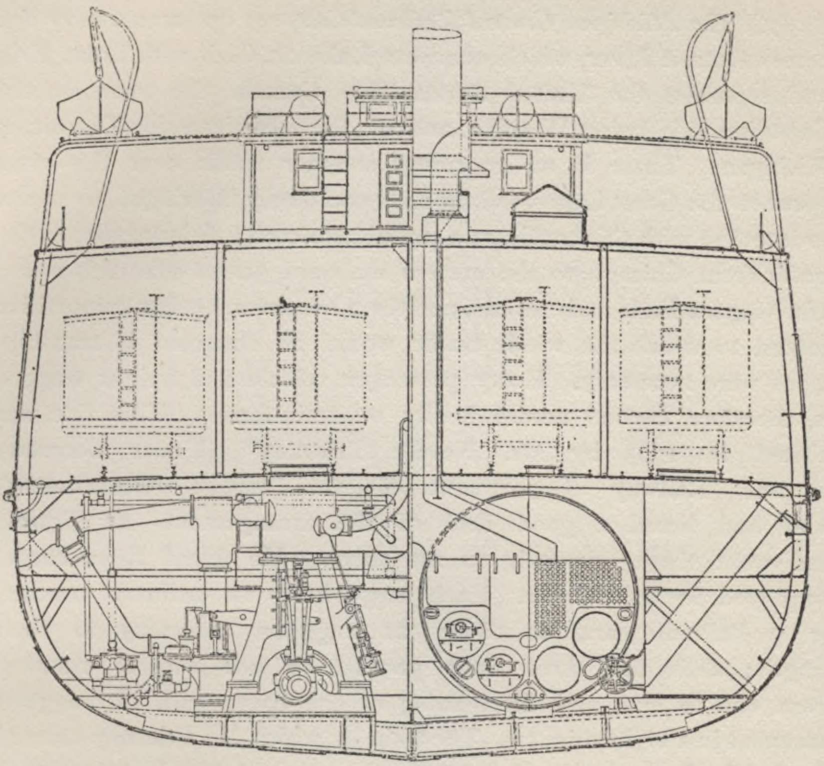


FIG. 29.—CROSS SECTION OF CAR FERRIES PÈRE MARQUETTE NOS. 18, 19, AND 20.

Fig. 30 gives a chart of the traffic development on this line from 1900 to 1904, showing both tons of goods and the number of cars carried.

(5.) The *Lake Michigan Car Ferry Transportation Company* operates between Chicago and Peshtigo—a distance of 240 miles. It owns two steam tugs and four cargo floats, of a carrying capacity of 26 cars 34 feet in length. It began to operate on August 28th, 1895.

(6.) On Lake Erie, the *Marquette and Bessemer Dock and Navigation Company* operates two ferry lines, one from Port Stanley, Ontario, to Conneaut Harbour, a distance of fifty-three miles, and the other from Rondeau to Conneaut Harbour, a distance of seventy-three miles. It owns two ferry-boats, provided with four rail tracks each, of a carrying capacity of 26 cars 34 feet in length. The total amount of goods ferried in 1903 was 417,162 tons.

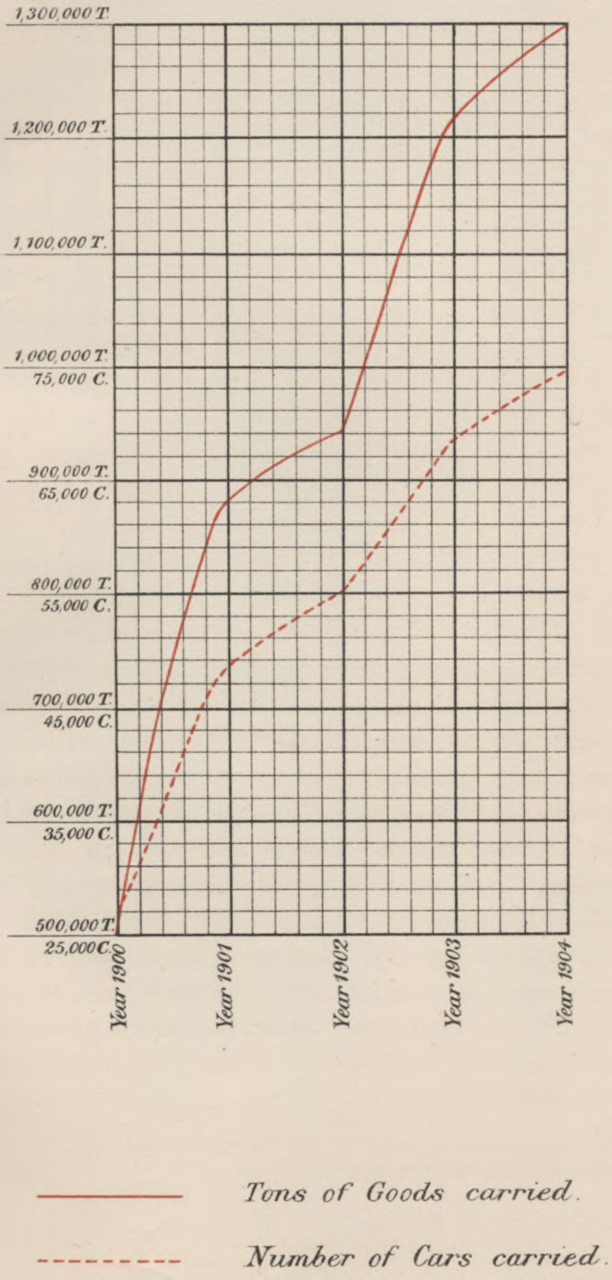
(7.) The *Michigan Central Railroad Company* operates a ferry line across Detroit River, which connects Lake St. Clair with Lake Erie, and separates the United States from Canada, the town on the Canadian side being Windsor, and on the American side Detroit, in Michigan. There is an enormous steamer traffic over this river between the Great Lakes, and the river could only be bridged, so as not to interfere with this traffic, at a prohibitive cost. A large part of the traffic from Chicago to the eastern seaboard passes over this route, *via* Niagara Falls and Buffalo, and there are several other competitive routes, to which the whole traffic would be deflected if transhipment were necessary. Every passenger vehicle and freight waggon is, therefore, carried across bodily on train-ferries. This line was visited in 1903 by Mr. Neville Priestley* (Under Secretary to the Railway Department of the Indian Government), who had heard a good deal of the arrangements at Detroit, and went there especially to see them. He found three barges employed in the service. Each barge holds 12 ordinary coaches, or 9 Pullman cars, or 18 to 21 waggons, according to their length; each has three lines parallel to one another running from end to end, and the loading of one barge with 18 waggons occupied just eight minutes. The train by which Mr. Priestley crossed consisted of seven cars (five passenger cars and two baggage cars), all bogies. From the time the train arrived at the wharf to the time it left, ten minutes were allowed. The train was boarded by two shunts, half on each of the outer lines (the middle line was occupied by waggons), and the operation took 3¾ minutes. The barge was under way within five minutes of the train reaching the dock. It took 11 minutes to cross the river, and 4 minutes to couple together the cars at the Windsor end, which was done by the shunting engine. The train engine then coupled on while the rear cars were still on the barge, and the train was on its way within 5½ minutes of the barge anchoring. The whole time occupied between the train arriving at the dock on one side and leaving on the other was 21½ minutes, and 30 minutes are allowed for the operation. The distance between the two points is one mile, and the cost of operating a single trip with a full load is about $12.

* Mr. Neville Priestley's Report on the Organisation and Working of Railways in America, 30th December, 1903, page 40.

FIG. 30. —

PÈRE MARQUETTE STEAMSHIP COY

TRAFFIC DEVELOPMENT FROM 1900 TO 1904.



At both Detroit and Windsor, the wharf runs parallel with the river, and the head of the docks is enclosed by walls built of upright logs, into which the head of the barge fits. At Detroit the bank is low, and the line is level up to the wharf, but at Windsor there is a high bank, and to enable the immediate approach to be on the level, so as to permit of waggons being shunted on and off the barges by engine power, a road, the gradient of which is 1 in 176, has been cut through the bank down to the level of the barge. The barges are so constructed that the vehicles can run straight on to them without requiring to be turned. At one end the barges are fitted with buffer stops; the vehicles are kept coupled together, and the car near the entrance end is secured by movable Scotch blocks (which come close under the wheels), and by safety chains.

The highest number of vehicles transferred in one day with three barges working all day and two all night, was 103 coaches and 1,850 waggons, or 1,953 of all kinds each way, and the normal number 937 daily each way between Detroit and Windsor. Except during busy times, only two barges are employed on the service. The barges were apparently light in construction, but were capable of taking any engine that was on the road, and the shunting engine always went on to the barge to place and remove vehicles.

Table IV. gives operating results of eight ferry lines, converted into English values.

Apart from the general information which this table gives, the most interesting column, from the point of view of the proposed Channel Ferry, is the one giving the average expenses per mile traversed. It will be seen that this item is lowest in the Ann Arbor Ferry, on which the average total cost per mile traversed by the ferry-boat amounts to about 5*s.* 5½*d.*; this cost includes maintenance, depreciation, and general management expenses in addition to transportation. The highest cost per mile is shown by the Mackinac Transportation Company, where this item amounts to about 12*s.* 10*d.*

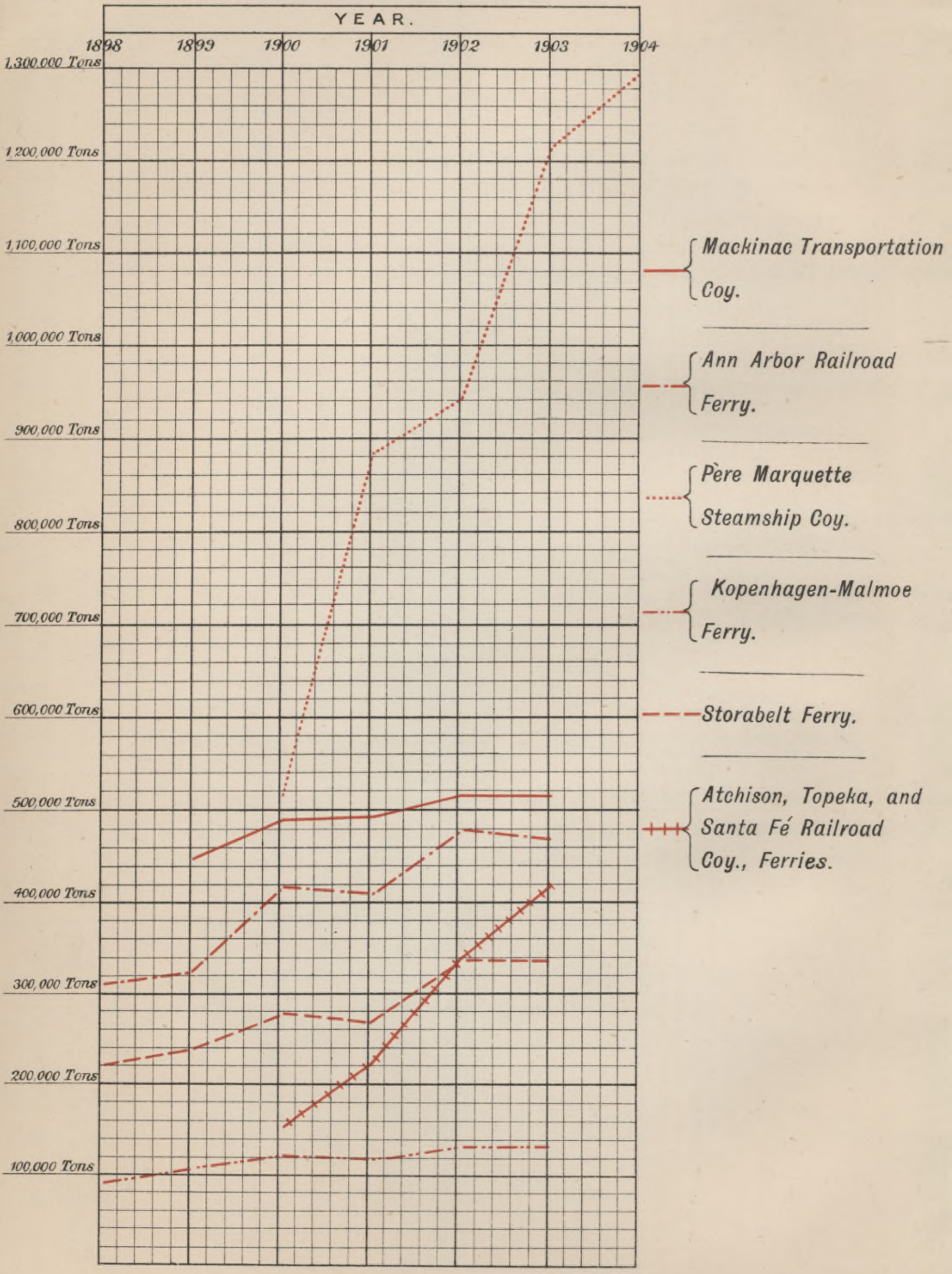
Table IV.—Operating Results of Various Train-Ferry Lines.

(All Figures are Converted into English Values.)

Name of Ferry Line.	Storabelt.	Kopenhagen Malmoe.	Gjedser Warnemünde.	Ann Arbor.	Mackinac Transportation Company.	New York, Philadelphia and Norfolk.	New York, Newhaven and Hartford.	Marquette and Bessemer Dock and Navigation Company.
Period of Operation.	1903.	1900–01.	1903–04. 1st October to 1st April (First Six Months of Operation).	1900–03. Four Years' Average.	1899–1903. Five Years' Average.	5 Years' Average.	1902.	1903.
Distance between ports in miles	16·4	18·7	26	77*	7·5	36	12	63*
Total number of single journeys made	8,198	1,590	476	1,531·5	2,687	2,943	5,443	948
Total number of cars ferried ...	...†	21,246	...†	27,121·5	34,743	61,194	64,583	15,296
Total weight of goods ferried in tons	336,950	123,910	27,107	443,959	492,234	723,232	...†	417,162
Total number of passengers ferried	525,400	27,700	22,300	10,833	57,890	...†	85,936	549
Total expenses in £	44,294·755	12,386·30	6,994·650	32,126·08	12,920·285	37,018·615	23,209·619	28,143·620
Average expenses per single journey in £	5·403	7·79012	14·695	20·977	4·8084	12·578	4·2641	29·6873
Average expenses per mile traversed in £	**0·32945**	**0·41658**	**0·56519**	**0·27244**	**0·6411**	**0·34939**	**0·35534**	**0·47123**
Average expenses per ton of goods per mile in £	0·008016	0·00534	0·009924	0·00094	0·0035	0·00142	...	0·001071

* Average. † Not ascertained.

FIG. 31. — COMPARATIVE TRAFFIC DEVELOPMENT OF VARIOUS TRAIN FERRY LINES.



(To face page 59.)

When it is borne in mind that these figures are ascertained for eight different ferry-lines, in two cases on an average of five years, and in one case on a four years' average, it will be admitted that some guidance can be gained by an average figure representing the mean expense per mile traversed on all these different lines. This mean cost works out at about 8*s*. 6*d*., and should form a trustworthy basis for an estimate of the expenditure to be incurred by the proposed Channel Ferry, in so far as it contemplates running boats of similar power and speed to those of the lines mentioned in the table.

As regards the general development of traffic which has taken place on the ferry-lines under review, whilst it would be bold to say that such development was only due to the establishment of ferries, it can hardly be denied that it must be attributable to this means of communication to no small degree. To illustrate such traffic development more fully, a chart is given in Fig. 31, showing the increase curves on several ferry-lines as far as ascertained.

CHAPTER IV.

THE DOVER-CALAIS TRAIN-FERRY SCHEME OF 1905.

Scheme presented to Parliament in Session of 1905—Quays—Situation in the Port of Dover—Reason of withdrawal of Bill—Lifts—Steamers—Connexion with Sir William H. White and with Sir W. G. Armstrong, Whitworth & Company—Previous experience of the last-named firm in building train-ferry steamers—Description of steamers intended for present scheme—Procedure for transhipment of trains—Special rolling stock—Aerothermic Waggon—Experiment with same—*Trains de Luxe*—American system of joint railroad cars—Proposed number of trips of train-ferry—Selection of terminals—Reason for selecting Dover—Advantages of the Port of Dover—Proximity to Continental ports—Dover a port of call for Transatlantic liners—Alternatives to Dover—Newhaven—Rivalry for Cross-Channel traffic.

The establishment of a Train-Ferry Service across the English Channel involves three engineering operations :—(1) the construction of a suitable quay for the reception of railway coaches and waggons and the berthing of the ferry-steamers; (2) the provision of means for transferring trains of railway vehicles from the quay to the steamers and *vice versâ*; and (3) the designing and building of steamers able to transport whole trains with safety and expedition in all weathers. For the first and second of these requirements Parliamentary sanction was necessary, and accordingly, in 1905, the Promotors lodged a Bill, called the Channel Ferry Railway and Quay (Dover) Bill, by which powers were sought to carry out the necessary works at Dover. (The situation selected for these works by the Company's engineers, Sir Douglas Fox and M. Thevenet Le Boul, will be seen in Fig. 32.)

(1.) *Quays.*—The quay designed by Sir Douglas Fox is shown in plan, elevation and section in Fig. 33. It will be noticed that it is connected by railway lines with the system of the South Eastern and Chatham Railway Company, and that it provides ample siding accommodation to enable several trains to be shunted on the left side of the lifts, and to allow a goods train some 360 feet long to be

FIG. 32.—GENERAL PLAN OF TRAIN-FERRY QUAY IN THE PORT OF DOVER (BILL OF 1905).

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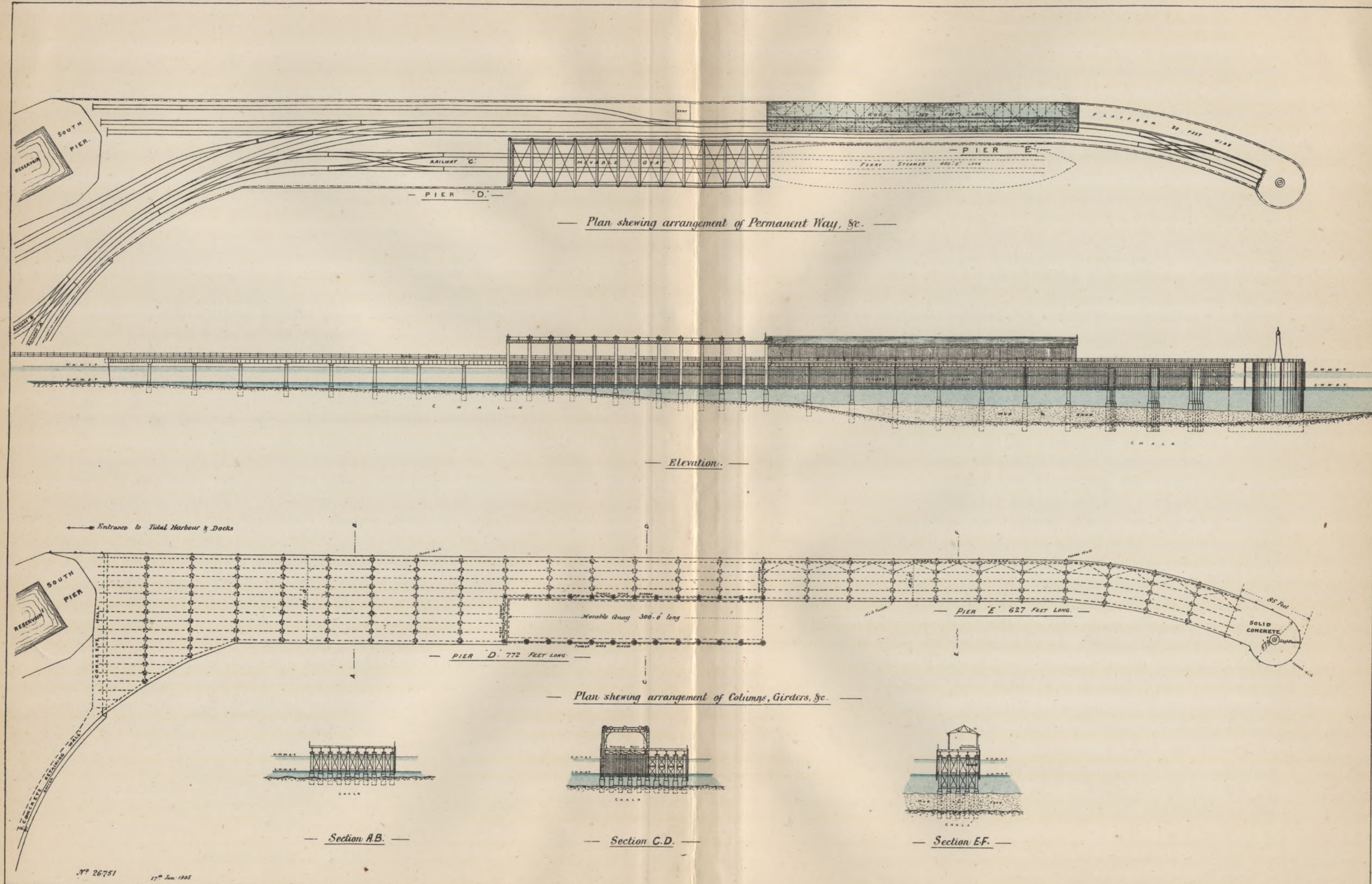
(After page 60.)

FIG. 33.— PLAN, ELEVATION AND SECTION OF PROPOSED PIER AND QUAY, AT DOVER (BILL OF 1905).



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(After page 60.)

housed under a roof for the purposes of Customs examination. In November, 1904, prior to the deposit of plans required by Parliament, the situation of the quay shown in Fig. 32 was selected as being the most favourable site, both for the purposes of the ferry service and in view of the improvements which were then understood to be contemplated within the port of Dover. Since that time, however, the arrangements in regard to the distribution of space within the commercial harbour at Dover have undergone considerable modification, and it became apparent that the site originally chosen for the quay must be abandoned, since it was open to objections on the part of the Admiralty and of the Dover Harbour Authorities. This change of plans at the port of Dover necessitated a considerable alteration in the position of the proposed quay—so considerable, indeed, as to exceed the limits of deviation permissible under Parliamentary standing orders. For this reason it was impossible to proceed with the Bill in its original form, and it was therefore withdrawn; the promotion of a new Bill will be necessary, in which due allowance must be made for the requirements of the Port Authorities in regard to the situation of the Ferry quay.

Designs for the quay to be constructed at the port of Calais have been elaborated by the French firm of Hersent Frères.

(2.) *Lifts.*—In existing train-ferry lines the transfer of trains from the quay to the steamer, and *vice versâ*, is generally effected by running the waggons over inclined planes. This method, though satisfactory in cases where the tidal fluctuations are not very large, and in consequence the level of the steamer's deck does not vary greatly in relation to the quay, is less suitable when, as at Dover, allowance must be made for an extreme variation of some 24 feet. The alternative to an inclined plane is a lift—either hydraulic or electric, and the problem was submitted to the Compagnie de Fives-Lille (a large French engineering firm interested in the promotion of the train-ferry scheme). As a result of their studies, they proposed to overcome the difficulty of variation in water level by the construction of electric lifts, which will be capable of raising or lowering a whole train from or to the level of the steamer, and which will thus ensure the horizontal position of the carriages, as well as an exact alignment of the rails during the process of transhipment. These lifts, the plans of which are shown in Figs. 34 and 35, will be able to deal with a railway train weighing some 400 tons, and of a length of about 700 feet, raising or lowering it a maximum distance of 24 feet within three minutes.

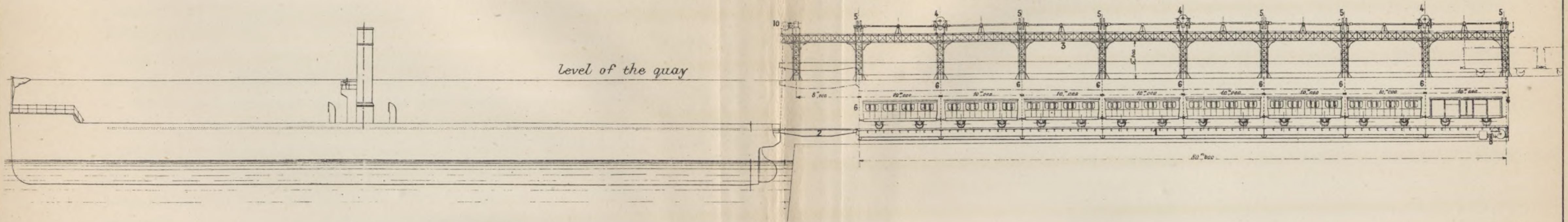
(3.) *Ferry Boats.*—The design of the ferry boats has naturally been a matter of much anxious thought, and a number of plans have been elaborated during the last four years, both in this country and in France. In this process of evolution the promoters of the scheme have been greatly indebted to Sir William H. White, K.C.B., F.R.S., who has acted as their consulting naval architect, and to the firm of Sir W. G. Armstrong, Whitworth & Co., who have embraced the project with characteristic thoroughness.

When the scheme was discussed in 1901, it was considered that a gradual application only was possible, and that the traffic likely to yield the best return was that in perishable goods, or rather in those goods which are specially liable to suffer by transfer from train to train, or train to boat, and *vice versâ*, such for instance as cut flowers and fruit. The provision of through communication for passengers did not at first seem so promising a source of revenue, and, therefore, in the earlier stages of the scheme the ferry boats were designed as a compromise between passenger and cargo steamers. After more mature consideration, however, it became evident that the existing passenger facilities at our Channel ports left something to be desired; the need of through communication by means of *trains de luxe* became more understood; and in order to meet the requirements of that very large class which demands comfort and is prepared to pay for it, the scheme was remodelled and the steamers divided into two classes—one class for passengers and one for cargo. The former class has been designed by Sir W. G. Armstrong, Whitworth & Company in collaboration with Sir William White, and the latter by the Chantiers de St. Nazaire.

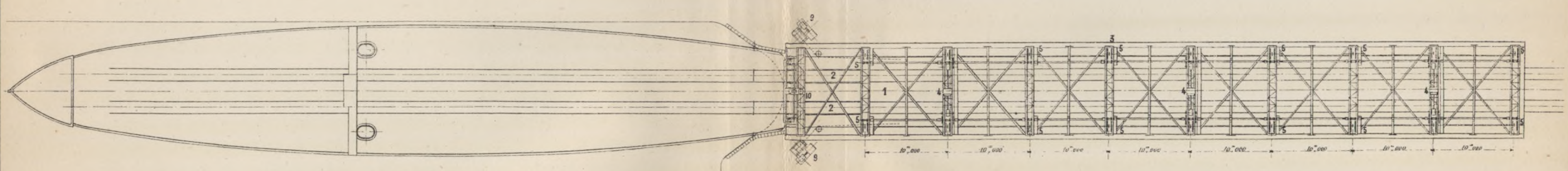
The connexion between the firm of Sir W. G. Armstrong, Whitworth & Company and the Channel Ferry Scheme is of long standing, for so far back as 1872 the late Lord Armstrong gave evidence as to the practicability of the ferry steamer proposal, and later, in 1883, a complete design and model were prepared under the instructions of Sir William White, who at that time occupied the position of Chief Constructor at Elswick Shipyard. When he left the firm to take up his duties as Chief Constructor to the

FIG. 34.—
APPARATUS FOR THE TRANSHIPMENT OF RAILWAY TRAINS.

LONGITUDINAL SECTION THROUGH THE AXIS OF THE METAL FRAME.



Plan view.



EXPLANATORY NOTES TO FIGURES 34 AND 35.

1. *Moveable lift platform receiving the trains to be transhipped.*
2. *Hinged apron bridge connecting the lift platform with the boat.*
3. *Metal frame receiving at its upper part the apparatus and mechanism for raising and lowering the lift platform.*
4. *Electric double endless screw windlasses operating the mechanism for raising the lift platform.*
5. *Mechanism for raising the lift platform connected with the electric windlasses which operate it by means of longitudinal transmissions, solidly connecting all the windlasses and ensuring the horizontal lie of the lift platform in all its positions.*
6. *Steel cables for the suspension of the lift platform.*
7. *Counterweights compensating the dead weight of the lift platform.*
8. *Electric drum-windlasses with steel cables for the transhipment of the trains (from the boat to the lift platform).*
9. *Electric drum-windlasses with steel cables for the transhipment of the trains (from the quay to the lift platform).*
10. *Electric windlass with two drums for the suspension and working of the hinged apron bridge.*

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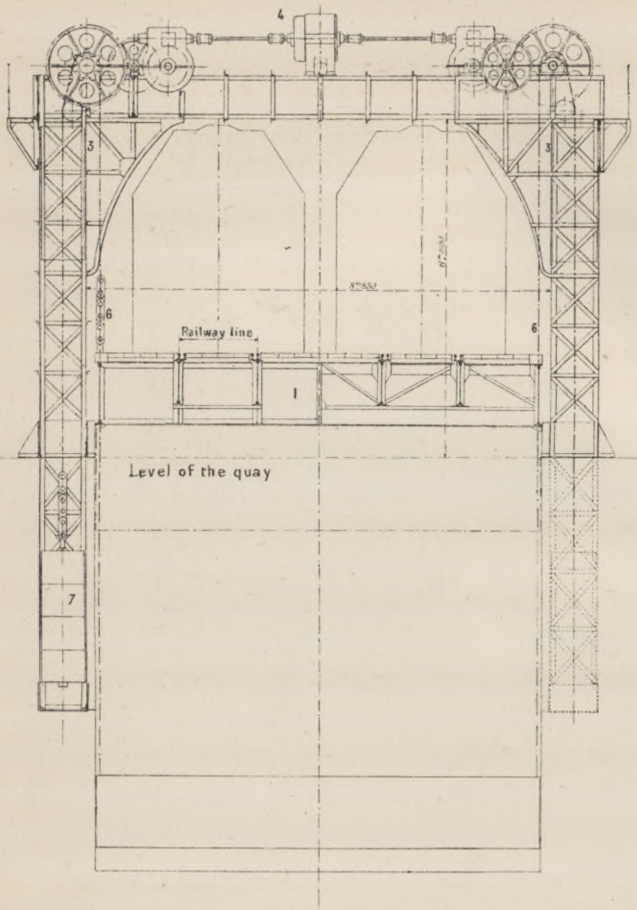
TRANSVERSE SECTION ALONG A, B, C, D.



Elevation

Plan view

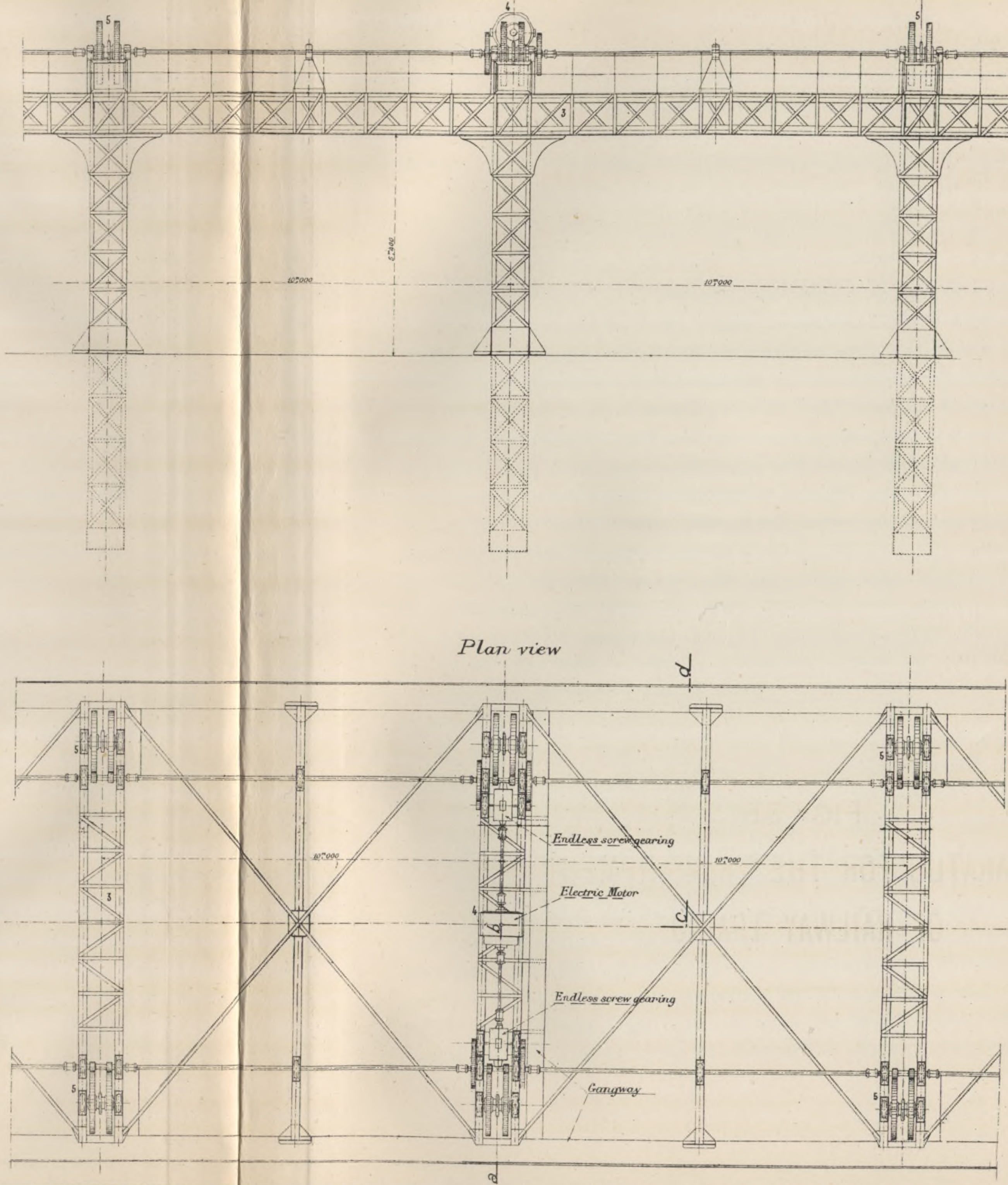


FIG. 35.—

APPARATUS FOR THE TRANSHIPMENT OF RAILWAY TRAINS.

(*After page 62.*)

Admiralty, the question was studied by his successor, Sir Philip Watt, who made several valuable contributions towards its solution. At that time propelling machinery of the paddle type was proposed.

The accounts of the American and other train-ferries given in the previous chapter are abundant proof of the trustworthiness of the forecast made by the late Lord Armstrong as to the practicability of the scheme, and the Elswick firm has now constructed three steamers of this kind, which have to carry out their work under conditions far more exacting than those under which the new Channel Ferry steamers will run.

The most important of these is the "Baikal," constructed for the Russian Government to carry trains across the lake of that name. The general arrangement of this ship can be easily understood from Figs. 36 and 37, which are photographs of the vessel herself, and from Fig. 38, which is from a model. She is first of all an icebreaking steamer; that is to say, she is of such form, proportions, and power as to enable her to force her way through field ice of three to four feet in thickness. This entails considerable breadth, and the deck area is sufficient to allow of three lines of rail, instead of two as contemplated in the new Channel Ferry proposal. The other two train-ferry steamers constructed by Sir W. G. Armstrong, Whitworth & Company are also obliged to carry out their work amidst ice of considerable thickness during the winter season, but, as the passage is short and the speed moderate, it was not considered desirable to increase their weight by adding such a superstructure as would be required to shelter the train.

In making the designs for the new Channel Ferry steamers the Elswick firm have drawn upon the experience gained under the severe conditions referred to above, and the present proposal provides for the comfort of passengers to an extent that has never hitherto been attempted in cross-Channel steamers. When the train has been shipped on board the steamer, the passengers will find themselves in what is to all intents and purposes an exceptionally well-arranged station; that is to say, they can alight on a wide platform, and walk under cover to a waiting-room, refreshment-room, smoking-room, or private cabin, all fitted up in a style with which the ordinary main line or even terminal station cannot compete. The time occupied in crossing the Channel may then be spent as the passenger desires. In the case of the night trains it is probable that the occupants of the sleeping-berths will not think it worth while to leave them, but as amongst the travelling public there will no doubt be some who prefer to move about, spacious accommodation is provided to meet their various needs.

The success which has attended the turbine system of propulsion has made it an easy task for the designers to solve what was, before the advent of this new mode, a very difficult question. In this case, by adopting turbine engines, a speed of some 23 knots can be attained without difficulty, and the proposed ferry steamers will in this respect be at least as good as, if not better than, any of the steamers at present plying between this country and France.

Fig. 39 shows the internal arrangements of the steamers, the position of the trains when on board, the extent of the passenger platforms, and the public and private accommodation which is provided. The great power and seaworthy character of the vessels would only be fully appreciated by experts, but it may be of interest to state that they are about 400 feet in length, and that the proportions have been determined with a view of ensuring initial stiffness and a wide range of stability, besides complete shelter and protection from all kinds of weather. A distinctive feature is found in the bascule doors at the fore and after ends of the train shelter; these can be opened and closed quickly by means of powerful mechanism, and will prevent any spray from reaching the railway carriages, even when the ships are driven at full speed against a head sea. The whole design (as illustrated) has been so far elaborated that the actual work of constructing the vessels could be begun at once if occasion required.

Fig. 40 shows a model which has been made of one of these ferry steamers moored at a terminal port. The train is on the hoist ready for embarkation, the apron or bow on the end of the lift is triced up ready for lowering, and the bascule doors at the bow and stern are open. These would, of course, be closed before the steamer moved from the berth.

The second class of steamer will be considerably smaller, of lower power and speed, and arranged for the conveyance of goods trains only, so that no passenger accommodation is required. It is intended that one vessel of each class shall be constructed in

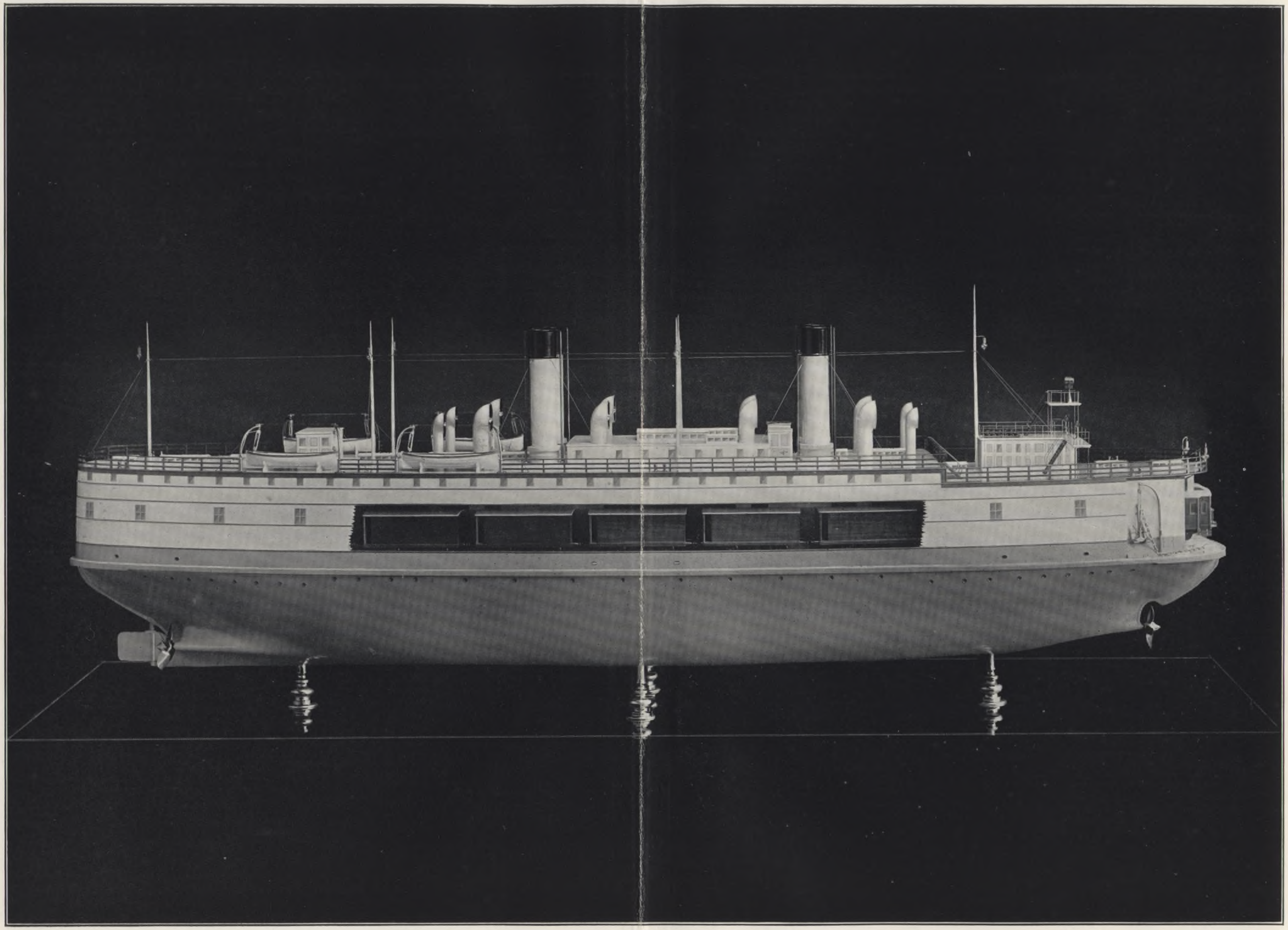
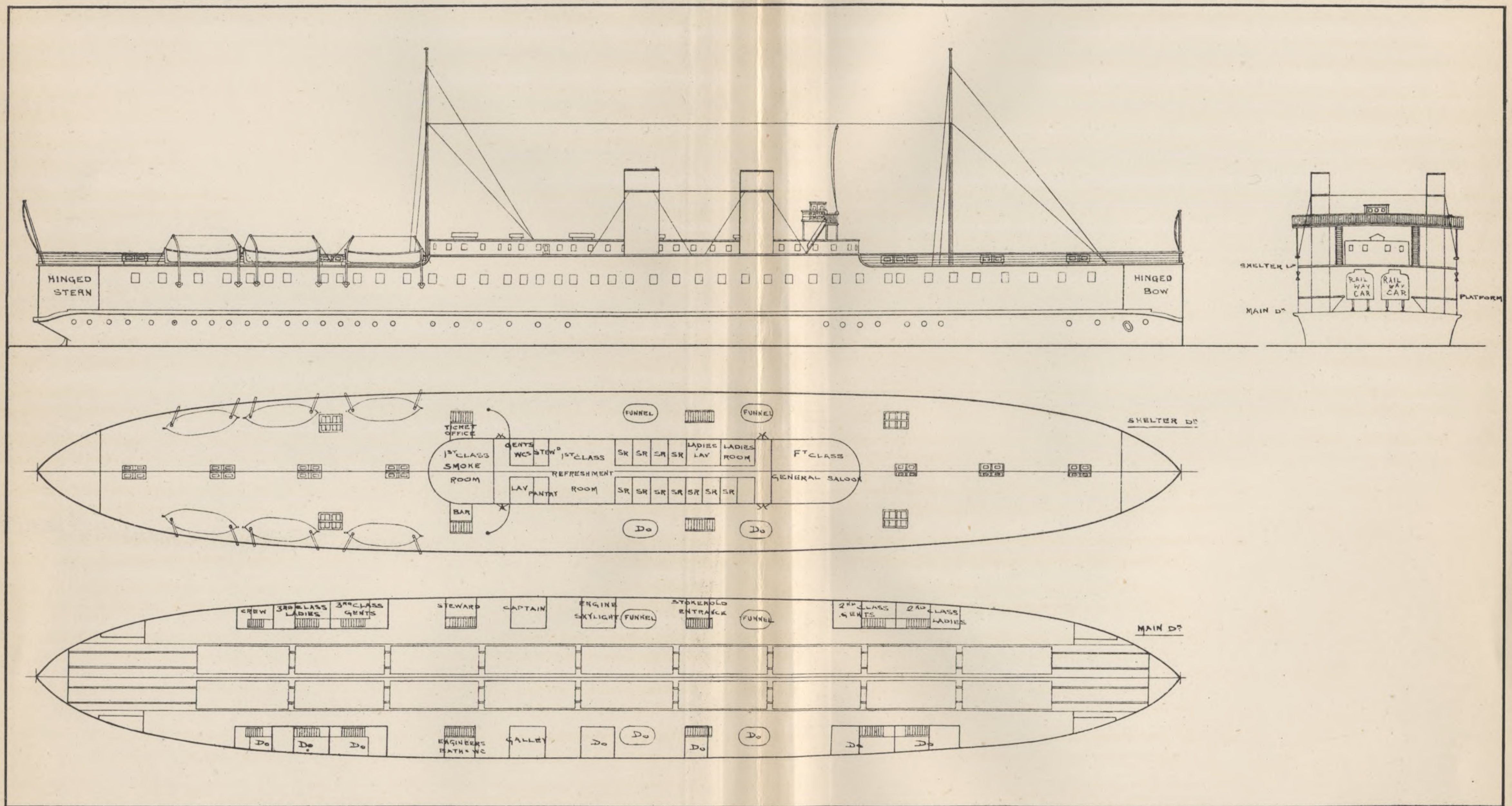


FIG. 38.—MODEL OF TRAIN-FERRY STEAMER "BAIKAL," BUILT BY SIR W. G. ARMSTRONG, WHITWORTH AND CO., LTD.

[*After page* 64.

FIG. 39.— PLAN, ELEVATION AND SECTION OF PROPOSED TRAIN FERRY STEAMER "DOVER-CALAIS."

Designed by Sir W. G. Armstrong, Whitworth & Co., Ltd.



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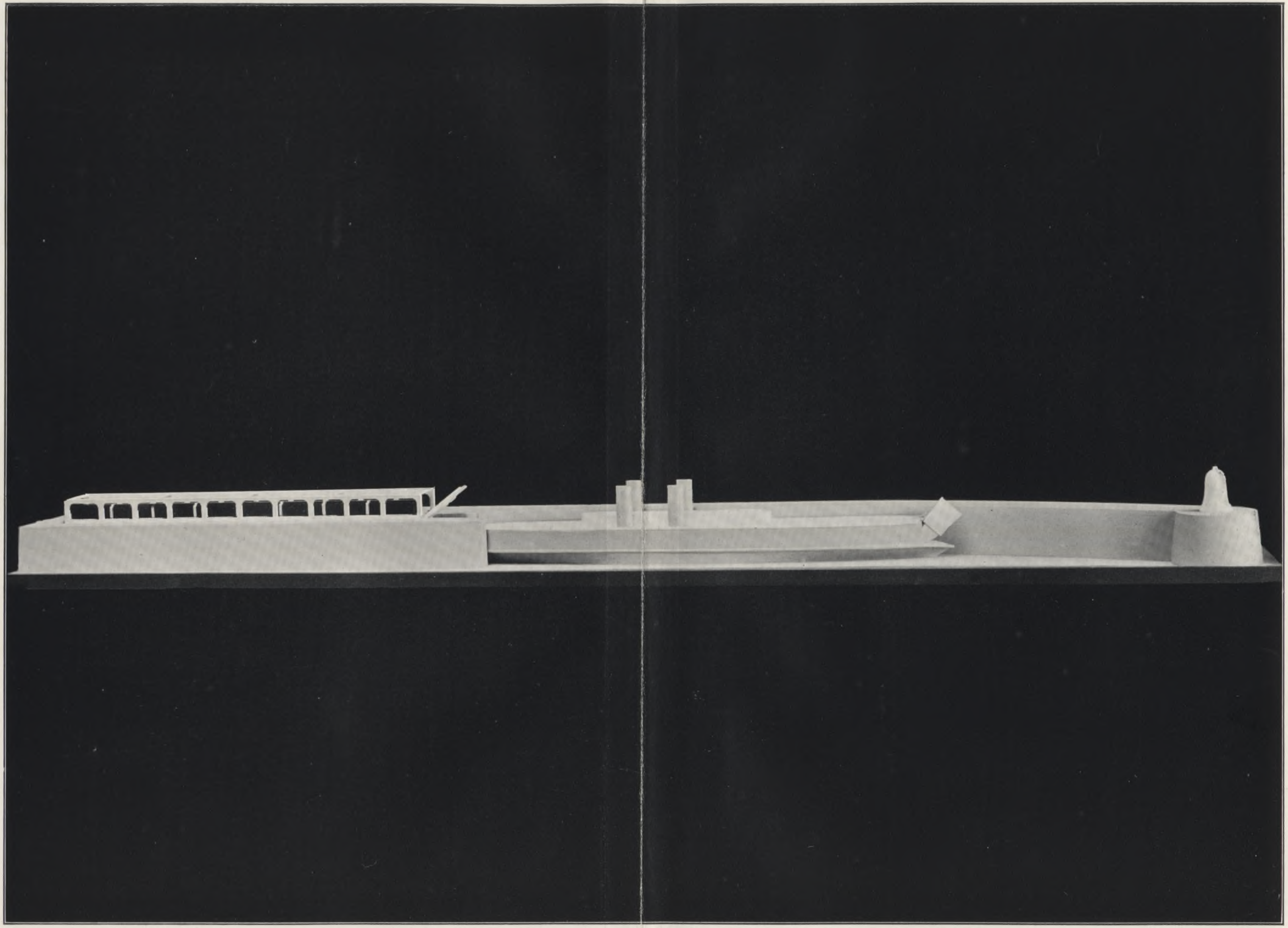

FIG. 40.--MODEL OF PROPOSED TRAIN-FERRY STEAMER "DOVER-CALAIS" MOORED TO QUAY. (APRON AND LIFT RAISED.)

[*After page* 64.

England and one of each class in France. The designs will, however, be identical, and the firms that will be entrusted with the execution are Sir W. G. Armstrong, Whitworth, & Company, and the Chantiers de St. Nazaire.

The process suggested for the transhipment of trains at the terminal ports is somewhat as follows:—Upon arrival at the ferry station, the main line engine will be detached from the train. Then, either by means of a shunting engine at the back of the train, or possibly by haulage from electric capstans, half of the train will be moved on to the platform of the lift, which is 350 feet long, and is furnished with two parallel lines of rail. The train will then be divided, and its rear half in turn moved on to the second line of rail on the lift. This operation completed, the lift will be lowered to the level of the steamer lying berthed against the projecting arm of the quay, and the train transferred by means of electric capstans to the rails on the deck over a short steel bridge or flap, fitted to the end of the lift platform, and hinged in such a way as to allow for the movement of the ship in the water, caused by the slight alteration of its displacement as it receives or is relieved of the load of the train. Conversely, on the arrival of the ship bearing the train, the electric lift will await its advent at the proper height; the train will be transferred from the ship on to the lift by means of the electric windlasses; and the lift raised to the height of the land rails, where the main line locomotive will be coupled on, and the train removed from the lift in two instalments.

Anglo-Continental transportation arrangements must also include special rolling stock, since, although the gauges of the Continental and British rails are alike, the profile of some of the foreign coaches and waggons does not allow of their travelling on the railway lines of this country. Whilst this objection could, of course, be overcome by using only British railway stock, it is hardly likely that the British railway companies would consent to all Continental traffic being carried in their cars alone, necessitating, as it would in many instances, a prolonged withdrawal of the cars from circulation.

To meet this difficulty, and as the chief goods traffic will consist

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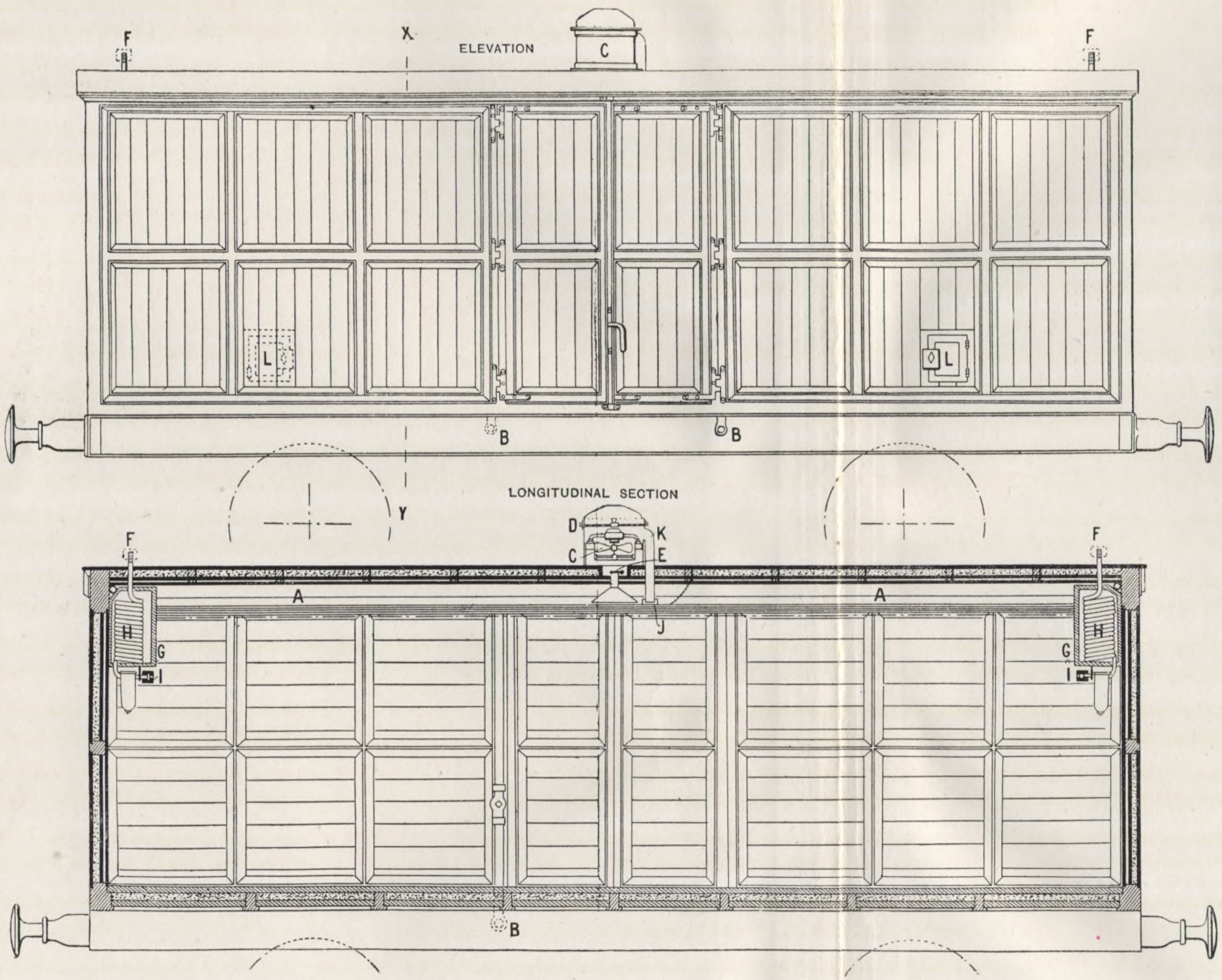
of valuable and perishable articles, increased advantages will be offered by the provision of special waggons, adapted for the most convenient handling of such articles, and fitted with special refrigerating machinery for their preservation. A few specimens of such refrigerating rolling stock have already been constructed, and appear to be working in a satisfactory way. One of these specimens, built in France and fulfilling all the conditions of the British Railway Specifications, of the "Conventions de Berne," and of the Special French Specifications (" tarifs speciaux communs G.V. 121 et P.V. 129"), is illustrated in Fig. 41. To test the advantages offered by this "Aerothermic Waggon" for international communication in connexion with the train-ferry scheme, an experiment was made on the 29th of August, 1905, when a consignment of peaches and grapes was despatched from Perpignan, in the south of France, to London. The consignment travelled *via* Paris, Dieppe and Newhaven, to the goods depôt of the London, Brighton and South Coast Railway at Willow Walk. Upon its arrival at Dieppe, the waggon was lifted bodily, with its wheels, on to one of the Railway Company's steamers, was unshipped by means of cranes at Newhaven, and again placed upon the rails, on which it ran on its own wheels to Willow Walk Station, arriving there at about eight o'clock in the morning of September 1st.

The fruit, which had thus travelled without disturbance or break of bulk for 63 hours, was sold by auction at Covent Garden immediately upon arrival, and realised from 25 to 33 per cent. more than similar fruit from the same locality sent in the ordinary way. Some "hard" peaches included in this experimental consignment were of a kind which, owing to their extreme perishability, can but seldom be sent from the South of France even to the Paris market; but in this waggon they reached London in perfect condition.

In order to obtain further information concerning the conditions in which the fruit travelled, a self-registering thermometer was placed inside the waggon, and another carried outside. (Fig. 42 gives the chart thus obtained, showing the variations of the internal and external temperature.)

The experiment with the Aerothermic Waggon evoked considerable interest in the press and among fruit growers and dealers, and a number of the latter who applied for detailed information, expressed



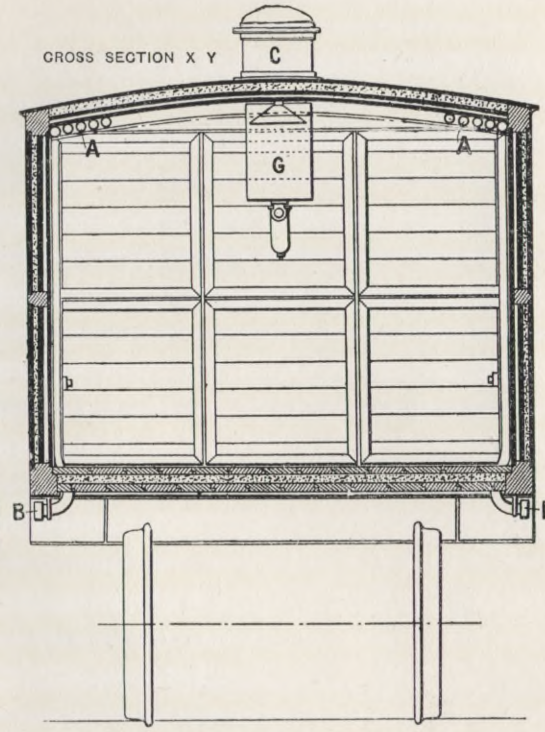


FIG. 41.—

AERO-THERMIC WAGGON.

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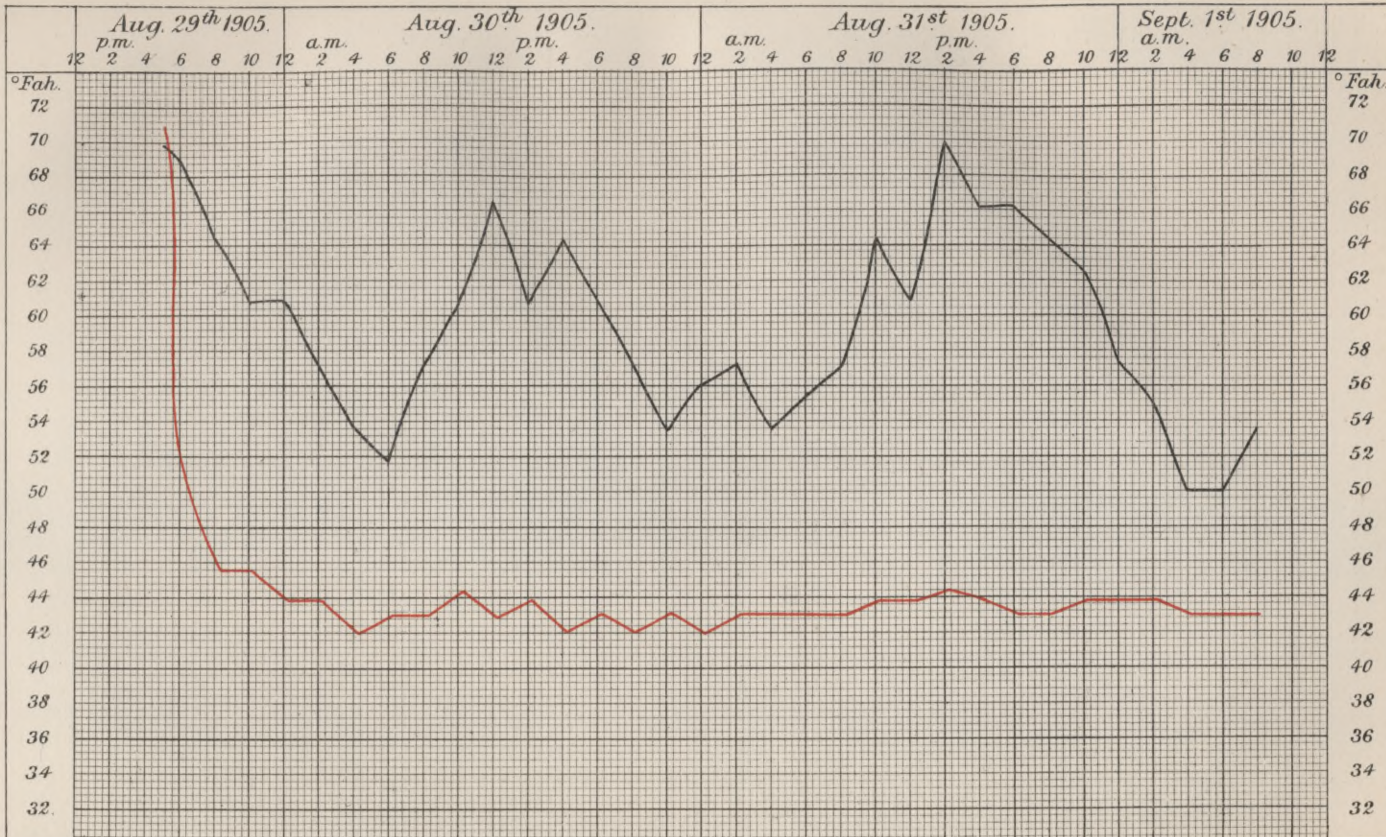

FIG. 42.— TEMPERATURE CHART OF THE AERO-THERMIC WAGGON OF THE INTERCONTINENTAL RLY. Co., LTD., ON JOURNEY FROM PERPIGNAN TO LONDON LOADED WITH 1,000 KG. OF PEACHES AND GRAPES.

——— = *Temperature in Fahrenheit of outside air as per self-registering thermometer attached to roof of waggon*

——— (red) = *Temperature in Fahrenheit of interior air as per self-registering thermometer suspended inside waggon.*

(To face page 66.)

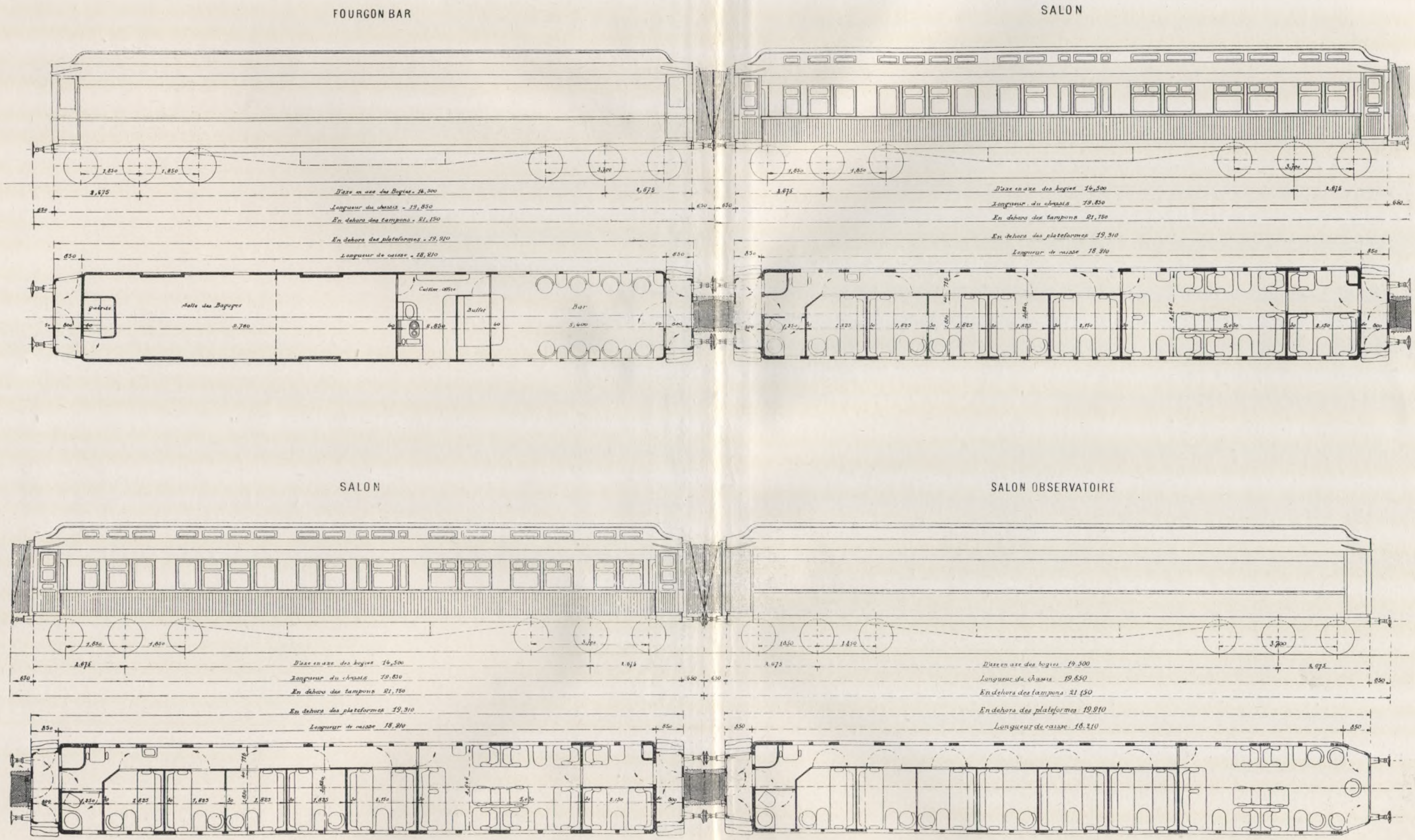

FIG. 43.—THE LONDON–PARIS "TRAIN-DE-LUXE," PROPOSED BY THE INTERNATIONAL SLEEPING CAR COMPANY, LTD.

[*After page* 66.

the hope that the service would pass from an experimental into a regular stage, as they considered it of the greatest advantage for the interchange of fruit, not only for the importation of peaches, cherries, and other fruits from the South, but for the exportation of British strawberries, and the re-exportation of bananas and pineapples.

As regards passenger coaches, it may be presumed that all passenger traffic passing across the Channel will be long distance traffic, and as one of the chief points of attraction will be the immunity from change of carriage, it is desirable that only such passenger coaches as give travellers all comforts and conveniences of the most modern and improved kind should be used. The International Sleeping Car Company, whose well known *trains de luxe* form such a feature of Continental travel, but have now to be boarded either at Calais, Ostend, or Paris, will use the Channel Ferry, thus making London, and possibly some of the Northern provincial towns, starting points for a number of their trains, and, with this end in view, the Company has already planned a special *train de luxe* for use between London and Paris, which is shown in Fig. 43.

The system suggested for the interchange of rolling stock resembles in part the American system of joint railroad cars, and the system which has long been in existence for the Anglo-Scottish railway traffic.

On the American system, the railway companies keep a record of the mileage covered on each other's lines by their special rolling stock, and pay the owners of the lines an agreed rate per mile. The rules ot interchange between various railroad systems are as follows:—At each point of junction with another railway an inspector examines the condition of the cars coming to his line, and if any defect exists, he demands from the delivering railway company a repair card, which states the nature of the defects, together with information necessary for identifying the car. If, after reaching its destination, the car is returned to the delivering railway with the same defects, it is received back in the same way as delivered; but, if new defects appear upon its return, a card must again be issued—this time to the returning railway. The arrangement permits any railway handling a car belonging to the Rolling Stock Association to effect repairs mentioned by the above cards, these being sent on to the owners of the car with a bill for the cost of repair. A fixed rate has been established, covering every detail of car repair, so that the amounts charged are always the same, and are not left to the option of the repairing railway. In determining the value of any car which may be partially or wholly wrecked, a deterioration percentage is agreed upon, so that the present value of any car can at all times be determined on the same basis.

In connexion with the question of rolling stock, which, in the case of the Channel Ferry, would be owned by an independent Company, it will be well to explain the function which the train-ferry is to perform. The ferry must be considered merely as a sea carrier, and as a sea carrier of one article only, namely, railway trains. In its dealings with car owners—whether they be railway companies, or an independent company owning rolling stock—it will be in the same position as a railway that transports rolling stock belonging to its neighbours or to private owners; that is to say, it will charge for the transport of cars on its steamer rails.

The question of traffic to be dealt with will be fully discussed in a subsequent chapter, but it may be mentioned here that, as the investigations made indicate that the facilities offered to passengers will, at the inception of the service, yield more important results than those for the transportation of goods, it is intended to concentrate attention, in the first instance, on the establishment of an effective and improved passenger service. To ensure the comfort of passengers, and to combine the conveniences at present existing with the additional convenience of immunity from change of carriage, eight trips will be run per 24 hours, viz.:—three day services to France and three to England, besides one night service each way.

As regards Customs arrangements, it has been ascertained that various concessions would be made in connexion with the proposed Ferry Service. Thus, the Customs authorities would allow all perishable articles, such as fresh fruit, flowers, butter, eggs, &c., to be examined either during transit on board the Ferry steamer, or on the quay at Dover, or during the progress of the train conveying this merchandise to its destination. Parcels and express packages would have to be examined on the quay at Dover, under the roofed shed provided for the purpose, whilst passengers' hand luggage would be

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(After page 68.)

FIG. 45.—BIRD'S-EYE VIEW, TAKEN FROM ABOVE DOVER CASTLE, OF THE NATIONAL AND COMMERCIAL HARBOURS OF DOVER AS THEY WILL APPEAR WHEN COMPLETED.

[*After page* 68.

examined on board the ferry steamer, and their registered luggage at the London termini.

Before explaining the reasons which determined the selection of the route Dover-Calais, and more especially of the port of Dover as terminal on the English side, it is curious to observe that Sir John Fowler, in his ferry scheme of 1872, not only selected the port of Dover, but chose a situation for his quay very closely resembling the one selected in the present instance; a reproduction of Sir John Fowler's plan is given in Fig. 44.

From an interesting article published in *The Nineteenth Century and After* (November, 1901) by Sir William Crundall and Mr. Worsfold Mowll, it will be seen that the port of Dover has occupied the attention of successive Governments for a considerable time. In the year 1897, the Government determined to form a National Harbour at Dover, of such magnitude as to make it, when completed, one of the finest artificial harbours in the world. In fact two harbours are at present being constructed; one a National Harbour by the Government, and the other a Commercial Harbour by the Dover Harbour Board. Fig. 45 gives a birds-eye view of the proposed completed harbour. The Admiralty Pier, well-known to most travellers to the Continent, has been extended seawards by 2,000 feet, and forms one of the boundaries of the proposed Commercial Harbour, which will have a low water area of some 75 acres, the other boundary being formed by the Prince of Wales' Pier. To the East, below the present military prison, an eastern arm, some 3,320 feet in length, has been constructed, whilst between the extension of the Admiralty Pier and the extremity of the eastern arm, a South breakwater 4,200 feet in length is in course of construction, leaving two entrances to the harbour of 800 and 600 feet respectively. In addition, further works are projected, namely the widening of the Admiralty Pier and the construction of a large Water Station thereon with all modern conveniences and appliances for the better accommodation of the Trans-Atlantic traffic. The magnitude of these works is clear evidence of the great importance attached to Dover by the Admiralty and the Government. The reason for that importance is obvious from Fig. 46, which is a map showing the various sea distances between Dover and other Channel ports on the Continent, and is taken from the Admiralty Chart.

A great concentration of foreign traffic at this port must be anticipated, owing partly to the saving in distance, and partly to its having within the last two years become a port of call for the boats of the following steamship lines :—

Hamburg American,
Red Star,
Deutsche Ost Afrika,
Hamburg South American,
Deutsche Levant,
Shire Line.

Fig. 47 will make apparent the advantages German and Belgian Trans-Atlantic liners gain by adopting Dover as a port of call, as the deviation from the direct line necessitated by touching at Dover is insignificant when compared to the deviation necessitated by other ports.

With these advantages, Dover seems destined to become the gateway of England in respect of Continental traffic. The ferry landing stage at Dover, while at first only connecting it with Calais, would doubtless ere long have its sister berths in all the principal Continental ports with which Trans-Channel services are at present carried on.

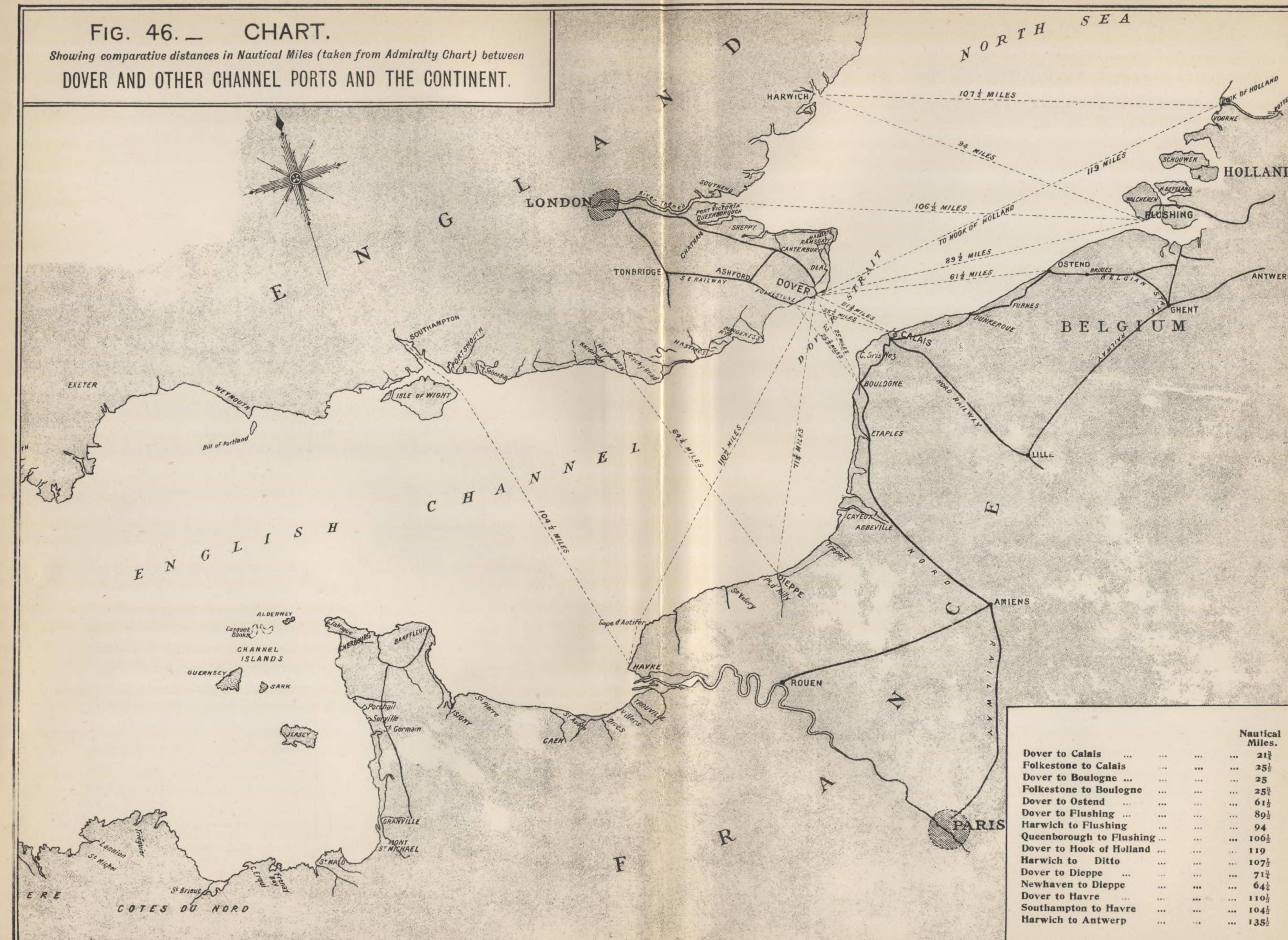
As will be seen in a later chapter, Dover already holds the premier position as a passenger port for Continental traffic. The establishment of a train-ferry line to France, with its attendant advantages as regards speed and certainty of transit, would naturally increase its traffic in goods very largely, but this development need involve no injury to rival ports, as all competent authorities seem to agree that increased facilities mean increased traffic, although it must, no doubt, in course of time, bring about the shifting of certain trade routes on the Continent.

Failing Dover, the choice of an English terminal for the Channel Ferry lies between Folkestone (which in point of situation is but very little inferior to Dover), Dungeness, and Newhaven. The last named port especially would offer singular advantages, connected as it is with such excellent railway arrangements both on the English and French sides, and, as the service *via* Newhaven-Dieppe even now occupies only an hour more than the service *via* Dover-Calais, there is little doubt that a train-ferry service on the Newhaven route would

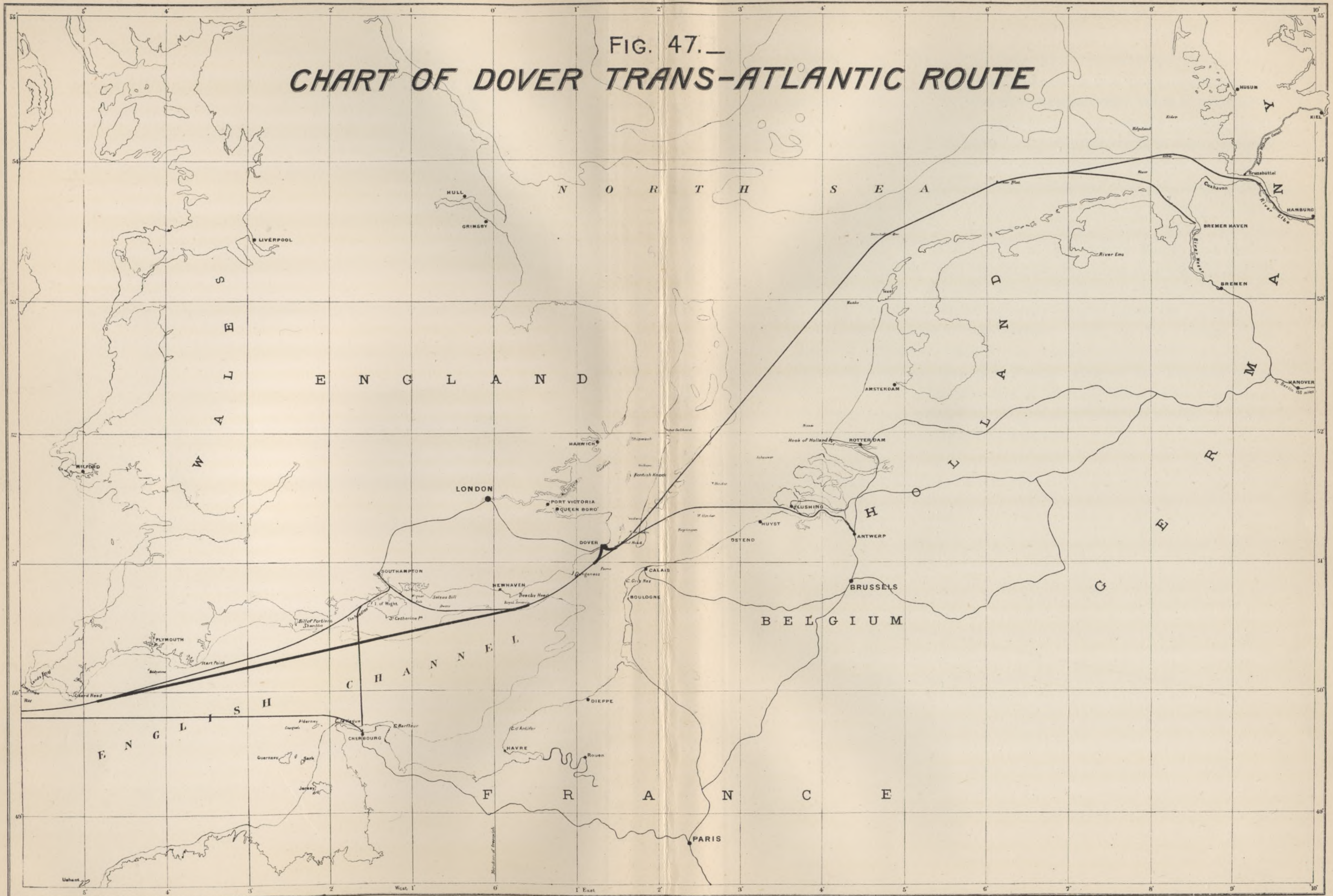
FIG. 46. — CHART.

Showing comparative distances in Nautical Miles (taken from Admiralty Chart) between

DOVER AND OTHER CHANNEL PORTS AND THE CONTINENT.



	Nautical Miles.
Dover to Calais	21¾
Folkestone to Calais	25½
Dover to Boulogne	25
Folkestone to Boulogne	25¾
Dover to Ostend	61½
Dover to Flushing	89½
Harwich to Flushing	94
Queenborough to Flushing	106½
Dover to Hook of Holland	119
Harwich to Ditto	107½
Dover to Dieppe	71¾
Newhaven to Dieppe	64¼
Dover to Havre	110½
Southampton to Havre	104½
Harwich to Antwerp	135½



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materially add to the traffic of that line. As, however, the establishment of a train-ferry is a new departure, it was thought desirable, in the first instance, to select the shortest sea route ; but it is anticipated that, very soon after the first establishment, a number of other train-ferry lines will be inaugurated, and that they will, in time, entirely supersede the Trans-Channel service in ordinary bottoms.

The approach to the Northern seaboard of the Continent has been a constant source of rivalry between the railway lines serving Switzerland, Northern Italy, Southern Germany and Austria, and the progress which has taken place is very largely due to this rivalry. The piercing of the Mt. Cenis Tunnel seemed to assure to the French lines the carriage of goods between Italy and the North ; but the piercing of the St. Gothard not only re-established the balance, but diverted the principal Italo-Northern traffic to the German lines, whence it ultimately reaches this country by means of the Belgian and Dutch railway systems. The piercing of the Simplon, to be followed by that of the Faucille, is probably destined to divert those trade routes to a degree not as yet estimable, but tending to cause further improvements in their directness.

CHAPTER V.

TRAFFIC AND REVENUE ESTIMATES.

Former estimates of traffic—Different method of present scheme—Goods traffic with France *via* Dover and Folkestone—Trade in gold and silver coin and bullion—Traffic in passengers—Comparative passenger rates—Comparative passenger rates between London and Paris—Reason of Dover's premier position as a passenger port—Rates for goods—Classification of goods—Existing trans-Channel railway rates—Through rates—Local rates—Apportionment of rates—Mr. J. Staats Forbes' apportionment in 1883—Average cross-Channel rate—Rates for gold and silver coin and bullion—The ferry a sea carrier of railway trains—Rates to be levied per railway truck—Estimate of average load per truck—Mr. Edwin A. Pratt's opinion—Average cross-Channel passenger rate — Detailed revenue estimate of train-ferry — Comparison of present estimate with former estimates—Sir John Fowler's estimate—Mr. Ward Hunt's estimate—Sir John Hawkshaw's estimate—Estimate of Channel Bridge and Railway Company.

In considering the commercial aspects of any scheme for securing unbroken intercommunication across the Channel, the primary and most important factor is the volume of the traffic which passes both in passengers and goods. Various methods for arriving at an estimate of such traffic have been adopted in former schemes. Those on which most information is available are the ferry schemes of 1870 and 1872, the tunnel schemes of 1883, and the bridge scheme of the Channel Bridge and Railway Company, Limited ; but the estimates were, for the most part, of a somewhat loose nature, and dealt chiefly and by preference with the anticipated increase of traffic, instead of with an exhaustive study of the traffic actually existing.

For the present ferry scheme a different method has been adopted. The basis of research has been rigidly confined to the existing traffic, and every endeavour has been made to ascertain the general trend and conjunctions of such traffic. The principle of compilation and the methods adopted are explained in detail in Chapter VII. so as to enable any reader to judge of the results obtained according to his opinion of the methods pursued. The result of these investigations, whilst in part of interest only for the present ferry scheme, may be considered to be of a somewhat general interest, as it is believed that an elaborate compilation of the volume of the whole trade of the United Kingdom (as expressed in weight) has not been attempted hitherto.

The only figures which immediately concern the proposed Channel Ferry are those that relate to the traffic existing at present on the routes Dover-Calais and Folkestone-Boulogne, which, since they are operated by one group of railways, may fairly be taken together. In the later appreciations it will be seen that this joining together of the two routes is merely for the sake of convenience, and in order to arrive at a general estimate of the revenue to be expected.

We find, upon investigation, that the total goods traffic between this country and France *via* Dover amounted to an average of 55,042 tons per annum during the years 1899 to 1903, whilst the traffic *via* Folkestone during the same period amounted to an average of 89,033 tons. (See Tables XI. and XII. on pages 123 and 126). In addition to articles of general trade a considerable traffic is carried on between this country and its neighbours in gold and silver coin and bullion. The high value of these consignments, and the risk connected with any transhipment of such valuable freight, make their transport by Channel Ferry of especial importance, and, from Table XV., on page 131, we see that the average quantity of these materials annually transported between this country and France, in the five years from 1899 to 1903, amounted to 14,567,550 oz., of a value of £4,817,495.

It has been mentioned in Chapter I. that, apart from the importance of immunity from transhipment to traffic in goods and merchandise of every kind, a very considerable benefit and advantage should also accrue to passengers. The tendency in railway transport, and in transport generally, is towards increased comfort and luxury; so great indeed has this become that railway companies constantly find themselves obliged to furnish travellers with through carriages to various destinations, even though the running of such carriages may not in itself be directly remunerative, and can only be considered as indirectly advantageous by serving to show the general progressiveness of the company and its desire to provide for the comfort and convenience of its customers.

In view of the importance of the passenger traffic between this country and the Continent, it is to be deplored that the same complete and exhaustive figures as are supplied by the Board of Trade concerning merchandise, cannot in all cases be obtained as regards passengers. No small difficulty has been encountered in the investigations which have been conducted on this point. They have been successful to a partial degree only, and that thanks to the courtesy of a number of British Consuls abroad and to various Consular Reports which made special mention of the passenger traffic.

It is obvious that only the passenger traffic by the most frequented routes to and from the Continent is of interest to us; figures of all these routes have been collected with the single exception of the line between Harwich and the Hook-of-Holland. Notwithstanding repeated endeavours to obtain figures for this route, both from the Great Eastern Railway Company itself, and from other sources, only meagre particulars have been collected—so jealously are the figures guarded by the railway company in question. This is the more regrettable as it would have been interesting to see whether the statistics of the traffic of that line bear out the conclusions which can be arrived at by examination of the traffic of the various other routes. But to fill up the lacuna as well as possible in the circumstances, an estimate has been made on the basis of the traffic between Harwich and Antwerp, available in a Consular Report, and its probable ratio to the traffic between Harwich and the Hook-of-Holland.

Table V. gives the passenger traffic across the English Channel, showing separately the traffic between the United Kingdom and France, and between the United Kingdom and the Belgian and Dutch ports, by the principal routes, with sea distance of each line, and giving the proportion borne by the traffic by each route to the total ascertained traffic with the respective country:—

Table V.—PASSENGER TRAFFIC ACROSS THE ENGLISH CHANNEL.

Showing separately the traffic between the United Kingdom and France, and between the United Kingdom and Belgium-Holland, by the principal routes, with the sea distances of each route and the proportion of traffic by each route to the total traffic with the respective country.

	Number.		Distance in Statute Miles.*	Average Per Cent. to Total for each Country.
	Year 1903.	Year 1904.		
TO AND FROM FRANCE, VIA—				
Dover–Calais	309,647	298,900	25·0	39·45
Folkestone–Boulogne... ...	210,753	233,703	29·6	28·81
Newhaven–Dieppe	202,043	213,522	74·0	26·94
Southampton–Havre	39,408	34,628	120·3	4·80
Total	761,851	780,753	...	100·00
TO AND FROM BELGIUM AND HOLLAND, VIA—				
Dover–Ostend	118,464	121,863	70·8	31·18
Queenboro'–Flushing	103,729	98,984	122·6	26·30
Harwich–Hook-of-Holland ...	108,000†	110,000†	123·8	28·29†
Harwich–Antwerp	54,353	55,334	156·0	14·23
Total	384,546	386,181	...	100·00
Grand total ...	1,146,397	1,166,934	...	...

* Distances converted from measurements taken on Admiralty Charts.

† Estimates.

The passenger traffic between this country and France, which, necessarily, also includes in some degree the traffic with Switzerland, Italy, Spain, &c., obviously possesses the most interest from the point of view of the contemplated ferry line. It will be seen from the table, that the proportion of traffic travelling by the various routes decreases in inverse ratio to the sea distance traversed by them. Thus, the line Dover-Calais carries the largest number of passengers, and has the shortest sea distance to traverse, whilst Southampton-Havre with the longest sea distance, has the smallest number of passengers.

A similar state of things exists as regards the traffic from and to Belgian and Dutch ports, although, in this case, the proportion established is merely approximate, owing to lack of exact information as regards the passenger traffic *via* Harwich and the Hook-of-Holland. This table tends to show that the factor to which passengers attach most importance is the shortness of the sea journey and such a conclusion is more fully borne out by considering in detail the various other considerations appertaining to trans-Channel traffic between this country and France.

The journey from London to Paris may be regarded as a representative example for illustrating the trans-Channel traffic between this country and France, and Table VI. gives the fares for passengers of all classes, together with the corresponding rates charged per mile, for the various routes by which that journey can be made.

Table VI.—COMPARATIVE PASSENGER RATES—LONDON TO PARIS.

	Distance Statute Miles.	1st Class Fare.	Rate per Mile.	2nd Class Fare.	Rate per Mile.	3rd Class Fare.	Rate per Mile.
		£ s. d.	d.	£ s. d.	d.	£ s. d.	d.
Via **Dover-Calais**: *Shortest time* 7 *hrs.* 40 *min.*							
Sea part of journey ...	25						
Land part of journey ...	262						
Total	287	2 16 8	**2·369**	1 19 8	**1·658**	1 5 9	**1·077**
Via **Folkestone-Boulogne**: *Shortest time* 6 *hrs.* 50 *min.*							
Sea part of journey ...	29·6						
Land part of journey ...	231						
Total	260·6	2 10 0	**2·302**	1 14 8	**1·596**	1 2 9	**1·048**
Via **Newhaven-Dieppe**: *Shortest time* 8 *hrs.* 41 *min.*							
Sea part of journey ...	74						
Land part of journey ...	180						
Total	254	1 18 7	**1·823**	1 8 0	**1·323**	0 18 7	**0·878**
Via **Southampton-Havre**: *Shortest time* 13 *hrs.* 26 *min.*							
Sea part of journey ...	120·3						
Land part of journey ...	222·25						
Total	342·5	1 13 10	**1·185**	1 4 10	**0·870**	—	—

It will be observed that to travel by Dover-Calais requires longer time than by Folkestone-Boulogne, and only about an hour less than by Newhaven-Dieppe; that the route has an aggregate distance longer than either of these lines; and that its first-class passenger rate exceeds that *via* Folkestone-Boulogne by 6*s.* 8*d.*, and that *via* Newhaven-Dieppe by 18*s.* 1*d.* Notwithstanding this, it commands a much larger traffic than either of the two routes mentioned, and we are, therefore, obliged to look for the cause of such preference on the part of passengers. The explanation that suggests itself is the shorter sea distance, and this explanation allows us to conclude that the establishment of a Channel Ferry between Dover and Calais, abolishing, as it will, most of the discomforts attached at present to the sea-passage, will even more—and to a very large extent—accentuate the pre-eminence of Dover as the gateway of England's communication with the Eastern and Southern parts of the Continent.

Table VII. shows the comparative rates per mile charged for the sea-passage by the various routes. It will be noticed that the rate *via* Dover-Calais is far the highest of all, and it is to be inferred that the shortness of the sea passage renders that route so popular with travellers that the South Eastern and Chatham Railway can ask, and get, over 25 per cent. more a mile than it charges by the route Folkestone-Boulogne, and some 70 per cent. more than is charged by the London, Brighton and South Coast Railway on the route Newhaven-Dieppe.

Table VII.—Comparative Sea Rates for Passengers on Transit to Continent.

	Distance Statute Miles†	Fare, 1st Class.	Rate per Mile.	Fare, 2nd Class.	Rate per Mile.
		£ s. d.	d.	s. d.	d.
Dover-Calais*	25·0	0 10 11	**5·240**	8 11	**4·280**
Folkestone-Boulogne*	29·6	0 9 5	**3·818**	7 5	**3·007**
Dover-Ostend*	70·8	0 9 0	**1·525**	7 2	**1·215**
Newhaven-Dieppe	74·0	0 18 6	**3·000**	13 6	**2·189**
Southampton-Havre	120·3	1 3 10	**2·377**	17 10	**1·779**
Queenboro'-Flushing	122·6	1 1 6	**2·104**	15 0	**1·468**
Harwich-Hook-of-Holland ...	123·8	0 19 0	**1·842**	13 0	**1·260**

* Port dues of 1*s.* 6*d.* at Dover, and 1*s.* 5*d.* at Calais or Boulogne are included in the above fares.

† Distances converted from measurements taken on Admiralty chart.

If all the information given by these tables is duly considered, the proposition may be put forward that any considerable improvement in the passenger service between Dover and Calais must very materially increase the traffic, and, although no attempt has been made in the estimates to encroach on the traffic of rival lines, it will be safe to assume that, without any difficulty whatever, the whole passenger traffic at present going both *via* Folkestone-Boulogne and *via* Dover-Calais (a traffic operated over the lines of the South Eastern and Chatham Railway Company) can be absorbed and dealt with by the Channel Ferry, especially if the service arrangements were made to meet the requirements of through Continental traffic, as has been explained in a previous chapter.

Having dealt with the volume of traffic which is at present being transported across the English Channel, both as regards passengers and goods, we are faced with the necessity of discussing the rates to be charged for transporting such part of that traffic as may be expected to make use of the Channel Ferry.

As regards goods, it may be admitted, that at the outset, only certain classes will find a considerable and immediate advantage in transit without break of bulk, and these articles have been classified in our investigations as "*Class* 1, *Articles of a Brittle, Perishable, and Valuable Nature.*" The classification of goods, from the point of view of a ferry, into those that will, naturally, find an advantage in such a method of transport, and into those articles to which it will offer no immediate and obvious advantages is, of course, much more limited than would be useful were any other purpose in view.

For the information of uninitiated readers, it will be well to say that the railway companies are subject to and bound by the Railway and Canal Traffic Act of 1888, and by the Railway Rates and Charges Orders Confirmation Acts of 1891–1892, the latter establishing certain maximum rates for the carriage of all goods and merchandise, classified into eight categories.* The rates which the railway companies propose to charge must be enumerated in rate-books, which must be open to public inspection at all railway stations that deal with goods traffic. In the terminal stations of railways, which are also terminals of any sea routes operated by the railways in

---

* Excluded from the eight categories are (a) animals, (b) carriages, (c) exceptional articles, (d) small parcels, (e) returned empties.

question, the rate-books must contain the relative proportion of charges for sea transport and for land transport.

This arrangement would appear to offer a solution of the difficulty of ascertaining the exact rates actually charged for the sea transport from Dover to Calais. The sea rates might at first sight be expected to be invariable for each article of trade, as the services to be rendered by the steamer, or by the company operating the steamer, cannot be influenced by any distance which the goods have to traverse by railway, either prior or subsequent to the sea journey. Such, however, is not the case, and this makes the whole question of arriving at the correct rates to be fixed one of extreme difficulty and intricacy.

If, for example, the rate-book of the South Eastern and Chatham Railway Company, at Dover, is consulted, it is found that the classification of the French Railways is adopted, and amounts of freight are stated in francs and centimes per 1,000 kg. In addition to these rates, various small fixed charges are levied on each consignment. The obligation imposed by the Railway and Canal Traffic Act of 1888, of stating what proportion of any through rate is appropriated to conveyance by sea, and of distinguishing such proportion from that which is allocated to conveyance by land on either side of the sea, is discharged by a note, which states :—" The rates shown in the tariff are divided per mileage, the South Eastern and Chatham Railway's proportion being on a mileage of 120 miles, Calais to London, but of this proportion one-third is for the conveyance by sea, Dover to Calais, and two-thirds for the conveyance by land, Dover-London. One-third of each of the rates, London-Calais, is for conveyance by sea, Dover-Calais, and two-thirds for conveyance by land, Dover-London."

The trader who sends goods simply from Dover to Calais, or *vice versâ*, pays amounts which are very different from those arrived at for the same transit by taking one-third of the through London-Calais rates, which suggests that the division, one-third sea and two-thirds land, is a purely arbitrary one, bearing no relation to the cost of the services rendered. The general rates, Dover-Calais, are as follows :—

Goods in Class 1	...	...	20/–	a ton.
" 2	...	...	16/8	"
" 3	...	...	13/4	"
" 4	...	...	10/10	"
" 5	...	...	8/4	"

These classes, it may be noted, proceed in reverse order to those of the English Railway Clearing House, in which Class 5 is the dearest and not, as here, the cheapest.

The above rates include landing charges at Dover in most cases, but there are some articles on which a landing fee is charged. On a certain number of articles exceptional rates are in force, both London-Calais and Dover-Calais.

Turning now to the through rates: if the rate-book at London Bridge Station is consulted, it is found that the through rates London-Calais and London-Boulogne for *petite vitesse* traffic are station to quay, whilst those from London to Paris are station to station rates. These latter include:—

(*a*) Carriage on the English railway.
(*b*) Steamer freight.
(*c*) Carriage on the French railway.
(*d*) Transfer between station and steamer.
(*e*) Petty expenses of Customs' examination.
(*f*) Expenses of loading and unloading, and station terminal charges.
(*g*) Cost of packing and unpacking goods for Customs' examination, except when special or extra labour is required.

The rates London to Calais or London to Boulogne, amount to some 10*s.* to 36*s.* a ton. On the basis of the statement made in the rate-books that, of these sums, two-thirds are attributable to the railway transit, and one-third to steamer transit, it would appear that the charge for the carriage Dover to Calais, or Folkestone to Boulogne, works out at from 3*s.* 4*d.* to 12*s.* a ton. This, therefore, shows a considerable difference from the rates which are enumerated in the Dover rate-book as applying between Dover and Calais, and which amount to some 8*s.* 4*d.* to 20*s.* a ton.

Obviously the Ferry would get no through traffic if it attempted to charge the local rates for carriage of goods across the Channel, because the local rates Calais-Dover or Boulogne-Folkestone, added to the local rate Dover-London or Folkestone-London, would be far in excess of the through rate London-Calais or London-Boulogne. As an example, eggs, sent in hampers or sieves at company's risk, are charged 26*s.* a ton Boulogne-Folkestone, and 25*s.* 6*d.* Folkestone-

London, or 51*s.* 8*d.* in all; whereas the through rate Boulogne–London, under the same conditions, is only 35*s.* 6*d.*

The local rates Dover–Calais or Folkestone–Boulogne, do not, therefore, appear a sound basis on which to found any calculation as to the rates that might be obtained by the Ferry for transport across the Channel.

It is doubtful whether greater reliance can be placed on figures obtained by taking one-third of the through rates between London and Calais or Boulogne (on the apportionment one-third to steamers, and two-thirds to railway, which applies between London and the French ports only); indeed this apportionment may be suspected to be merely a rough and ready method of securing nominal obedience to the requirements of the Railway and Canal Traffic Act of 1888. At any rate, it cannot be accepted as a measure of the cost of operation as between land and sea. The London, Brighton and South Coast Railway adopts the same one-third sea, and two-thirds land, divisions for the Dieppe-London traffic. Now, its charges Dieppe-London vary between 9*s.* and 30*s.* per ton of 1,000 kg., the portion for the steamer thus being from 3*s.* to 10*s.*, and its route consists of about 56 miles by rail and 74 miles (statute) by sea. The South Eastern and Chatham route being roughly 25 miles sea and 75 miles land, it follows that while, on this apportionment, the South Eastern and Chatham Railway gets from 6*s.* 8*d.* to 24*s.* for carrying a ton 75 miles by land, and 3*s.* 4*d.* to 12*s.* for carrying a ton 25 miles by sea, the London, Brighton and South Coast Railway gets 6*s.* to 20*s.* for 56 miles of railway, but only 3*s.* to 10*s.* for 74 miles of sea. This alone appears to suggest the arbitrary nature of the apportionment, at least from the point of view of cost of service, especially as the goods rates of the London, Brighton and South Coast Railway are believed, on the average for equal mileage, to be some 5 per cent. lower than those of the South Eastern and Chatham.

Further, there is some evidence to show that the apportionment one-third to sea, two-thirds to rail, is not, or at least has not always been, that actually adopted by the South Eastern and Chatham itself. Mr. J. Staats Forbes*, in 1883, speaking of wool, said that from

* Report from the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, Questions 1678 and 1762.

London station to Calais wharf, the rate per ton was 15s., of which *7s. 6d.* was apportioned to the railway, and *7s. 6d.* to the boat, though he admitted that this was "a very arbitrary attribution."

The difficulties encountered in ascertaining rates for *grande vitesse* traffic are similar. From information received at the Continental Department at London Bridge, the rate from London to Boulogne per *grande vitesse* appears to be 11*s.* 3*d.* per 200 lbs., or, say, 126*s.* a ton. The rate for parcels from London to Folkestone, according to the time-book of the Company, is 4*s.* 6*d.* per 112 lbs., or 90*s.* a ton. The balance attributable to sea transport would thus be about 36*s.* a ton.

From the very careful and detailed studies and investigations which have been made on the subject of rates, the conclusion has been reached that, at all events, it will not be an excessive estimate if we take the rate of *7s. 6d.* per ton as an average for all goods transported across the Channel between Dover and Calais. It must be expressly mentioned that this estimate is the average rate for all goods, namely, for goods of Class 1 (of a brittle, perishable and valuable nature), and for goods of Class 2 (all other articles). As the Ferry would chiefly transport goods of the first class, which are subject to a much higher rate, owing to their nature and character, it can with the more certainty be assumed that this estimate is below the mark.

To a certain extent, the estimate is corroborated by the statement of Mr. J. Staats Forbes before Lord Lansdowne's Joint Committee, in 1883, when he mentioned that, in 1882, the tonnage of goods conveyed between Dover and Calais was 26,599, and the receipts therefrom were £10,000.* This works out at a rate of just over *7s. 6d.* per ton.

In connexion with Mr. Forbes' figures, it must be remarked that they do not include parcels; these he mentions separately, as having yielded £10,000† for 328,000 parcels. Our estimate of *7s. 6d.* a ton on the contrary does include parcels, and is therefore all the more likely to prove an under estimate.

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* Report from the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, Question 1750 and 1751.

† Report from the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, Question 1750 and 1751.

Unfortunately, it is impossible to be sure whether Mr. Forbes' figure for the receipts is an actual one, or is merely arrived at by taking one-third of the gross receipts from London to Calais, or half and half, as he seemed to prefer.

As, from the foregoing, it has become apparent that the through rates, London to Calais, include the transhipment charges, and as it therefore must be held that those charges are also included in the one-third attributable to sea transport, we do not enter in detail into an investigation of what the transhipment charges really are.

The sea rates for gold and silver coin and bullion appear to be 4*d.* per £40 of value, whilst the mail contract amounts to £25,000 annually.

Having computed the average rate which can be expected per ton for all goods transported from Dover to Calais, or *vice versâ*, it is necessary to mention that this computation is intended merely to serve as a guide for the proposed charge. In effect and practice, an independent ferry company could not undertake the transport of goods at a rate levied per ton, or at any other rate usual with railway companies.

It is thought that, even if the ferry were being operated as an adjunct of the railway companies, and not as an independent company, it would not be feasible to apportion to it rates based on the quality, class, and weight of goods transported. In reality, a train-ferry has no other function than to transport trains, and is not concerned with the loading and contents of those trains. It can be usefully considered as a sea carrier, carrying across the Channel such trucks or cars as may be handed to it by the railways. Logically, this should apply to passenger traffic as well as to goods traffic; but, as regards the former, it is not proposed to adopt this system, since it might have the unfortunate result of encouraging in the railway companies a tendency towards overcrowding. As regards goods traffic, however, where the loading of the cars is necessarily dependent on the management of the railways, and on the efficiency of the collecting offices at the various centres, this practice can only be fruitful and advantageous to the successful and economical handling of goods.

The rate to be charged by the Channel Ferry has been worked out at £1 per 8-ton truck, and it will vary according to the size and carrying capacity of the trucks and according to the special uses to

G 2

which the various railway cars are put. In arriving at this standing charge of £1, the average load per truck has been estimated at a little over 2½ tons.

That this estimate of 2½ tons is not too high can be gathered from the instructive book on "*Railways and their Rates*" by Mr. Edwin A. Pratt, which shows that the average load per truck dealt with at three of the largest provincial goods depôts belonging to the London and North Western Railway Company (presumably in October, 1902) amounted to only 2 tons 7 cwt. 3 qrs. In general, Mr. Pratt says that the average load obtained by British railway companies for trucks with a capacity of at least seven tons is between two and three tons. But he also mentions that the average actual load of frozen or chilled meat from America on the Liverpool–London special meat train amounted to 3 tons 10 cwt. per truck. On the Great Eastern Railway, bacon from Denmark is carried in average truck loads varying from 6 tons 13 cwt., to 7 tons 5 cwt., and Danish butter is transported in consignments of about 6 tons per truck. The loading of this perishable produce from abroad is thus much better than the average for ordinary inland traffic; hence, as the traffic with which the train-ferry will be especially concerned will be Continental traffic, or comparatively speaking long distance traffic, the assumption of a little over 2½ tons as the average load per truck is very moderate.

Turning now to receipts from passengers, we find from Table VII. on page 77, that the sea rate Dover-Calais is 10*s.* 11*d.* first-class, and 8*s.* 11*d.* second-class. From these rates the port dues at Dover and Calais must be deducted, leaving the net rates received by the railway companies at about 8*s.* for first-class, and 6*s.* for second-class. As, on this route, the proportion of passengers travelling first-class probably exceeds the proportion by second-class, and as the intended service will show a distinct advance over that hitherto in use, an average rate per passenger of 7*s.* can be assumed without proposing any increase of price.

To resume, therefore, we deal with a goods rate of £1 per truck of the smallest size, and with a passenger rate of 7*s.* per head, with gold and silver coin and bullion at a rate of 4*d.* per £40 value, and with the Mails at the present contract price of £25,000.

In order to make an estimate of the revenue of the proposed Channel Ferry, it will be necessary to assume that this system of transportation is adopted by the Managing Committee of the South Eastern and Chatham Railway Companies. In that event, the railway companies having to deal with the traffic as ascertained by our investigations could count on the following revenue :—

(*a*) *From the Dover-Calais route, per Channel Ferry :—*

	£
Passengers : 526,500 (being average for both the Dover–Calais and Folkestone–Boulogne routes for the years 1903 and 1904) at 7*s*. per head	184,275
Goods traffic :	
55,042 tons nett weight	
add 13,760 tons (being 25 per cent. packing weight)	
Total, 68,802 tons of goods requiring 27,521 trucks, at £1 per truck	27,521
Gold and silver coin and bullion : at 4*d*. per £40 value	2,007
Mails	25,000
Sundries : Passengers' luggage, private cabins (7 cabins per trip, at £1 each)	21,197
Total	£260,000

(*b*) *From the Folkestone–Boulogne Route* (*Ordinary Bottoms*) :—

Goods traffic :	
89,033 tons, nett weight	
add 22,258 tons (being 25 per cent. packing weight)	
Total, 111,291 tons, at an average rate of 7*s*. 6*d*. per ton	41,734
Total	£41,734

It may be interesting to compare this estimate with the revenue estimates made on former occasions. Sir John Fowler gave the following revenue estimate before the Committee of the House of Lords, enquiring into the International Communication Bill, on July 5th, 1872 :—

Passengers	£191,000
Goods	67,800
Bullion, parcels, &c.	22,500
Mails	17,000
Extra for private cabins	20,000
Total	£318,300

Mr. Ward Hunt, on July 8th, 1872, before the same Committee, gave his estimate worked out for the train-ferry Bill of 1870, on the following lines:—

	£
Passengers	170,000
Goods	50,000
Mails	17,000
Bullion and parcels	15,000
Dues and railway mileage	5,000
Private cabins	15,000
Total	272,000

and for the train-ferry scheme of 1872 the total of his estimated revenue amounted to £327,000.

Sir John Hawkshaw, examined before the Select Committee of both Houses of Parliament enquiring into the Channel Tunnel scheme, gave as his revenue estimate from the tunnel:—*

	£
Passengers	600,000
Goods	300,000
Total	900,000

The Channel Bridge and Railway Company estimated the revenue from the projected bridge in 1893 at £3,200,000.†

In concluding this chapter, the point may again be emphasized that the estimate we have formed is based on the traffic actually existing, and, unlike the estimates quoted for kindred schemes, does not depend in any degree on expectations of the increased traffic to be fostered by improved facilities. Beyond doubt, the establishment of the ferry will be followed by an expansion of the traffic, but we have preferred to rely solely on existing actualities rather than speculate in future possibilities.

* Report from the Joint Select Committee of the House of Lords and the House of Commons, on the Channel Tunnel, Question 465.

† "Channel Bridge," page 116.

CHAPTER VI.

CAPITAL AND EXPENDITURE ESTIMATES.

Expenditure connected with Channel train-ferry required to earn revenue—Expenditure connected with Folkestone-Boulogne service in ordinary bottoms—Division of annual train-ferry expenditure — General expenses—Expenses of maintenance — Expenses of conducting transportation—Ship's crew—Ship's carrying capacity—Number of trips required to deal with traffic—Expenditure on working lifts—Annual expenditure of train-ferry in tabulated form—Capital expenditure necessary for train-ferry—Proposals connected with 1905 Bill—Assumed capital arrangements—Annual income necessary to meet capital charges—Comparison of revenue and expenditure.

In proceeding to estimate the expenditure that must be incurred to earn the revenue calculated in the previous chapter, we again consider both Channel routes of the South Eastern and Chatham Railway Company to be an indivisible whole, and assume either that the ferry system is adopted by the railway company, or that an independent ferry company is formed, to which the railway company transfers all sea-transport across the Channel. In the latter case, it is anticipated that, for some time to come, low grade goods traffic would continue to travel in ordinary bottoms on the route Folkestone-Boulogne.

The total expenditure necessary to conduct the trans-Channel traffic may be divided into :—

(*a*) Expenditure in working the train-ferry between Dover and Calais, and

(*b*) Expenditure in working ordinary bottoms on the line Folkestone-Boulogne.

For the sake of simplicity, it will be desirable to begin with the second, and to say that, from figures furnished by the late Mr. James Staats Forbes, before the Committee on the International Communication Bill of 1872* (more recent figures are not available), the average expenditure of the London, Chatham and Dover Railway for working the trans-Channel traffic, appears to have been some-

* Committee Sitting of May 1st, 1872, Question 1026.

where about 55 per cent. of their revenue. On that basis, the expenditure on the Folkestone–Boulogne service would amount to £22,953 14*s.*

This part of the estimate is thus summarily dismissed with a few lines, for two reasons: first, because no recent trustworthy data are available; and, secondly, because, whatever the expenditure may be, it should continue to be the same as that hitherto incurred and borne by the railway companies.

As the cost of working the ferry line between Dover and Calais relates to a new experiment, and to an entirely new order of things, it is necessary to enter into this branch of the proposed service in great detail.

The annual expenses of running the train-ferry can be divided into three headings:—(1) General or Management Expenses; (2) Expenses of Maintenance; and (3) Expenses of Conducting Transportation; this last heading being sub-divided into (*a*) Fixed Expenditure, and (*b*) Expenditure that varies with the frequency of the voyages.

(1.) The *General Expenses*, such as board of directors, management and offices, form an item which every reader is able to estimate for himself, but it must be borne in mind that, in this whole estimate of revenue and expenditure, it is assumed that the train-ferry will be run in conjunction with, or under the auspices of the railway companies, both on this and on the other side of the Channel. Whilst it may possibly be owned by an independent company, with its own board of directors, management and offices, it will, owing to its sole function as sea carrier, have no clerical, collecting, or despatching organisation, nor any very complicated accountants' department. An annual expenditure of £10,000 under the heading of General Expenses should, therefore, be ample, and this should not be influenced to any large extent by the amount of traffic carried.

(2.) As regards *Expenses of Maintenance:* Under this heading may be included the upkeep of material, such as quays, lifts, ships, &c., and also a certain cost for insurance.

For the upkeep of ships, six per cent. on their cost has been found to be sufficient by the Ann Arbor ferry line, and should be ample in this case also. Two express train-ferry steamers, each costing £130,000, will be able to deal with the traffic in the early stages of the scheme, or in fact with the amount of traffic shown in the preceding chapter. A third ferry steamer, held in reserve, will ensure the continuity of the service, in the event of repairs becoming necessary to either of the other two boats. A detailed calculation showing their capacity to deal with the whole traffic is given on page 90. The allowance for upkeep of quays and lifts should not exceed one-half per cent. on the initial cost, whilst insurance of two ships under way should be fully covered by an allowance of 3 per cent. on their cost.

This gives a total of about £33,488 per annum for maintenance.

(3*a*.) Under the heading of *Conducting Transportation*, we find certain charges which will either be fixed or not entirely dependent on the number of journeys made, whilst with others the reverse is the case. Amongst the former are the wages of ships' crews and purchase of stores, and under the latter can be classed fuel and expenses for working of lifts.

In order to work the steamers at their maximum capacity, three complete crews must be allowed per steamer, each comprising the following:—

One Captain.	One Cabin Boy.
One Chief Officer.	One Stewardess.
One Second Officer.	One Chief Engineer.
One Third Officer.	One Second Engineer.
Twelve Seamen.	One Third Engineer.
Eight Stewards.	Six Firemen.
Four Deck Boys.	Ten Trimmers.
One Cook.	Two Greasers.

The wages of one such crew have been estimated at some £335 per month, food allowance at some £120 per month per crew, and deck and engine-room stores at about £200.

This gives a total for what we term "fixed charges of transportation" of £37,560 per annum.

(3*b*.) The *Charges Dependent on the Frequency of the Trips* have been calculated on the assumption that eight trips are made per 24 hours, or about 2,920 trips per annum. That this number of trips will be amply sufficient to deal with the existing traffic can be seen from the subjoined calculation of the ferry-steamers' carrying capacity.

The *passenger cars* being of a maximum length of 69 feet $4\frac{5}{8}$ inches, and the rail length on the ship being 694 feet, the capacity is 10 cars. Each car can accommodate from 40 to 50 passengers; therefore, assuming an average of only 30 passengers, this gives a boat capacity of 300 passengers per trip. (One passenger equals $0{\cdot}0033\dot{3}$ boat trip load.)

With two-axle eight-ton *goods trucks*, of an average length of 18 feet, the boat's capacity will be 38 trucks. With an assumed average load of $2\frac{1}{2}$ tons per truck, the boat will have an average capacity of 95 tons of goods per trip. (One ton of goods equals 0·010526 boat trip load.)

On the basis of these figures—

526,500 passengers will require 1,755 boat trips, and 68,802 tons of goods will require 724·2 boat trips. Therefore, the total boat trips required in one year (365 days) will be 2,479·2, or 6·792 per 24 hours.

Mails and passengers' luggage are estimated to require 241 trips per annum, or 0·660 trip per 24 hours.

This shows us that the *grand total of boat trips required per* 24 *hours will be* 7·452.

It is estimated that the ferry steamers will each consume about ten tons of coal per trip, and will require some five tons of coal twice during 24 hours for the purpose of banking up and raising steam. The total expenditure on *Coal*, assuming a price of 20*s*. per ton, will thus be about £36,500 per annum.

The *Working of the Lifts* has been calculated at about 16*s*. $4\frac{1}{2}$*d*. per trip, or some £2,391 per annum. Details of this calculation may be of interest:

For the shipping and unshipping of railway trains, one lift operation will have to take place on each shore. Each single trip will, therefore, comprise a double lift operation, that is to say, one raising and one lowering.

The maximum difference of water level, due to the tide, in the English Channel at Dover is given as 24 feet, and the fact that the tides ebb and flow periodically would lead one to suppose that, over a length of time, it would be correct to calculate the average height of the lifting operation at one-half this maximum, namely 12 feet. A calculation on this basis would leave out of account the fact that the railway lines on shore (viz., on the quay), will be situated considerably above the water level at the highest tide ; this is, of course, compensated to a large extent by the height of the ship's deck above the water line, but it will, nevertheless, be prudent to allow a further two feet, and to take the maximum height and depth at 26 feet, instead of 24 feet, and the mean, therefore, as 13 feet.

From calculations supplied by the makers of the lifts, it would appear that the total mean electric energy required per single trip, involving one mean raising and one mean lowering operation, amounts to 21·1 Board of Trade units. Taking the outside price of 2*d.* per Board of Trade unit, the price of the lift operation per trip would amount to 3*s.* 6·2*d.* (£0·175833) for electric energy.

In addition, at least three men will be required to operate one lift. As they will be working during the whole of the 24 hours, three shifts should be allowed, or nine men per lift, viz.:—eighteen men for both lifts. Taking their wages at £2 per week each, we get an expenditure of £36 per week, and, assuming 56 trips per week, we arrive at a cost for labour per single trip of 12*s.* 10¼*d.* (£0·64286). The total cost per single trip for lift operation, would, therefore, amount to about 16*s.* 4½*d.* (£0·81869), exclusive of upkeep, repairs or depreciation.

Total Expenditure.—These items together give a total expenditure under all headings of £119,939 per annum. For convenience sake, this is shown in tabulated form :—

ESTIMATED EXPENDITURE CHANNEL FERRY.

	Amount.	Total.
(1.) *General Expenses*—	£	£
Board of Directors, Management and Offices		10,000
(2.) *Maintenance*—		
Three ships at 6 per cent. of cost (about £390,000)	23,400	
Insurance, say 3 per cent. (two ships under way)	7,800	
Quays and lifts, $\frac{1}{2}$ per cent. of cost (about £457,686)...	2,288	
		33,488
(3A.) *Conducting Transportation*—		
Wages of six crews at £335 each per month	24,120	
Food allowance crews at £120 each per month	8,640	
Deck and engine stores at £200 per month (per ship)	4,800	
		37,560
Total		81,048
(3B.) *Conducting Transportation, assuming eight trips per 24 hours*—		
Coal at 10 tons per trip	29,200	
Coal for banking up and raising steam *four times*, 5 tons per 24 hours, viz., £2·5 per trip	7,300	
Working of lifts, including labour both sides, at £0·81869 per trip	2,391	
		38,891
Grand total		£119,939

Average total cost per trip under all headings if 2,920 *trips are made per annum*—£41·075, *or* £41 1*s.* 6*d.*

The financial proposals connected with the Bill of the Intercontinental Railway Company, Limited, in 1905, for the realisation of the proposed train-ferry scheme from Dover to Calais, amounted to

£1,000,000, whilst the actual monetary expenditure contemplated in that scheme amounted to £847,686, made up as follows :—

	Amount.
	£
Proposed quay and works at Dover, as per estimate, in connexion with Channel Ferry Railway and Quay (Dover) Bill	253,686
Quays and works at Calais	140,000
Three train-ferry steamers	390,000
Electric train lifts at Dover and Calais (as per Contractors' estimate)	64,000
Total	£847,686

leaving £152,314 for working capital, and for additional ferry steamers in the event of the traffic development necessitating an enlargement of the fleet.

Arrangements were made for a company (called "The Channel Ferry Company" or some other suitable name) to be formed, and to apply for the whole of the shares of the Statutory or Parliamentary Company to be created by the Bill above mentioned. It was further contemplated that the Channel Ferry Company should provide the money for the execution of the Calais Harbour Works, for the building of the ferry steamers, and for the necessary working capital.

If we assume the formation of such a company, with an authorised capital of £1,000,000, and borrowing powers on Debentures to the extent of £300,000, this should suffice both to establish the Channel Ferry on a scale commensurate with the existing traffic, and to enlarge the scheme when the expanding traffic demanded it.

For first requirements a capital issue could be made amounting to £700,000 of five per cent. Preference Shares, whilst £200,000 was borrowed on four per cent. Debentures, redeemable at a premium (say £105) in 30 years. To meet the fixed charges on this issue, an annual income of £12,287 10*s.* (viz. :—Debenture interest, £8,000 ; Debenture sinking fund, on the basis of the "Sun" Table, £4,287 10*s.*) would be sufficient, all excess income being available for distribution among the shareholders.

A comparison of the gross revenue estimated in Chapter V. with the total annual expenditure estimated in this chapter yields the following results :—

	Amount. £	s.	d.	Total. £	s.	d.
Gross revenue Dover–Calais route ...	260,000	0	0			
Gross revenue Folkestone–Boulogne route*	41,734	0	0			
				301,734	0	0
Working expenses Dover–Calais route	119,939	0	0			
Working expenses Folkestone–Boulogne route*	22,953	14	0			
Debenture interest	8,000	0	0			
Debenture Sinking Fund	4,287	10	0			
				155,180	4	0
Balance nett profit				£146,553	16	0

It is thus easy to see that the proposed scheme, apart from its general utility, promises to be remunerative, especially when it is borne in mind that, in all our estimates, we have merely dealt with figures for existing traffic, and not with any possible expansion due to improved intercommunication.

* On referring to page 85, it will be seen that our revenue estimate is made from the point of view of the South Eastern and Chatham Railway Company, the total revenue from both the Dover–Calais and the Folkestone–Boulogne routes being taken; this necessitates the same principle being followed in the expenditure estimate.

If the figures for the Dover-Calais route alone were taken, one train-ferry steamer under way, and one in reserve, would suffice; the comparative revenue and expenditure would, in that event, be as follows:—

Revenue.

	£	s.	d.
Passengers: 304,273 (average Dover–Calais) at 7*s*. per head	106,495	11	0
Goods traffic	27,521	0	0
Gold and silver coin and bullion ..	2,007	0	0
Mails	25,000	0	0
Sundries: Passengers' luggage, private cabins (5 cabins per trip) ..	11,387	0	0
	£172,410	11	0

Expenditure.

	£	s.	d.	£	s.	d.
(1.) General Expenses ..				10,000	0	0
(2.) Maintenance:						
Two ships at 6 per cent.	15,600	0	0			
Insurance 3 per cent...	3,900	0	0			
Quays and lifts ..	2,288	0	0			
				21,788	0	0
(3A.) Conducting Transportation: (Three crews) ..				18,780	0	0
(3B.) Conducting Transportation: (Six trips per 24 hours, 2,190 trips per annum)						
Coal	21,900	0	0			
Coal for banking up twice per 24 hours	3,650	0	0			
Working lifts: £0·81869 per trip/.. ..	1,793	0	0			
				27,343	0	0
				£77,911	0	0

CHAPTER VII.

TRADE AND TRAFFIC.—METHOD OF COMPILING STATISTICS.

Trade statistics—Object in view—British Trade Returns—Method adopted to answer question, "What amount of goods may the Channel Ferry expect to carry?"—Answer given in tons of weight—Three steps—Sources of information—Years investigated, 1899, 1900, 1901, 1902, and 1903—Detailed explanation of method of compilation—Board of Trade statistics—Custom House statistics—Unavoidable errors—Their extent—List of articles comprised in Class 1—Proportion of trade passing through various ports—Special tables prepared by Statistical Department of Custom House—Difficulties and labour connected with compilation of statistics—Number of calculations made.

As has been shown in a previous chapter, the revenue estimates put forward in connexion with the numerous schemes that have from time to time been proposed for establishing railway communication between Great Britain and the Continent have been of a widely divergent character, and the divergencies they exhibit emphasise the fact, familiar to every student of statistics, that the value of figures can only be judged when the methods by which they have been obtained are fully known. This consideration convinced us of the desirability of giving detailed explanations of the methods we adopted in arriving at our figures, especially as the procedure we decided to follow obliged us to take cognisance of the whole trade of the United Kingdom with all countries, so that our results, we believe for the first time, enable the fluctuations in the weight of all articles imported to or exported from this country to be compared directly with the fluctuations in their value over a number of years. This explanation of method forms the subject of the present chapter, and may possibly be found wearisome by those who are not interested in statistics; but in that case it may be passed over without impairing the completeness of the following and final chapter, which contains the results yielded by the enquiry.

The object we have in view should be remembered at the outset, namely, to ascertain the amount of goods, passengers, mails, &c., which, in the event of the establishment of a train-ferry from Dover to Calais, will require transportation by that means.

The statistics concerning passengers and mails having been dealt with in Chapter V., and presenting no difficulties, we are here merely concerned with the amount of merchandise; and this amount we must ascertain in weight, namely in tons of 2,240 lbs., the ton being the unit generally used in fixing railway or other transport rates in this country.

In all British Trade Returns, the various articles of trade are enumerated with a specification of their total value, whilst only in some instances are the quantities also given in denominations of weight, volume, or numbers. The problem of ascertaining the weight in tons of the total trade of the United Kingdom—that is to say of every article of which that trade consists—is therefore one of considerable difficulty.

Before explaining the method adopted for solving this problem, it may be well to outline the process by which, taking the whole British trade as a starting point, we eventually reached the figures giving the answer to our Query: "What amount of goods may the Channel Ferry expect to carry?"

The first step was to ascertain the weight of the whole trade of the United Kingdom with all countries; this gave us the total traffic which radiates from, or converges towards this country, by all the various sea-ways, through all British ports.

This done, it became necessary to extract the portion which finds its way across the English Channel, and thereby comes within the sphere of possible attraction of an improved system of communication. For this purpose, those countries of Europe were selected which—owing to their geographical position or from other considerations—appeared most likely to be the recipients or originators of such traffic. The countries thus selected were France, Belgium, Holland, and Germany.

From the whole traffic between the United Kingdom and those countries, we had again to separate what is immediately available on the line selected (Dover–Calais), and what passes through adjoining lines. It was, therefore, necessary to ascertain the traffic of those

English ports which seemed most likely to be the principal gateways through which the trade with the selected countries is carried. Foremost amongst these ports is of course Dover, the others being London, Folkestone and Southampton. Newhaven and Harwich had to be omitted for reasons of economy which will be explained later.

This system of compilation was considered to be logical and harmonious, as showing, first, all there is to carry; second, what proportion of this traffic total is being carried to or from countries lying more or less within the sphere of our scheme; and, lastly, what proportion of the second category is being carried through the port of Dover and through adjacent ports. In this way figures were obtained for the traffic on which the Channel Ferry could immediately rely, and a basis was found for an approximate estimate of the traffic development that might be anticipated.

All our investigations into trade figures have been founded on information contained in the following publications:—

The fifty-first number of the Statistical Abstract of Trade for the United Kingdom.

The Annual Statement of Trade of the United Kingdom for 1903, *Vols.* 1 *and* 2.

Consular Reports, Nos. 2,409, 2,582, 2,768, 2,976, 3,146, *and* 3,346.

Annual Statement of the Navigation and Shipping of the United Kingdom for the year 1903.

Accounts relating to Trade and Navigation of the United Kingdom for December, 1904.

Handel des Deutschen Zollgebiets im Jahre 1903, 1 *Teil, Heft XI.*

We have also made use of:

Special Tables prepared on behalf of the Intercontinental Railway Company by the Statistical Department of the Custom House, sub-dividing the trade of the various ports into the trade with the whole world, and with the four selected countries.

As figures for a single year, and the selection of any year, seemed to be both misleading and arbitrary, it was decided to take the five latest years for which full particulars were available at the time when the work was begun, namely, 1899, 1900, 1901, 1902, and 1903.

To illustrate the manner in which these various publications were utilised for our purpose, we must go through the different stages and enumerate the difficulties which were encountered and overcome.

The *Statistical Abstract* deals with the trade of the United Kingdom in a number of tables, dividing it into "Imports," "Exports of British and Irish Manufactures and Produce," and "Exports of Foreign and Colonial Merchandise exported from the United Kingdom." Table 34 of that publication, for instance, gives the declared value of the principal and other articles imported into the United Kingdom ("Value Table"), whilst Table 32 gives the quantities of the principal articles thus imported ("Quantity Table"). The discovery of the weights of the different articles formed the ultimate object of our studies, and if Table 32 had supplied these, no further investigation would have been needed. This, however, is not the case, as it will be seen that the quantities given in Table 32 are for fewer articles than those for which the values are given. Furthermore, the quantities are not always expressed in weight, but are expressed in numbers, barrels, gross, yards, thousands, bushels, bunches, dozens, dozen pairs, tuns of 252 gallons, quarters, proof gallons, loads, or other denominations. The problem of furnishing each article given in the value table with its respective quantity expressed in weight is, therefore, one of considerable complication. For articles given in the Quantity Table, we should require a knowledge of the weight equivalents for denominations of quantity, such as measures of length or capacity, whilst for articles not mentioned in any denomination of quantity whatsoever, some source had to be found which would enable their weight to be ascertained.

It is true that a certain amount of help in this research is given by Table 57 of the *Statistical Abstract*, which shows the average price per unit of a number of articles imported into this country. This average value furnishes us with a ratio, and by dividing the total monetary value represented by the Imports of any one article by the average value per unit of that article, we obtain the total quantity imported expressed in the denomination of the unit. If this denomination of the unit were in all cases a denomination of weight, it would be easy to convert it into tons, but inspection of Table 57 will show that the average value for a number of articles is given in respect of the various denominations of units under which they appear in the Quantity Table (No. 32), such as barrels, gross, &c.; and, further, that the articles thus furnished with average values are but few.

This Average Value Table (No. 57)—although it has not greatly furthered our work—has helped us to illustrate its fundamental principle, inasmuch as it has shown that, to complete our research, we must be put in possession of two data respecting each article of trade, namely, the aggregate value of the trade in such article and its average value per unit of weight.

The aggregate value of the total trade in each article, and the average value of such article are, therefore, cardinal factors in our investigations. But the average value has another function, and that is a classifying function; for it is the surest guide as to whether the article in question has a closer interest for our purpose, and forms one of that class which, because valuable in relation to weight, will find a material advantage in selecting transportation by the proposed ferry, or whether, owing to low value in relation to weight, it must always have a tendency to select the cheapest mode of transportation, such as an all-sea route.

There is one more difficulty which it is necessary to mention, and which had to be overcome in order to ascertain the weight of *all* articles included in the Imports into the United Kingdom. At the end of Table 34 are found entries of "All Other Articles Manufactured," "All Other Articles Unmanufactured," and "Parcel Post." These entries represent unenumerated articles, and are the balance between the grand total of the Import Trade and the sum total of all articles enumerated separately. These unenumerated articles form the inevitable margin of error in all calculations of quantities, for it is impossible to obtain accurate data concerning the component parts of these entries. In all statistical work, it must be the endeavour at the outset to reduce as far as possible all inevitable causes of error or factors of uncertainty. For this purpose, the various tables given in the *Statistical Abstract* had to be compared with the more detailed tables of a similar nature contained in the *Annual Statement of Trade of the United Kingdom.*

This latter volume is compiled by the Statistical Department of the Custom House, whilst the *Statistical Abstract* is compiled by the Commercial and Statistical Department of the Board of Trade from the figures supplied by the Statistical Department of the Custom House. The tables in the Custom House statistics give much more detail, and enumerate a number of articles which are not enumerated in the Board of Trade statistics; the articles left unenumerated in the former statistics are, consequently, considerably less in most years than is the case in the latter.

It will naturally be asked why this should create any difficulty, as it obviously points to the Custom House statistics being made the basis of research, in preference to those of the Board of Trade. It would take too much space to state in detail the reasons which induced the compiler to waver in the decision as to which of the two statistical works should be used as a basis, and, for the present, the general statement may suffice that, as the ultimate object was to obtain totals and not details (which only form the means to an end), it was determined to select as comprehensive a classification of articles as possible. For this purpose, the desirability of using the Board of Trade statistics, in preference to those of the Custom House, was obvious. The wisdom of the decision had finally to be tested as regards the inevitable margin of error, consisting of the unenumerated category of articles.

Upon comparing the aggregate amount represented by unenumerated articles during the five years under review in the two Blue Books, it was found that in the case of Imports, they represented about 1·31 per cent. of the totals in the *Statistical Abstract*, as against 0·81 per cent. in the *Annual Statement of Trade*. In respect of Exports of British and Irish Produce, the unenumerated articles in the *Statistical Abstract* amounted to about 2·52 per cent. against 1·91 per cent. in the *Annual Statement of Trade*. In these two classes of trade, the difference in the above percentages between the two Blue Books did not seem sufficiently large to render the adoption of the more detailed Custom House statistics necessary, but, upon comparison of the Exports of Foreign and Colonial Merchandise, it was found that the unenumerated articles in the *Statistical Abstract* represented 8·3 per cent. of the total, whilst the unenumerated articles in the *Annual Statement of Trade* represented only 0·54 per cent. This difference was too considerable to be ignored, and it was, therefore, decided to use Table 8 of the first volume of the *Annual Statement of Trade* as regards Exports of Foreign and Colonial Merchandise, in preference to the corresponding table in the *Statistical Abstract*.

The process of compilation which was followed (continuing to take Imports as example) consisted in copying all articles given in Table 34 of the *Statistical Abstract*, together with their value for each of the five years under investigation, and setting against them the weight of all corresponding articles as far as given in Table 32. Thereafter, a number of estimates, comparing quantities of measure with quantities of weight in various articles, were obtained from other publications of the Board of Trade (notably from the Blue Book, Cd. 1761 of 1903, entitled *British and Foreign Trade and Industry*), and were used to convert quantities of measure into quantities of weight. There then remained a large residue of articles for which either no quantity was given, or for which the quantity given did not enable us to convert it into weight.

For the purpose of dealing with this residue, it was necessary to have recourse to the German Statistical Work entitled *Handel des Deutschen Zollgebiets im Jahre*, 1903. In this publication a very large number of articles is enumerated, in nearly all cases by weight of 100 kg., and by value of 1,000 marks. The publication deals in separate volumes with the trade of the German Empire with various countries—amongst others with the trade with Great Britain. By taking this volume, and finding the equivalent articles for all those articles involving research in each of the respective years, it became possible to find what proportion in value was represented by a certain quantity in weight of the said article, and thus to ascertain the average value per unity of weight of the said article which had formed part of the trade with Great Britain in the year in question.

The average value of the article in question obtained in this manner was used to ascertain the total weight of the trade in the respective article, by dividing the total value of the aggregate of such article (as given for example, *qua* Imports, by Table 34) by this average value, and thus obtaining the weight represented by the total value.

To realise fully the great difficulty and complication of this proceeding, it must be remembered that the classification of the German and British Statistical Works is entirely different, and that the grouping of articles comprised under one denomination in the latter is much more inclusive than in the former; the number of articles forming a group in the British Trade Returns are widely scattered in the German statistics, and the exact fixing of the equivalent articles requires a good deal of research in addition to thorough knowledge of both languages.

From the foregoing account, the impression may have been created in the mind of the reader that, where so many calculations based on assumptions of equivalence have to be made, and where the underlying argument so constantly proceeds either from the greater to the less or from the less to the greater, only a very rough approximation of correctness can have been arrived at. It may quite reasonably be objected that the use of the German Statistical Work must necessarily involve certain errors, as it cannot be correct to apply to the whole trade of the United Kingdom, figures extracted merely from its trade with Germany; that, furthermore, it has been admitted that the correspondence of the German and British classifications of articles is far from perfect; and that it is, therefore, impossible to be certain that the classification of the articles selected entirely tallies in the statistics of the two countries. Such objections are doubtless justified, but as it is impossible to eliminate all errors, however great the care and trouble taken, endeavours should be made to mitigate them by estimating their extent or their maximum range.

As a guide in doing this, all our calculations can be divided into absolute calculations (liable to clerical errors only), and indirect calculations; by the latter we designate all calculations which in some shape or form contain a factor of assumption.

In dealing with the trade between the United Kingdom and the Whole World, the percentage of indirect calculations to all calculations represents 29·1 per cent. in the Imports; 7·9 per cent. in the British and Irish Exports; and 20·2 per cent. in the Foreign and Colonial Exports. If we assume the indirect calculations to be within 15 per cent. of the correct figure (either more or less), we find that the maximum error possible in our results amounts to 4·4 per cent. in the Imports; 1·2 per cent. in the British and Irish Exports; and 3 per cent. in the Foreign and Colonial Exports.

In assuming the accuracy of the indirect calculations to be within 15 per cent. of the correct figure, a wide margin has been allowed, and a guide for this estimate has been given us by the Returns of the Board of Trade for 1904 (published since the compilation of our figures). In this year, the weight of some twenty additional groups of articles is given, of which the value only had been mentioned hitherto. On comparing the average value per ton for each of these articles, derived for the year 1904 by absolute calculation, with the average value per ton for the same article as used by us in our statistics, and as obtained by indirect calculation for the years 1899 to 1903, we find that the total error of our indirect calculations amounts to some 11 per cent. In such comparison no allowance is made for the probable fluctuation in prices between 1903 and 1904, which may have increased the discrepancy to some extent. Our assumption of an error of 15 per cent. is, therefore, exaggerated, and is merely used to illustrate the more forcibly the maximum error to which the figures presented are liable.

By the process described above, we finally obtained the weight of quantities for all articles separately enumerated, and all that remained to complete our task was to ascertain the weight represented by "Articles Unenumerated Manufactured," "Articles Unenumerated Unmanufactured," and "Parcel Post," of which three groups mention has been made on page 99.

Arguing that "Articles Unenumerated Manufactured," while containing none of the groups of articles enumerated under special headings in the year to which they refer, probably contained articles of a value ranging between the lowest and highest values of those which were enumerated,* and arguing further that the index of values of all the enumerated articles would probably give some indication of the value of those which were not enumerated, the following method was adopted as regards these nondescripts :—

All manufactured articles were extracted, and both the aggregate value, and the aggregate quantity of these were added up ; then, by dividing the total value of all manufactured articles by the total weight of all manufactured articles, a mean average value per ton for manufactured articles was established in each of the five years individually. It was considered that this mean average value must be a near enough approximation to the average value of the "Articles Unenumerated Manufactured," and by this index of their value their weight in tons was ascertained by indirect calculation.

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* In the first volume of the "Annual Statement of Trade" tables are given which specify the articles comprised under "Goods Unenumerated Manufactured" and "Goods Unenumerated Unmanufactured." These tables, however, leave a further residue of unspecified articles.

The same process was pursued as regards "Parcel Post," which was assumed to consist of "Articles Unenumerated Manufactured."

As regards "Articles Unenumerated Unmanufactured," a course similar to the above was adopted; substituting, however, all raw materials and unmanufactured articles in the collective group formed for the purpose of arriving at a mean average value per ton.

In reference to this method, it may perhaps again be well to meet possible objections, and to explain the maximum error to which it gives rise. As has been seen on page 100, the unenumerated articles under Imports represent only 1·31 per cent.; under British and Irish Exports, 2·52 per cent.; and under Foreign and Colonial Exports, 0·54 per cent. As our method, even if erroneous, must be within some measure of accuracy, the error is again reduced to a very small fraction; for, even if we allow an error in estimation of 25 per cent., this would only result in a total error of 0·3 per cent. in the Imports; 0·6 per cent. in the British and Irish Exports; and 0·1 per cent. in the Foreign and Colonial Exports.

We have now completed the description of the process by which the total quantities of the Imports of the United Kingdom were prepared, and it will hardly be necessary again to go into detail as regards the compilation of the Exports of both classes, for it was carried out on identical lines.

Having thus determined the total weight in tons of the whole trade of the United Kingdom, and, by dealing with the totals of the three classes of trade separately, established the average value per ton of all Imports, of all British and Irish Exports, and of all Foreign and Colonial Exports, we had to classify the articles in such a way as to distinguish them into those to which carriage by means of the Channel Ferry might appear to offer advantages, and those to which it did not. This was done, as above mentioned, by making use of the average value per ton, which seemed a satisfactory guide in the selection. All articles of a valuable, perishable and brittle nature were included in the collective term "Class 1," and are enumerated in the following list. "Class 2" comprises all other articles not mentioned in the list:—

Imports.

Class I.—Articles Brittle, Perishable, or Valuable.

Animals :—
- Horses.
- Oxen, Bulls, Cows, and Calves.
- Sheep and Lambs.

Apparel and Slops :—
- Waterproofed.
- Not waterproofed.

Arms and Ammunition.
Art, Works of, other than Pictures.
Bacon and Hams :—
- Bacon.
- Hams.

Basketware.
Bead Trimmings.
Beef :—
- Fresh.
- Salted.
- Preserved, other than Salted.

Beer and Ale.
Books, Maps, and Charts.
Bristles.
Brushware.
Butter.
Buttons and Studs, not of Metal.
Caoutchouc.
- Manufactures of.
- Boots and Shoes.
- Other Sorts.

Carriages, Carts, &c. :—
- Motor Cars and parts (including Motor Cycles).
- Other Descriptions and parts thereof.

Cheese.
Chemical Manufactures and Products, unenumerated.
China, Earthenware and Porcelain.
Clocks.
Cocoa, Raw.
Cocoa or Chocolate, ground, prepared, or in any way manufactured.
Coffee.
Confectionery, including Fruits and Vegetables preserved in Sugar.
Cordage :—
- Twine and Cable Yarn.
- Hemp Yarn.

Cork, Manufactured.
Cotton :—
- Raw.
- Yarn.

Cotton Manufactures :—
- Piece Goods.
- Hosiery.
- Unenumerated.

Diamonds.
Drugs :—
- Bark, Peruvian.
- Opium.
- Unenumerated.

Dyeing or Tanning Stuffs :—
- Bark, for Tanning.
- Cutch and Gambier.
- Extracts.
- Dyes from Coal Tar.
- Indigo.
- Myrobalans.
- Sumach.
- Valonia.
- Unenumerated.

Eggs.
Electrical Goods and Apparatus.
Embroidery and Needlework.
Fancy Goods (known as Paris Goods).
Feathers :—
- Ornamental.
- Bed.

Fish :—
- Fresh.
- Cured and Salted—
  - Sardines.
  - Unenumerated.

Flax and Hemp :—
- Flax, Dressed and Undressed.
- Hemp and other like Substances (except Jute), Dressed and Undressed.

Flowers :—
- Artificial.
- Cut and "Everlastings."

Fruit :—
- Almonds.
- Apples, Fresh.
- Bananas, Fresh.
- Cherries, Fresh.
- Currants, Dried.
- Grapes, Fresh.
- Pears, Fresh.
- Plums, Fresh.
- Raisins.
- Nuts used as Fruit (except almonds).
- Oranges, Lemons, Limes and Citrons.
- Currants, Fresh.
- Gooseberries, Fresh.
- Strawberries, Fresh.
- Fresh, Unenumerated.
- Dates.
- Unenumerated, Dried or Preserved.

Glass :—
- Window.
- Plate.
- Bottles.
- Flint, Plain, Cut, or Ornamented, and Other Manufactures of Flint Glass.
- Manufactures, Unenumerated.

Glue, Size, and Gelatine.
Gum of all Sorts.
Gutta Percha.
Hair, Unenumerated.

Hair, Manufactures of
Hardware and Cutlery.
Hats or Bonnets, Trimmed or Untrimmed:—
  Of Straw.
  Of Other Materials.
Hops.
Isinglass.
Ivory: Teeth, Elephants', Sea Cows', or Walrus'.
Lace and Articles thereof: All kinds.
Lard.
Leather:—
  Undressed.
  Dressed.
  Varnished, Japanned, or Enamelled.
Leather Manufactures:—
  Boots and Shoes.
  Gloves.
  Unenumerated.
Linen:—
  Yarn.
  Manufactures.
Margarine and Artificial and Imitation Butter.
  Oleo-Margarine.
Meat, Unenumerated:—
  Salted or Fresh.
  Preserved, other than Salted.
Metals:—
  Brass, Bronze and Metal Bronzed or Lacquered, Manufactures of.
  Copper, Manufactures of, not otherwise enumerated.
  Iron and Steel, Wrought or Manufactured—
    Cycles and parts thereof.
    Machinery and parts.
  Platinum, Wrought or Unwrought.
  Quicksilver.
  Tin, in Blocks, Ingots, Bars, or Slabs.
  Zinc Manufactures.
  Metals Unenumerated, Wrought or Manufactured.
Milk, Condensed.
Mouldings, Gilt.
Musical Instruments.
Mutton:—
  Fresh.
  Preserved.
Nuts and Kernels, used for expressing oil therefrom.
Oil:—
  Olive.
  Chemical; Essential or Perfumed.
Paper and Pasteboard:—
  Unprinted.
  Printed or Coated.
  Strawboard and Millboard.
  Wood Pulp Board.
Perfumery.
Pictures and Drawings by Hand
Prints, Engravings and Photographs.
Plants, Shrubs, Trees and Flower Roots.
Pork.
Potatoes.
Poultry and Game (alive or dead).
Rabbits (dead).
Scientific Instruments (other than Electrical).
Sewing Machines.
Shells of all kinds.
Silk:—
  Knubs or Husks and Waste.
  Raw.
  Thrown and Spun.
Silk Manufactures:—
  Broad Stuffs:
    Silk or Satin.
  Velvet, plain or figured.
  Ribbons.
  Other Manufactures.
Skins and Furs:—
  Goat, Undressed.
  Seal.
  Rabbit Skins.
  Furs, Unenumerated.
  Manufactures of, including Rugs.
Spices:—
  Pepper.
  Of all other sorts.
Sponge.
Straw Plaiting for making Hats or Bonnets.
Sugar:—
  Refined and Sugar Candy:
    Lumps or Loaves.
    Other sorts.
Tea.
Tobacco:—
  Manufactured, Cigars and Snuff.
  Unmanufactured.
Toys and Games.
Vegetables:—
  Tomatoes.
  Raw, Unenumerated.
  Preserved by Canning.
Watches.
Wax (including Ozokerit and Earth Wax).
Wine:—
  In Casks.
  In Bottles, Still.
  In Bottles, Sparkling:—
    Champagne.
    Other.
Wood and Timber:—
  Cabinet and Joiners' Work.
Woodware, Turnery, &c.
Wool:—
  Alpaca, Vicuna and Llama.
  Camels' Hair.
  Mohair (Angora Goats' Hair).
  Goats', other than Mohair.
  Sheep or Lambs'.
Woollen and Worsted Yarn:—
  Yarn for Weaving.
  For other purposes, including Berlin Wool and Zephyr Yarn.

Woollen Manufactures :—
  Cloths.
  Stuffs.
  Carpets and Rugs.
  Unenumerated.
Yeast, Dried.

Exports of British and Irish Produce.

Class I.—Articles Brittle, Perishable or Valuable.

Animals: Horses.
Apparel and Slops.
Arms and Ammunition :—
  Fire-arms (small).
  Gunpowder.
  Ammunition, unenumerated.
  Of all other Kinds.
Bags and Sacks, empty.
Biscuits and Bread.
Books, Printed.
Candles of all Sorts.
Caoutchouc, Manufactures of.
Chemical Products :—(Except Sulphate of Copper).
Clocks and Watches and parts thereof.
Cocoa or Chocolate, Ground or Prepared.
Cordage and Twine.
Cotton Yarn and Twist :—
  Grey.
  Bleached and Dyed.
Cotton Manufactures :—
  Piece Goods, Unbleached.
    Bleached.
    Printed.
    Dyed or Manufactured of Dyed Yarn.
    Of Mixed Materials.
  Hosiery: Stockings and Socks.
    Other kinds.
  Thread for Sewing.
  Lace and Patent Net.
  Unenumerated.
Cycles, and parts thereof.
Dye Stuffs :—
  Products of Coal Tar.
  Other Sorts, unenumerated.
Earthen and Chinaware :—
  Red Pottery, Brown Stone Ware, and Manufactures of Clay.
  Earthenware, Chinaware, Parian, and Porcelain.
Electrical Goods and Apparatus.
Fish (Except Herrings).
Fishing Tackle.
Flax and Hemp, Dressed and Undressed.
Furniture, Cabinet and Upholstery Wares.
Glass, Plate, Rough or Silvered.
  Flint.
Haberdashery and Millinery.
Hardware.
Cutlery.
Hats, Felt.
Hats, Straw.
Instruments and Apparatus :—
  Surgical, Anatomical and Scientific.
Jewellery.
Leather :—
  Unwrought.
  Wrought, Boots and Shoes.
  Of other Sorts.
  Saddlery and Harness.
Linen Yarn.
Linen Manufactures :—
  White or Plain.
  Printed, Checked, or Dyed.
  Sailcloth and Sails.
  Thread for Sewing.
  Of other Sorts.
Machinery :—
  Steam Engines :—
    Agricultural.
    Other Descriptions.
  Other Sorts :—
    Agricultural Machinery.
    Textile Machinery.
    Mining.
    Other.
Meat :—
  Beef.
  Mutton.
  Pork.
  Bacon.
  Hams, &c.
Medicines.
Metals :—
  Iron :—
    Wire of Iron and Steel and Manufactures thereof (exclusive of Telegraph Wire prior to 1903).
    Anchors, Grapnels, Chains and Cables.
    Tubes and Pipes.
    Nails, Screws and Rivets.
    Bedsteads.
  Copper, Unwrought :—
    Ingots, Cakes, or Slabs, and Precipitate.
    Wrought or partly Wrought :
      Mixed or Yellow Metal.
      Of other Sorts.
  Brass of all Sorts.
  Lead.
  Tin, Unwrought.
  Unenumerated and Manufactures thereof.
Milk, Condensed.
Musical Instruments.

Paper and Pasteboard:—
Writing or Printing Paper and Envelopes.
Paper Hangings.
Pickles, Vinegar, Sauces, Condiments, Preserved Fruits, and Confectionery.
Pictures, Drawings, Prints, Engravings, Photographs, &c.
Plate and Plated Ware.
Provisions, unenumerated.
Sewing Machines.
Silk: Thrown, Twist, and Yarn.
Silk Manufactures:—
Broad Stuffs, of Silk or Satin.
Of Silk mixed with other Material.
Handkerchiefs, Scarves and Shawls.
Ribbons of all kinds.
Lace.
Other kinds of Silk.
Of Silk mixed with other Material.
Skins and Furs:—
British Sheep and Lambs', Undressed, without the Wool.
Other Sorts.
Dressed, not Leather.
British, Unenumerated.
Foreign, British Dressed.
Soda Compounds.
Spirits.
Starch and Blue.
Stationery, other than Paper.
Sugar: Refined.
Tobacco and Snuff Manufactured in the United Kingdom.
Toys and Games.
Umbrellas and Parasols.
Wool:—
Sheep and Lambs'.
Flocks and Ragwool.
Foreign, dressed in the United Kingdom.
Noils.
Waste.
Combed or carded and Tops.
Woollen and Worsted Yarn.
Woollen and Worsted Manufactures:—
Woollen Tissues:
Heavy Broad, All Wool.
Heavy Broad, Mixed.
Heavy Narrow, All Wool.
Heavy Narrow, Mixed.
Light Broad, All Wool.
Light Broad, Mixed.
Light Narrow, All Wool.
Light Narrow, Mixed.
Worsted Tissues:
Worsted Coatings, Broad, All Wool.
Worsted Coatings, Broad, Mixed.
Worsted Coatings, Narrow, All Wool.
Worsted Coatings, Narrow, Mixed.
Worsted Stuffs, &c., All Wool.
Worsted Stuffs, &c., Mixed.
Flannels.
Blankets.
Hosiery.
Carpets and Druggets.
Rugs, Coverlets, or Wrappers.
Small Wares.
Yarn, Alpaca, and Mohair, and other Sorts unenumerated.

Exports, Foreign and Colonial.

Class I.—Articles Brittle, Perishable or Valuable.

Ammunition:—
Gunpowder.
Shot, large and small.
Rockets and other combustibles for purposes of war, Explosives, Percussion Caps, and Ammunition unenumerated.
Animals, Living:—
Oxen and Bulls.
Cows.
Calves.
Sheep and Lambs.
Horses (including Ponies):
Stallions.
Mares.
Geldings.
Other kinds.
Apparel and Slops, viz.:—
Waterproofed by any Process.
Not Waterproofed.
Arms:—
Swords, Cutlasses, Matchets, and Bayonets.
Arms (*continued*):—
Cannons and Mortars, and parts thereof.
Rifles, Carbines, Fowling Pieces, Muskets, Pistols, or Guns of any other sorts, unenumerated, and parts thereof.
Arms, Ammunition, and Military and Naval Stores:—
Ammunition:
Propellants: Gunpowder.
High Explosives: Dynamite and other High Explosives.
Small Arms Ammunition.
Fuzes, Tubes, Primers, &c.
Percussion Caps.
Metal Cartridge Cases other than Small Arms Ammunition: Empty.
Rockets and other Combustibles for warlike purposes, Explosives and Ammunition of natures not named above.

Arms, Ammunition, and Military and Naval Stores (*continued*):—
  Cannon: Guns, Howitzers, Mortars, and parts thereof.
  Small Arms:
    Rifles, Carbines, Muskets, and Fowling Pieces.
    Revolvers and Pistols.
    Swords, Cutlasses, Bayonets, and Arms of other sorts, not Firearms.
  Torpedoes and Submarine Mine Appliances.
  Military, Naval, and Ordnance Stores and Appliances not enumerated above.
Art, Works of (other than Pictures).
Baskets and Basketware.
Beads, of all sorts.
Bead Trimmings.
Blacking and Polishes, not containing Spirits or Sweetening Matter.
Bladders, Casings, and Sausage Skins.
Books, Printed.
Bristles.
Brooms and Brushes.
Butter.
Buttons and Studs, not of Metal.
Candles of all sorts.
Caoutchouc:—
  Manufactures of:
    Boots and Shoes.
    Other Sorts (except Apparel Waterproofed).
Cards, Playing.
Carriages, Waggonettes, Carts, &c.:
  Cycles, other than Motor Cycles.
    Parts thereof.
  Motor Cars (including Motor Cycles)
    Parts thereof.
Cheese.
Chemical Manufactures and Products (other than Alkali, Bleaching Materials, Borax, Brimstone, Carbide of Calcium, Glycerine, Saltpetre, and Soda Compounds).
Chicory and Coffee, Roasted and Ground, Mixed.
Chinaware or Porcelain, and Earthenware.
Chloral Hydrate.
Chloroform.
Clocks.
Clocks, parts thereof.
Cocoa:—
  Raw.
  Husks and Shells.
  Or Chocolate, Ground, Prepared, or in any way manufactured.
  Butter.
Coffee:—
  Raw.
  Kiln-Dried, Roasted, or Ground.
Collodion.
Confectionery (not containing any article liable to duty).
Cordage, Cables, Rope and Twine, of Hemp or like material.
Cork, Manufactured.
Cotton:—
  Raw.
  Yarn.
  Manufactures:
    Piece Goods, Muslins.
    Piece Goods, other than Muslins.
    Piece Goods, Grey, unbleached.
    Piece Goods, White, bleached.
    Piece Goods, printed.
    Piece Goods, Dyed or Manufactured of Dyed Yarn.
    Hosiery of all sorts.
    Lace and articles thereof.
    Unenumerated.
Curios.
Cutlery.
Drugs:—
  Bark, Peruvian.
  Opium.
  Quinine and Quinine Salts.
  Unenumerated, including Medicinal Preparations not liable to Duty.
Dye-stuffs and Substances for Tanning or Dyeing:—
  Bark for Tanning.
  Cochineal.
  Cutch.
  Gambier.
  Dyes obtained from Coal Tar:
    Alizarine.
    Aniline.
    Other Coal Tar Dyes.
  Extracts.
  Indigo.
  Myrobalans.
  Sumach.
  Valonia.
  Unenumerated.
Eggs.
Electrical Goods and Apparatus, except Machinery and Telegraphic Appliances.
Embroidery and Needlework.
Ether:
  Acetic.
  Butyric.
  Sulphuric.
Ethyl Bromide.
Ethyl Chloride.
Extracts (other than for tanning or dyeing), unenumerated
Fancy Goods (known as Paris Goods).
Feathers and Down in Beds and for Beds.
Feathers and Down, Ornamental.
Fish (including Turtle):—
  Fresh, Herrings.
  Fresh, other sorts of Fresh Fish.
  Fresh, Shell Fish: Oysters for Food.
  Fresh, Shell Fish: Oysters for Breeding purposes.

Fish (including Turtle) *continued*:—
Fresh, Shell Fish: Other sorts of Shell Fish.
Cured or Salted: Canned Sardines.
Cured or Salted: Canned Salmon.
Cured or Salted: Canned Lobsters.
Cured or Salted: Canned, other Sorts.
Cured or Salted: Not Canned, All Sorts.
Flax, Dressed or Undressed.
Floorcloth, Linoleum, and Kamptulicon.
Flowers, Artificial.
Flowers, Fresh.
Fruit, Dried or Preserved without Sugar, liable to Duty:—
Currants.
Figs and Fig Cake.
Plums, French, and Prunelloes.
Plums, Dried or Preserved without Sugar, not otherwise described, including Dried Apricots.
Prunes.
Raisins.
Fruit, not liable to Duty:—
Apples, Raw.
Apricots and Peaches, Raw.
Bananas.
Cherries, Raw.
Gooseberries, Raw.
Grapes, Raw.
Lemons, Limes, and Citrons.
Nuts: Almonds.
Other Nuts, used as fruit.
Oranges.
Pears, Raw.
Plums, Raw.
Strawberries, Raw.
Unenumerated, Raw.
Dried:
Dates.
Unenumerated.
Fruit preserved without Sugar (other than Fruit liable to duty as such):
Canned or Bottled.
Other than Canned or Bottled.
Fruits and Vegetables preserved in sugar.
Fruit Juice (not containing Spirit).
Galls.
Glass:—
Window and German Sheet, including Shades and Cylinders.
Plate.
Flint, plain, &c., and Manufactures of Flint Glass.
Bottles.
Manufactures, other sorts.
Glue, Size, and Gelatine, not containing added Sugar.
Gum:—
Arabic.
Kowrie.
Lacdye, Seedlac, Shellac, and Sticklac.
Unenumerated.
Gutta Percha: Manufactures of.
Hair:—
Camels'.
Cow, Ox, Bull, or Elk.
Goats', other than Mohair.
Horse.
Unenumerated.
Manufactures of (other than of Goats' Wool or Hair).
Hardware (unenumerated).
Hats or Bonnets:—
Of Straw, Trimmed or Untrimmed.
Of Other Materials, Trimmed or Untrimmed.
Hemp:—
Dressed or Undressed.
Yarn.
Unenumerated Vegetable Substances applicable to the same uses as Hemp or Flax.
Hides, Raw, and pieces thereof:—
Dry.
Wet.
Honey.
Hops.
Isinglass.
Ivory:—
Teeth, Elephants', Sea-cows', or Walrus'.
Vegetable.
Jewellery.
Jute, Yarn:—
Manufactures of, including Piece Goods, Sacks, and Bags.
Lace, Unenumerated.
Lamps and Lanterns.
Lard:—
Imitation Lard.
Leather:—
Undressed.
Dressed.
Varnished, Japanned, or Enamelled.
Manufactures:—
Boots and Shoes.
Gloves.
Other Sorts.
Licorice, not containing added Sugar or other Sweetening Matter.
Linen, Yarn:—
Manufactures, including Manufactures of Linen mixed with Cotton.
Machinery and Mill Work, or parts thereof.
Not being Steam Engines, viz:—
Sewing Machines.
Mining.
Textile.
Other Descriptions.
Electrical of all kinds.
Margarine (including all kinds of Artificial or Imitation Butter).
Mats and Matting.
Meat (except Poultry and Game):—
Bacon.
Beef, Fresh.
Beef, Salted.

Meat (except Poultry and Game) (*continued*):—
Hams.
Mutton, Fresh.
Pork, Fresh.
Pork, Salted (other than Bacon and Hams).
Rabbits (dead).
Unenumerated, Salted or Fresh.
Preserved otherwise than by Salting:
Beef.
Mutton.
Other sorts (other than Bacon and Hams).
Metal: Leaf not Gold.
Metals and Ores:—
Brass, Bronze, and Metal Bronzed or Lacquered, Manufactures of.
Copper:
Unwrought, in Bars, Blocks, Slabs, Cakes, and Ingots.
Part Wrought.
Manufactures of, unenumerated.
Gold:
Ore of (including the Value of Gold contained in Auriferous Ores and Metals).
Leaves of.
Iron and Steel:
Cycles (including those with Motors) and parts thereof.
Platinum, Wrought or Unwrought.
Quicksilver.
Tin, in Blocks, Ingots, Bars, and Slabs.
Metal, unenumerated:
Unwrought.
Wrought or Manufactured.
Methylic Alcohol, not purified so as to be potable.
Mica, Talc, French Chalk, &c.
Milk:—
Fresh (in cans or drums).
Cream.
Condensed.
Powder.
Preserved, other kinds (including Impoverished, Humanised, Peptonised, and Sterilised Milk).
Mouldings for Picture Frames, and Gilt Mouldings.
Musical Instruments.
Nuts and Kernels, for expressing Oil therefrom.
Nuts, other sorts, unenumerated (not being Drugs, Dye Stuffs, or Fruit).
Oils:—
Olive.
Chemical, Essential, or Perfumed.
Oleo-Margarine or Oleo-Oil.
Painter's Colours and Pigments.
Paper:—
Unprinted, on reels.
Unprinted, not on reels.
Printed or Coated.
Strawboard or Millboard.

Paper (*continued*):—
Wood Pulp Board.
Perfumery, and Articles used in the manufacture thereof.
Pickles and Vegetables, preserved in Salt or Vinegar.
Pictures and Drawings, by hand.
Plaiting of Straw, &c., for making Hats or Bonnets.
Plants, Shrubs, Trees and Flower Roots.
Plate of Gold.
Plate of Silver, gilt or ungilt.
Plated and Gilt Ware.
Poultry and Game, alive or dead.
Precious Stones: Diamonds.
Precious Stones: unset, Other Descriptions.
Prints, Engravings, Photographs, Maps, and Charts.
Sauces or Condiments, unenumerated, not sweetened.
Scientific Instruments, other than Electrical.
Shells of all kinds.
Silk:—
Knubs, or Husks of Silk and Waste.
Raw.
Thrown, dyed or not dyed.
Spun Silk Yarn, dyed or not dyed.
Manufactures: Broadstuffs, Silk or Satin Velvet.
Lace and Articles thereof.
Ribbons, Silk or Satin.
Other kinds.
Unenumerated.
Skins and Furs:—
Skins, Goat, undressed.
Sheep, undressed.
Unenumerated, undressed.
Dressed (not Leather).
Furs, Rabbit Skins:—
Undressed.
Dressed.
Seal Skins:—
Undressed.
Dressed.
Unenumerated:—
Undressed.
Dressed.
Manufactures of Skins and Furs, including Skin Rugs.
Soap:—
Toilet.
Transparent, in the manufacture of which Spirit has been used.
Specimens illustrative of Natural Science, unenumerated.
Spices, not sweetened:
Cinnamon.
Ginger.
Pepper.
Unenumerated.
Spirits:—
Brandy.
Rum.

Spirits (*continued*) :
Imitation Rum.
Geneva.
Unenumerated, not Sweetened.
Unenumerated, Sweetened or Mixed, tested.
Foreign, Various Sorts, Mixed in Bond.
British and Foreign.
Liqueurs, Cordials, Mixtures, and other Preparations containing Spirits, not tested for Strength.
Perfumed.
Articles not Separately Enumerated, in the Manufacture of which Spirit was used.

Sponge.

Stationery, other than Paper, including Ink.

Sugar :—
Refined, in Lumps and Loaves.
Refined, Other Sorts, including Sugar Candy.
Unrefined, Beetroot.
Unrefined, Cane and Other Sorts.
Saccharin and Mixtures containing Saccharin or other substances of like nature or use.

Articles, containing Sugar or other Sweetening Matter :—
Blacking, Liquid, containing Sugar or other Sweetening Matter.
Candied or Drained Peel.
Cherries, Drained, imported in Bulk.
Chutney.
Confectionery :—
Containing more than 50 per cent. of Chocolate.
Containing more than 50 per cent. of Chocolate, and in the Manufacture of which Spirit has been used.
Containing not more than 50 per cent. of Chocolate.
Containing not more than 50 per cent. of Chocolate, and in the Manufacture of which Spirit has been used.
Containing no other ingredient than Sugar, except Flavouring.
Containing no other ingredient than Sugar, except Flavouring, and in the Manufacture of which Spirit has been used.
Hard, in the Manufacture of which Spirit has been used.
Soft : A B Gums (at Lower Rate).
Soft : Other Soft Confectionery (at Higher Rate).
Other Soft Confectionery, in the Manufacture of which Spirit has been used.
Flowers in Crystallised Sugar (Violets, Rose Petals, &c.).
Fruit :—
Not liable to Duty as such, canned or bottled, preserved in thin Syrup.
Not liable to Duty as such, canned or bottled, preserved in thick Syrup.
Crystallised, Glacé and Metz, except Fruit liable to Duty as such.
Imitation, Crystallised or not (at Lower Rate).
Imitation, Crystallised or not (at Higher Rate).
Liable to Duty as such, except Currants, preserved in Sugar.
Pulp, not liable to duty as such, preserved in thin Syrup.
Pulp, not liable to duty as such, preserved in thick Syrup.
Ginger, preserved in Syrup or Sugar.
Marmalade, Jams, and Fruit Jellies not made from Fruit, liable to Duty as such.
Marzipan.
Milk, Condensed, Sweetened, whole.
Milk, Condensed, Sweetened, separated or skimmed.
Milk Powder containing added Sugar (at Lower Rate).
Nestlé's Milk Food.
Other Manufactured or Prepared Articles containing Sugar or kindred Sweetening Matter.
Tea.

Tin, Manufactures of, unenumerated.

Tobacco :—
Unmanufactured, Stemmed or Stripped.
Unmanufactured, Unstemmed.
Stalks.
Manufactured :
Cigars.
Cavendish or Negrohead.
Snuff.
Other Manufactured Tobacco :
Cigarettes.
Other sorts.

Toys and Games.

Watches : Parts thereof.

Wax (including Ozokerit, Earth Wax).

Wine :—
Imported in Casks.
Imported in Casks, Mixed in Bond.
Imported in Bottles :
Still.
Sparkling :
Champagne.
Saumur.
Burgundy.
Hock.
Moselle.
Other sorts.

Wood and Timber :—
Manufactures of :
Furniture and Cabinet Ware.

Wood and Timber (*continued*):—
  Manufactures of:
    House Frames, Fittings, and Joiners' Work.
  Other Sorts (including Woodware and Turnery).
Wool:—
  Alpaca, Vicuña and Llama.
  Goats' Wool or Hair: Mohair.
  Sheep or Lambs' Wool.
  Other kinds, and Flocks.
Woollen Yarn:—
  For Weaving.
  For other purposes, including Berlin Wool and Zephyr Yarn.
Woollen Manufactures:—
  Of Goats' Wool or Hair.
  Of Wool (other than Goats):
    Cloths.
    Stuffs.
    Carpets.
    Rugs.

Our next step consisted in sub-dividing the trade of the United Kingdom into the trade with France, Belgium, Holland, Germany and "All Other Countries" respectively. For this purpose we had recourse to Table 12 in the second volume of the *Annual Statement of Trade of the United Kingdom*, which gives our trade with each foreign country and British Possession. We again proceeded in a similar way to that adopted with the total trade, that is to say, converted all weights given in the Blue Book into tons, and then proceeded, by indirect calculation, to obtain the quantity in tons represented by the monetary value of the trade in those articles for which no weights were given. For the indirect calculations, we made use of the average values per ton ascertained when establishing the weight of the total trade.

"Articles Unenumerated Manufactured and Unmanufactured" (which in this Table are specified under the collective name, "All other Articles") and "Parcel Post" were dealt with in the same way as in dealing with the total trade, but, in this instance, we took the mean averages of all manufactured or unmanufactured articles in the respective country tables given in the second volume of the Custom House statistics.

In order to find the relative importance of our trade with each of the respective countries, and with all the respective countries together, as compared to our trade with the whole world, the mean average value per ton of the various classes of trade with each country was ascertained, and, in addition, the proportion of the trade in each of the two classes of articles to the total trade of the United Kingdom in such class was determined. We were thus able to find with which country we deal in the most valuable goods, and what rank as buyer or seller the various countries take in reference to their trade with us.

As regards our third step, namely to ascertain the trade with the various countries carried through various selected ports, we had to meet the difficulty that none of the Blue Books fulfilled our requirements, even to a sufficiently approximate extent to enable us to use their data. Tables 9, 10, and 11 of the second volume of the *Annual Statement of Trade*, although they give the trade of the United Kingdom carried through every British port, do not specify the origin or destination of that trade as regards countries.

Some measure of help is afforded by Table 14 of the *Annual Statement of the Navigation and Shipping of the United Kingdom*, which gives the number and shipping tonnage of vessels entered and cleared at each of the ports of Great Britain, with their origin and destination, and by Table 15 of the same work, which gives under the various countries, a grouping of the shipping entered and cleared at the principal ports through which the trade with the respective countries is carried.

Whilst the latter table, therefore, presents some measure for the selection of the most important ports in the trade with the various countries, the former enables us to make a rough estimate of the relative importance of the trade with each country to the total trade that finds its way through the respective ports. It is needless to say that all such judgments can be merely of the roughest kind, as there exists hardly any relation between the actual weight of goods carried, and the tonnage capacity of ships frequenting the various ports.

To overcome these difficulties, it was necessary to apply to the Statistical Department of the Custom House in order to have special tables prepared, giving additional information to that already supplied by Tables 9, 10, and 11 of the second volume of the *Annual Statement of Trade*. The Custom House furnished us with tables giving the total trade passing through the ports of London (including Queenborough), Dover Folkestone, and Southampton, sub-divided into trade with France, Belgium, Holland, Germany, and the rest of the world respectively. As the expense of preparing these tables and the time occupied in their preparation were not inconsiderable, we were reluctantly obliged to forego obtaining the compilation of similar tables for Newhaven and Harwich.

These special tables did not give us the weight in tons of each article transported, but merely gave the various articles in the denominations of quantity and value in which they appeared in all other instances in the trade statistics of this country. We thus again had to elaborate the weight in tons of a considerable number of articles by indirect calculation.

This having been done, and the total weight of trade passing through the various ports ascertained, the trade was again divided into two classes, and the mean average value per ton of each class was calculated. Finally, for the purpose of comparing the relative importance of the trade—both in articles of Class 1 and of Class 2—between each of the four selected ports and each of the four selected countries, with the trade of the whole United Kingdom, in each class with each country, the various ratios were calculated, and expressed in percentage.

Before closing this attempt to detail step by step the method pursued in our enquiry, it will perhaps be of interest to state, without enlarging upon the difficulties and labour connected with the compilation of statistics on such a scale, that the work of ascertaining the weight, origin, and destination of the trade passing merely through the port of London, covered some 36 sheets of specially prepared tabulating paper of a size of 22 inches by 17 inches. In all, calculations were executed to a number exceeding 132,000, most of them being divisions in which both the divisor and the dividend contained, as a rule, from five to seven figures. For the purpose of coping with these, three large calculating machines were in practically constant use, and a word of appreciation must be said for two of these machines, furnished by Messrs. S. Tate, which stood rough and continuous usage without ever giving trouble.

CHAPTER VIII.

Trade and Traffic.—Figures and Conclusions.

The trade of the United Kingdom with the Whole World during 1899, 1900, 1901, 1902, and 1903—Fluctuation in value—Fluctuation in quantity—The average trade of the United Kingdom with the Whole World divided into countries—Investigations into the relative value of the trade with various countries—Proportion of trade of the United Kingdom with France, Holland, Belgium, and Germany—The trade of the United Kingdom passing through the ports of Dover, Folkestone, Southampton, and London—Proportion of trade carried through those ports—The port of Dover--Enumeration of principal goods passing through Dover—The port of Folkestone—The port ot Southampton—The port of London—Channels through which our trade with France passes—Traffic in gold and silver coin and bullion—The deflection of trade—Division of trade routes between the United Kingdom and France—Opinion of Mr. Samuel Lack Mason.

Before turning to the tables, attention must be called to two things: first, the weight given in all instances is the nett weight, that is to say, is exclusive of packings; and secondly, the figures of weight and average value per ton are not in all cases absolutely correct. Notwithstanding the fact that the greatest care and trouble have been taken to give accurate results, such absolute accuracy is unobtainable; if, however, the foregoing chapter is consulted it will be seen that the maximum error in the tables is computed at under 5 per cent.

As has been explained in Chapters V. and VII., the classification of goods adopted, consists merely of a division into two classes, Class 1, comprising those of a brittle, perishable, or valuable nature, while Class 2 comprises all others. A more elaborate classification was felt to be at once confusing and unnecessary. A list of articles comprised in Class 1 is given in Chapter VII., page 105.

Table VIII. shows the trade of the United Kingdom with the Whole World, for each of the five years from 1899 to 1903, and adopts the division into Imports, Exports of British and Irish produce, and Exports of Foreign and Colonial produce, which is customary in the Blue Books, where the Exports are invariably distinguished according as to whether they are of British and Irish produce or

Table VIII.—THE TRADE OF THE UNITED KINGDOM WITH THE WHOLE WORLD.

	Nett Quantity in Tons.					Average Value per Ton in £.					Total Declared Value in £.				
	1899.	1900.	1901.	1902.	1903.	1899.	1900.	1901.	1902.	1903.	1899.	1900.	1901.	1902.	1903.
Imports—															
Articles, brittle, perishable or valuable	7,770,660	8,049,425	7,410,658	8,203,461	8,647,129	40·529	42·013	46·048	41·658	41·179	314,939,753	338,178,254	341,246,105	341,738,425	356,082,983
All other articles	36,908,653	36,675,381	36,970,436	38,014,998	39,126,472	4·609	5·041	4·889	4·910	4·767	170,095,830	184,896,909	180,744,093	186,652,849	186,517,306
TOTAL	**44,679,313**	**44,724,806**	**44,381,094**	**46,218,459**	**47,773,601**	**10·856**	**11·695**	**11·762**	**11·432**	**11·358**	**485,035,583**	**523,075,163**	**521,990,198**	**528,391,274**	**542,600,289**
Exports of British produce—															
Articles, brittle, perishable or valuable	3,699,314	3,047,180	3,213,491	3,585,722	4,182,448	47·490	59·138	57·567	51·480	47·027	175,680,206	180,203,566	184,989,612	184,594,111	196,688,849
All other articles	51,304,709	54,189,268	50,932,498	52,882,436	54,612,002	1·731	2·048	1·866	1·869	1·723	88,812,005	110,988,430	95,032,764	98,829,855	94,111,259
TOTAL	**55,004,023**	**57,236,448**	**54,145,989**	**56,468,158**	**58,794,450**	**4·809**	**5·087**	**5·172**	**5·019**	**4·946**	**264,492,211**	**291,191,996**	**280,022,376**	**283,423,966**	**290,800,108**
Exports of Foreign and Colonial produce—															
Articles, brittle, perishable or valuable	920,611	829,058	886,643	859,859	885,165	60·149	63·385	64·880	65·728	68·575	55,374,235	52,550,101	57,525,732	56,517,155	60,700,586
All other articles	781,872	771,386	786,315	688,991	658,184	12·365	13·782	13·120	13·495	13·481	9,668,212	10,631,657	10,316,160	9,297,658	8,872,978
TOTAL	**1,702,483**	**1,600,444**	**1,672,958**	**1,548,850**	**1,543,349**	**38·204**	**39·478**	**40·552**	**42·493**	**45·080**	**65,042,447**	**63,181,758**	**67,841,892**	**65,814,813**	**69,573,564**
Total Trade—															
Articles, brittle, perishable or valuable	12,390,585	11,925,663	11,510,792	12,649,042	13,714,742	44·065	47·874	50·714	46·079	44·731	545,994,194	570,931,921	583,761,449	582,849,691	613,472,418
All other articles	88,995,234	91,636,035	88,689,249	91,586,425	94,396,658	3·018	3·345	3·226	3·219	3·067	268,576,047	306,516,996	286,093,017	294,780,362	289,501,543
GRAND TOTAL ...	**101,385,819**	**103,561,698**	**100,200,041**	**104,235,467**	**108,111,400**	**8·034**	**8·473**	**8·681**	**8·420**	**8·352**	**814,570,241**	**877,448,917**	**869,854,466**	**877,630,053**	**902,973,961**

NOTE.—This Table does not include Gold and Silver Coin or Bullion.

Table IX.—THE FLUCTUATION IN QUANTITY, AVERAGE VALUE PER TON, AND TOTAL VALUE OF THE TRADE OF THE UNITED KINGDOM DURING THE YEARS 1899 TO 1903.

Taking all Figures relating to 1899 as 100, and giving the Figures for the other Years their due Proportionate Value.

	Proportionate Nett Quantity in Tons.					Proportionate Average Value per Ton in £.					Proportionate Total Declared Value in £.				
	1899.	1900.	1901.	1902.	1903.	1899.	1900.	1901.	1902.	1903.	1899.	1900.	1901.	1902.	1903.
Imports	100·000	100·102	99·332	103·445	106·925	100·000	107·728	108·346	105·306	104·624	100·000	107·843	107·619	108·939	111·868
Exports of British produce	100·000	104·059	98·440	102·662	106·891	100·000	105·781	107·548	104·367	102·849	100·000	110·095	105·872	107·158	109·947
Exports of Foreign and Colonial produce ...	100·000	94·006	98·266	90·976	90·653	100·000	103·335	106·146	111·227	117·998	100·000	97·139	104·304	101·187	106·966
TOTAL TRADE	100·000	102·146	98·830	102·811	106·634	100·000	105·438	108·026	104·778	103·945	100·000	107·719	106·787	107·741	110·853

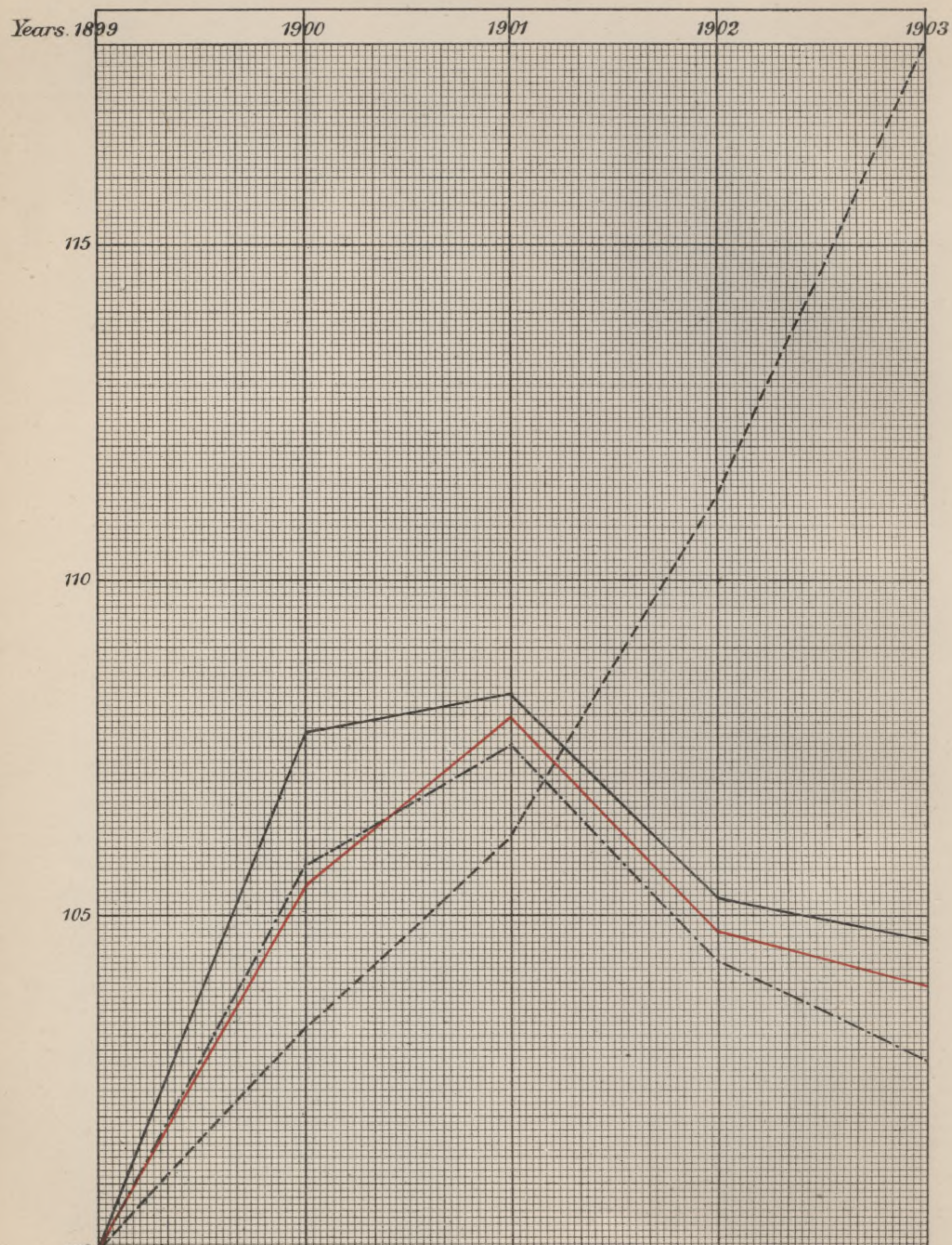
[*After page* 116.

FIG. 48.—

TRADE OF UNITED KINGDOM.

AVERAGE VALUE PER TON IN PER CENT.

TAKING YEAR 1899 AS 100.



—— = Imports. – – – = Exports of Foreign and Colonial Produce.

–·–·– = Exports of British Produce. —— = Total Trade.

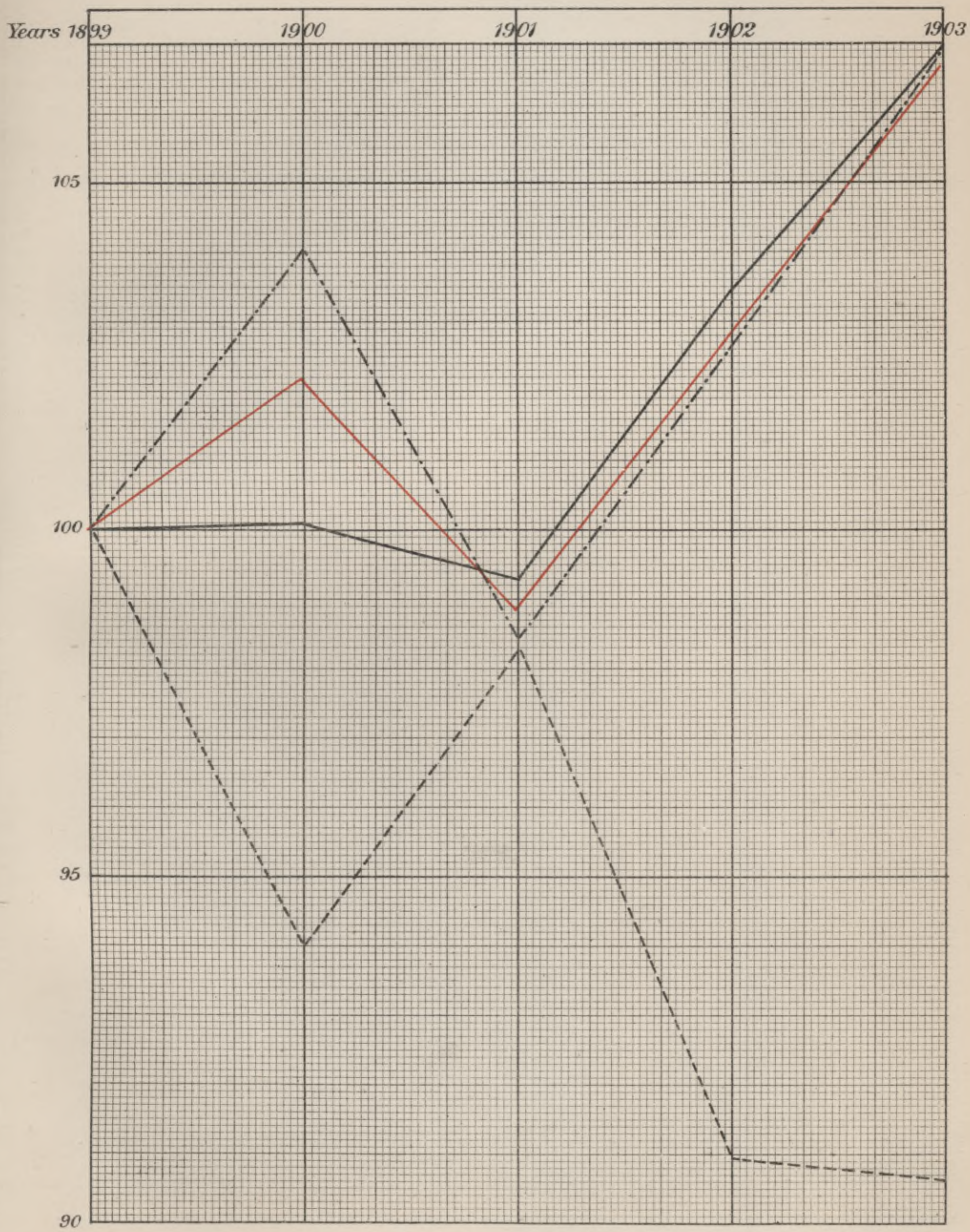
(To face page 117.

FIG. 49.—

TRADE OF UNITED KINGDOM.

QUANTITY IN PER CENT.

TAKING YEAR 1899 AS 100.



——— = *Imports.* ---- = *Exports of Foreign and Colonial Produce.*

-·-·- = *Exports of British Produce.* ——— = *Total Trade.*

(*To face page 116.*)

Table X.—Average for Five Years (1899–1903) of the Trade of the United Kingdom with the Whole World.

Showing separately the Trade with the Principal European Countries, and the proportion which each Class of Trade with those Countries bears to the Total Trade of the United Kingdom in such Class, and the proportion of the Whole Trade with each Country to the Whole Trade of the United Kingdom.

Country.	Articles.	Imports from—				Exports to— British and Irish Produce.				Exports to— Foreign and Colonial Produce.				Total Trade with—			
		Nett Quantity.	Average Value per Ton.	Total Declared Value.	Percentage of Quantity.	Nett Quantity.	Average Value per Ton.	Total Declared Value.	Percentage of Quantity.	Nett Quantity.	Average Value per Ton.	Total Declared Value.	Percentage of Quantity.	Nett Quantity.	Average Value per Ton.	Total Declared Value.	Percentage of Quantity.
		Tons.	£	£		Tons.	£	£		Tons.	£	£		Tons.	£	£	
France ...	Articles brittle, perishable or valuable	895,727	51·956	46,538,636	11·174	377,978	24·112	9,113,846	10·661	72,234	83·579	6,037,271	8·244	1,345,939	45·834	61,689,753	10·821
	All other articles	1,467,257	3·425	5,025,960	3·909	7,996,173	0·939	7,510,228	15·149	50,942	15·590	794,203	6·909	9,514,372	1·401	13,330,391	10·448
	Total	**2,362,984**	**21·822**	**51,564,596**	**5·187**	**8,374,151**	**1·985**	**16,624,074**	**14·866**	**123,176**	**55·461**	**6,831,474**	**7·634**	**10,860,311**	**6·908**	**75,020,144**	**10·493**
Germany ...	Articles brittle, perishable or valuable	979,327	23·082	22,605,225	12·217	470,438	36·235	17,046,318	13·268	119,385	79·327	9,470,440	13·624	1,569,150	31·305	49,121,983	12·616
	All other articles	1,337,982	7·273	9,730,632	3·564	6,416,986	1·207	7,747,792	12·157	90,160	15·595	1,406,056	12·227	7,845,128	2·407	18,884,480	8·615
	Total	**2,317,309**	**13·954**	**32,335,857**	**5·087**	**6,887,424**	**3·600**	**24,794,110**	**12·227**	**209,545**	**51·905**	**10,876,496**	**12·986**	**9,414,278**	**7·224**	**68,006,463**	**9·096**
Belgium ...	Articles brittle, perishable or valuable	337,102	55·836	18,822,552	4·205	142,219	47·946	6,818,856	4·011	56,137	59·570	3,344,071	6·406	535,458	54·132	28,985,479	4·305
	All other articles	1,073,744	5·821	6,249,801	2·860	1,135,419	2·093	2,376,253	2·151	64,479	14·665	945,601	8·745	2,273,642	4·210	9,571,655	2·497
	Total	**1,410,846**	**17·771**	**25,072,353**	**3·097**	**1,277,638**	**7·197**	**9,195,109**	**2·268**	**120,616**	**35·565**	**4,289,672**	**7·475**	**2,809,100**	**13·726**	**38,557,134**	**2·714**
Holland ...	Articles brittle, perishable or valuable	525,497	50·350	26,458,996	6·555	144,128	38·230	5,509,966	4·065	56,684	63·292	3,587,652	6·469	726,309	48·955	35,556,614	5·839
	All other articles	880,505	7·325	6,449,568	2·346	1,586,355	2·400	3,807,004	3·005	65,290	16·259	1,061,547	8·855	2,532,150	4·470	11,318,119	2·781
	Total	**1,406,002**	**23·406**	**32,908,564**	**3·086**	**1,730,483**	**5·384**	**9,316,970**	**3·072**	**121,974**	**38·116**	**4,649,199**	**7·559**	**3,258,459**	**14·385**	**46,874,733**	**3·148**
All Other Countries	Articles brittle, perishable or valuable	5,278,613	42·438	224,011,694	65·849	2,410,867	60·535	145,942,282	67·995	571,827	59·623	34,094,128	65·257	8,261,307	48·908	404,048,104	66·419
	All other articles	32,779,700	4·708	154,325,437	87·321	35,649,250	2·135	76,113,586	67·538	466,478	11·897	5,549,927	63·264	68,895,428	3·425	235,988,950	75·659
	Total	**38,058,313**	**9·941**	**378,337,131**	**83·543**	**38,060,117**	**5·834**	**222,055,868**	**67·567**	**1,038,305**	**38·181**	**39,644,055**	**64·346**	**77,156,735**	**8·295**	**640,037,054**	**74·549**
Whole World	Articles brittle, perishable or valuable	8,016,266	42·219	338,437,103	100·000	3,545,630	52·016	184,431,268	100·000	876,267	64·516	56,533,562	100·000	12,438,163	46·583	579,401,933	100·000
	All other articles	37,539,188	4·842	181,781,398	100·000	52,784,883	1·848	97,554,863	100·000	737,349	13·233	9,757,334	100·000	91,060,720	3·175	289,093,595	100·000
	Grand Total ...	**45,555,454**	**11·419**	**520,218,501**	**100·000**	**56,329,813**	**5·006**	**281,986,131**	**100·000**	**1,613,616**	**41·082**	**66,290,896**	**100·000**	**103,498,883**	**8·391**	**868,495,528**	**100·000**

Note.—This Table does not include Gold and Silver Coin or Bullion.

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merely a re-exportation of Imports, either weighted with additional British labour or only transhipped.

Under the heading "Total Declared Value in £" will be found the totals extracted from official statistics, such as the *Statistical Abstract*, referred to previously.

Under the heading "Nett Quantity in Tons" will be found the result of the calculations explained in the previous chapter, and under the heading "Average Value per ton in £" will be found the quotient resulting from a division of "Value" (as stated in the Blue Books) by "Quantity." This column "Average Value per ton in £" gives an interesting criterion of the variation in value or price of the general trade of this country during the years in question.

Thus, we see that the general Imports rose in value in 1900 to the extent of about 16*s.* 9*d.* per ton, and to the extent of about 1*s.* 4*d.* per ton in the year 1901, reaching the maximum in that year. Thereafter prices declined to the extent of about 6*s.* 7*d.* per ton in 1902, and about 1*s.* 6*d.* per ton in 1903. In the Exports of British and Irish produce there is a similar rise from 1899 to 1901, and a fall from the latter year to 1903.

The fluctuation in prices does not, however, seem to have had the same trend in the Exports of Foreign and Colonial produce. The value of these re-exports appears to have increased steadily during the five years under observation, the increases year upon year having been £1 5*s.* 6*d.*, £1 1*s.* 6*d.*, £1 18*s.* 10*d.*, and £2 11*s.* 9*d.* per ton respectively in 1900, 1901, 1902, and 1903.

When the total of the trade of the United Kingdom is considered, the fluctuation in price is again seen to be on the increase up to 1901, and on the decline thereafter, although the last year represents an increase upon the first year observed. In this instance, a great stability of price values will be noticed, the fluctuations being insignificant, *viz.*: an increase of 8s. 9d. per ton in 1900, and of 4s. 2d. per ton in 1901, and a decrease of 5s. 3d. per ton in 1902, and of 1s. 4d. per ton in 1903.

Turning to the volume of the whole trade expressed in tons, we find an increase in 1900, a decrease in 1901, an increase in 1902, and another increase in 1903, which brings the total above that for any of the four preceding years.

To illustrate these movements still more clearly, Table IX. has been calculated, giving the percentage values of the totals of Table VIII., the first of the five years being taken as the index year at 100. The same thing is shown graphically as a curve in the charts given in Figs. 48 and 49.

Table X. gives the averages, for the five years dealt with in Table VIII., of the trade of the United Kingdom with the Whole World, sub-divided into the trade with various selected countries, and with the rest of the world. In addition to the sub-divisions given in Table VIII., a column has been added giving the proportion of the quantity of the trade in each class of goods with each country to the total trade of the United Kingdom in such class of goods, the latter being taken as 100, and the former expressed in per cent.

A great many interesting conclusions can be drawn from this Table, since it affords an indication of the relative trade which the United Kingdom is carrying on with France, Germany, Belgium, Holland, and the rest of the world, respectively.

For the purpose of investigating the relative value and proportion of our trade with these four countries, Tables XA., XB., XC., and XD. have been prepared; they give merely the average value per ton and the percentage of quantity in the two classes of articles, and in all articles irrespective of class.

Table XA.—IMPORTS.

Value per Ton and Proportion of Trade between Various Countries and the United Kingdom.

Countries.	Articles of Class "1."		Articles of Class "2."		All Articles.	
	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.
	£		£		£	
From France ...	51·956	11·174	3·425	3·909	21·822	5·187
,, Germany ...	23·082	12·217	7·273	3·564	13·954	5·087
,, Belgium ...	55·836	4·205	5·821	2·860	17·771	3·097
,, Holland ...	50·350	6·555	7·325	2·346	23·406	3·086
Total of above	...	34·151	...	12·679	...	16·457
From all other countries... ...	42·438	65·849	4·708	87·321	9·941	83·543

Table XB.—EXPORTS (BRITISH AND IRISH PRODUCE).

Value per Ton and Proportion of Trade between Various Countries and the United Kingdom.

Countries.	Articles of Class "1."		Articles of Class "2."		All Articles.	
	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.
	£		£		£	
To France	24·112	10·661	0·939	15·149	1·985	14·866
,, Germany ...	36·235	13·268	1·207	12·157	3·600	12·227
,, Belgium... ..	47·946	4·011	2·093	2·151	7·197	2·268
,, Holland... ...	38·230	4·065	2·400	3·005	5·384	3·072
Total of above	...	32·005	...	32·462	...	32·433
To all other countries	60·535	67·995	2·135	67·538	5·834	67·567

Table XC.—EXPORTS (FOREIGN AND COLONIAL PRODUCE).

Value per Ton and Proportion of Trade between Various Countries and the United Kingdom.

Countries.	Articles of Class "1."		Articles of Class "2."		All Articles.	
	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.
	£		£		£	
To France	83·579	8·244	15·590	6·909	55·461	7·634
,, Germany ...	79·327	13·624	15·595	12·227	51·905	12·986
,, Belgium... ...	59·570	6·406	14·665	8·745	35·565	7·475
,, Holland ...	63·292	6·469	16·259	8·855	38·116	7·559
Total of above	...	34·743	...	36·736	...	35·654
To all other countries	59·623	65·257	11·897	63·264	38·181	64·346

Table XD.—TOTAL TRADE.

Value per Ton and Proportion of Trade between Various Countries and the United Kingdom.

Countries.	Articles of Class "1."		Articles of Class "2."		All Articles.	
	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.	Average Value per Ton.	Per Cent. of Quantity.
	£		£		£	
With France ...	45·834	10·821	1·401	10·448	6·908	10·493
,, Germany ...	31·305	12·616	2·407	8·615	7·224	9·096
,, Belgium ...	54·132	4·305	4·210	2·497	13·726	2·714
,, Holland ...	48·955	5·839	4·470	2·781	14·385	3·148
Total of above	...	33·581	...	24·341	...	25·451
With all other countries	48·908	66·419	3·425	75·659	8·295	74·549

From Table XA, which deals with Imports, it will be seen that the most valuable goods of Class 1 are imported from Belgium. Ranking next in order of value per ton comes France, then Holland, then "All Other Countries," while the value per ton of these goods imported from Germany ranks lowest. The trade in articles of Class 2, which are of little importance for our purpose, requires no special comment here. In regard to the proportion of Imports, we find that the four countries contribute 34 per cent. of our total Imports in goods of Class 1, whilst they only account for about 13 per cent. of our total Imports of low-class goods; and that if all goods are taken together, the Imports from these four countries represent about 16 per cent. of the total.

Table XB, which deals with Exports of British and Irish produce, shows that, as regards goods of Class 1, our Exports which possess the highest value per ton do not go to the four countries, but go to "All Other Countries." Our Exports of this category are of the lowest value per ton in our dealings with France, both in respect of the individual classes and also if all articles are taken together. It will be observed that the four countries absorb about one-third of the total of British exports.

Table Xc, deals with Exports of Foreign and Colonial produce (Transhipment Trade). As regards articles of Class 1, we find that France takes goods of the highest value per ton, Germany, Holland, "All Other Countries," and Belgium ranking after in the order named. As regards the proportion of this trade in Class 1, in Class 2, and in all articles taken together, the four countries absorb somewhat over one-third of our trade with the whole world.

Table XD, gives the same information as regards the Total Trade between this country and the world, and if this Table, which supplies a criterion of the importance of our respective clients, is considered, it will be seen that, as regards relative value in goods of Class 1, our trade with Belgium is the most important, the average value per ton being £54 2*s.* 8*d.* Next to it ranks Holland with an average value of £48 19*s.* 1*d.* per ton; then "All Other Countries" with an average value of £48 18*s.* 2*d.* per ton; then France with an average value of £45 16*s.* 8*d.* per ton; and finally Germany with an average value of £31 6*s.* 1*d.* per ton. As regards the proportion of the whole trade between this country and the various other countries in goods of Class 1, the four countries selected represent about one-third, or 33·6 per cent. Of this proportion, Germany accounts for about 12½ per cent.; France for about 11 per cent.; Holland for about 6 per cent.; and Belgium for about 4 per cent. In articles belonging to Class 2, the proportion represented by the four countries to the total trade with the United Kingdom in this class, represents only about 24·3 per cent.; France representing about 10½ per cent.; Germany about 8½ per cent.; and Holland and Belgium only about 2½ per cent. each. Taking the whole trade, irrespective of class, we find that the proportion of the four countries is about 25·5 per cent., of which France represents about 10½ per cent., Germany about 9 per cent., Holland about 3 per cent., and Belgium about 2¾ per cent. The inference is that if the proportion of trade is considered in connexion with the average value per ton of the trade, France is in every respect (at least among European countries) our most valuable customer.

Tables XI., XII., XIII. and XIV. bring us nearer to the object we have in view, namely, to ascertain the actual traffic which is at present passing over the English Channel. They give the average, for the five years dealt with in Table VIII., of such part of the trade of the United Kingdom with the Whole World (subdivided into the trade with the various selected countries and with the rest of the world) as passes through the ports of Dover, Folkestone, Southampton and London respectively. All goods are again divided into two classes, and the weight in tons is given of each class separately and of both classes together, whilst to each entry is adjoined the average value per ton. Furthermore, in order to show the relative importance of the various ports, in respect of the trade with the different countries more immediately interesting us, the proportion of each class of trade is shown in percentage; that is to say, the whole trade with the respective country, passing through all British ports, in the respective class of articles, is taken as 100, and the proportion of trade passing through the port in question expressed in per cent.

As regards Dover, we find that the total volume of trade passing through that port amounts to 80,133 tons, and that of this total 55,042 tons are contributed by the trade with France, 51,643 tons representing goods of the first class, and 3,399 goods of the second class. Taking the three kinds of trade separately, in order to study the relative importance of Dover as a shipping port with France, we see that, in Imports of goods of Class 1, Dover carries 3·9 per cent. of the total coming from France into the United Kingdom. Of British Home Exports to France in Class 1, only 1·24 per cent. passes through Dover, but, of the Transhipment Trade with France in Class 1, as much as 16·64 per cent. is dealt with at that port.

If these proportions are considered in conjunction with all that has been said about the situation of Dover in relation to France, the exiguity of its goods traffic with that country is indeed surprising. But small as that goods traffic is, it is still considerable when compared to Dover's traffic with Germany, Holland, and Belgium.

If we now glance at the average value per ton of the goods trade with France, we find it to be very high indeed, namely: for Class 1, £210 per ton in the Imports; £216 per ton in British Home Exports; and £107 in the Transhipment Trade. Even for Class 2, the average value of the Home Exports to France, passing through the port of Dover, attains the high value of £44 per ton.

As the Port of Dover is the one most immediately concerning us,

Table XI.—AVERAGE FOR FIVE YEARS (1899–1903) OF THE TRADE OF THE PORT OF **DOVER** WITH THE WHOLE WORLD.

Showing separately the Trade with the Principal European Countries and the Proportion which the Quantity of Trade in Each Class bears to that of the United Kingdom in the Respective Class and Country.

	France.			Germany.			Holland.			Belgium.			Other Countries.			Trade with Whole World.		
	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.
Imports—	Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£	
Articles brittle, perishable or valuable	34,925	210·04	3·90	95	153·93	0·01	16	481·56	0·00	2,883	501·14	0·85	322	152·75	0·01	38,241	231·475	0·48
All other articles	2,607	10·38	0·18	122	38·16	0·01	3	13·33	0·00	29	31·79	0·00	17,401	2·80	0·05	20,162	4·04	0·05
TOTAL	**37,532**	**196·17**	**1·59**	**217**	**88·84**	**0·01**	**19**	**407·63**	**0·00**	**2,912**	**496·47**	**0·21**	**17,723**	**5·52**	**0·04**	**58,403**	**152·96**	**0·13**
Exports of British produce—																		
Articles brittle, perishable or valuable	4,700	216·05	1·24	605	346·72	0·13	14	380·21	0·01	1,649	328·41	1·16	279	448·65	0·01	7,247	261·80	0·23
All other articles	792	44·30	0·01	121	40·04	0·00	5	44·44	0·00	58	44·07	0·00	44	44·36	0·00	1,020	43·79	0·00
TOTAL	**5,492**	**191·28**	**0·07**	**726**	**295·60**	**0·01**	**19**	**291·84**	**0·00**	**1,707**	**318·75**	**0·13**	**323**	**393·58**	**0·00**	**8,267**	**234·90**	**0·01**
Exports of Foreign and Colonial produce—																		
Articles brittle, perishable or valuable	12,018	107·65	16·64	540	98·59	0·45	35	23·66	0·06	262	199·57	0·47	608	121·85	0·11	13,463	109·50	0·15
All other articles	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	**12,018**	**107·65**	**9·76**	**540**	**98·59**	**0·26**	**35**	**23·66**	**0·03**	**262**	**199·57**	**0·22**	**608**	**121·85**	**0·06**	**13,463**	**109·50**	**0·83**
Total Trade—																		
Articles brittle, perishable or valuable	51,643	186·76	3·84	1,240	223·89	0·08	65	213·17	0·01	4,794	425·24	0·89	1,209	205·50	0·01	58,951	207·35	0·47
All other articles	3,399	18·28	0·04	243	39·10	0·00	8	32·75	0·00	87	39·98	0·00	17,445	2·90	0·02	21,182	5·95	0·02
GRAND TOTAL ...	**55,042**	**176·35**	**0·51**	**1,483**	**193·61**	**0·02**	**73**	**193·40**	**0·00**	**4,881**	**418·37**	**0·17**	**18,654**	**16·03**	**0·02**	**80,133**	**154·11**	**0·07**

NOTE.—This Table does not include Gold and Silver Coin or Bullion.

it may be of interest to enumerate some of the articles of which the trade with France passing through that port consists, viz.:—

IMPORTS.

Class 1.—*Articles Brittle, Valuable or Perishable.*

Apparel and Slops.
Baskets and Basketware.
Cork Manufactures.
Cotton Manufactures of all kinds.
Eggs.
Embroidery and Needlework.
Fancy Goods.
Ornamental Feathers.
Artificial Flowers.
Fruit.
Jewellery.
Leather Manufactures: Gloves.
Fresh Meat.
Gold Leaves.
Platinum.
Pictures.
Scientific Instruments.
Silk Yarns.
Silk Manufactures (average value per ton £2,929).
Manufactures of Skins.
Watches.
Wine.
Woollen Yarns (average value per ton varying from £249 to £286 15*s.*).
Woollen Manufactures.

Class 2.—*All Other Articles.*

Machinery and Metal Work (average value per ton £47).
Iron and Steel of all kinds.
Vegetables of all kinds.

EXPORTS OF BRITISH AND IRISH PRODUCE.

Class 1.—*Articles Brittle, Valuable or Perishable.*

Apparel.
Printed Books.
Cotton Yarns.
Cotton Piece Goods.
Pictures.
Plate and Plated Ware.
Prints and Engravings.
Silk Yarns (average value per ton varying from £1,079 10*s.* to £1,126 13*s.*).
Silk Manufactures (average value per ton, £2,641 6*s.*).
Skins and Furs.
Woollen and Worsted Manufactures—Piece Goods (average value per ton, £349 18*s.*).
Leather Manufactures.

Class 2.—*All Other Articles.*

Machinery and Metal Work.

EXPORTS OF FOREIGN AND COLONIAL PRODUCE.

Class 1.—*Articles Brittle, Valuable or Perishable.*

Drugs.
Fancy Goods.
Ornamental Feathers (average value per ton, varying from £2,367 6*s.* to £8,110 19*s.*).
Lace.
Platinum.
Musical Instruments.
Perfumery.
Pictures.
Silver Plate.
Precious Stones.
Raw Silk.
Silk Manufactures.
Skins and Furs.
Cigars.
Watches.
Wine.
Sheep and Lambs' Wool.
Woollen Manufactures.

Class 2.—*All Other Articles*

None Exported.

To turn to the Port of Folkestone :—Of the total volume of trade, equal to 92,695 tons, passing through Folkestone, as much as 89,033 tons are contributed by the trade with France, 84,899 tons being in goods of the 1st Class, and only 4,134 tons in goods of the 2nd Class.

As regards the proportion of the trade with France carried through Folkestone, Imports of Class 1, represent 7·65 per cent. of the total French Imports of that class into Great Britain. Home Exports to France represent 2·47 per cent. in goods of Class 1, and Re-exports represent 9·68 per cent. The average values per ton are again very high. The trade with Germany, Holland, Belgium, and "All Other Countries" carried through Folkestone, is insignificant.

In dealing with the Port of Southampton we find its trade with France, though absolutely larger than that of either Dover or Folkestone, to be relatively smaller when compared with its total trade. Of the total volume of 623,038 tons, 104,876 tons are carried from and to France, and of these 97,315 tons consist of articles of Class 1, and 7,561 tons of articles of Class 2. The proportion of the whole British trade with France in articles of Class 1 that finds its

Table XII.—Average for Five Years (1899-1903) of the Trade of the Port of **FOLKESTONE** with the Whole World.

Showing Separately the Trade with the Principal European Countries, and the Proportion which the Quantity of Trade in Each Class bears to that of the United Kingdom in the Respective Class and Country.

	France.			Germany.			Holland.			Belgium.			Other Countries.			Trade with Whole World.		
	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.
Imports—	Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£	
Articles brittle, perishable or valuable	68,565	172·41	7·65	*	...	...	2,588	117·74	0·49	1	254·00	0·00	132	163·98	0·00	71,286	170·41	0·89
All other articles	2,976	32·29	0·20		...	...	527	12·45	0·06	...	...	...	...	...	...	3,503	29·30	0·01
Total	**71,541**	**166·58**	**3·03**	*	...	...	**3,115**	**99·92**	**0·22**	**1**	**254·00**	**0·00**	**132**	**163·98**	**0·00**	**74,739**	**163·80**	**0·17**
Exports of British produce—																		
Articles brittle, perishable or valuable	9,338	107·72	2·47	48	260·77	0·01	22	183·90	0·01	12	111·67	0·01	30	125·33	0·00	9,450	108·74	0·26
All other articles	1,158	48·27	0·01	4	36·25	0·00	3	46·00	0·00	...	...	...	1	25·00	0·00	1,166	48·21	0·00
Total	**10,496**	**101·16**	**0·12**	**52**	**243·50**	**0·00**	**25**	**167·36**	**0·00**	**12**	**111·67**	**0·00**	**31**	**123·06**	**0·00**	**10,616**	**102·09**	**0·02**
Exports of Foreign and Colonial produce—																		
Articles brittle, perishable or valuable	6,996	107·20	9·68	3	273·33	0·00	4	129·00	0·01	...	...	...	287	42·36	0·05	7,290	104·73	0·83
All other articles	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	**6,996**	**107·20**	**5·68**	**3**	**273·33**	**0·00**	**4**	**129·00**	**0·00**	...	...	...	**287**	**42·36**	**0·03**	**7,290**	**104·73**	**0·45**
Total Trade—																		
Articles brittle, perishable or valuable	84,899	159·92	6·31	51	261·51	0·00	2,614	118·31	0·36	13	123·31	0·00	449	83·73	0·00	88,026	158·35	0·71
All other articles	4,134	36·76	0·04	4	36·25	0·00	530	12·64	0·02	...	...	...	1	25·00	0·00	4,669	34·02	0·00
Grand Total ...	**89,033**	**154·20**	**0·82**	**55**	**245·13**	**0·00**	**3,144**	**100·50**	**0·10**	**13**	**123·31**	**0·00**	**450**	**83·59**	**0·00**	**92,695**	**152·09**	**0·09**

Note.—This Table does not include Gold and Silver Coin or Bullion. * Under one Ton neglected.

Table XIII.—AVERAGE for FIVE YEARS (1899–1903) OF THE TRADE OF THE PORT OF **SOUTHAMPTON** WITH THE WHOLE WORLD.

Showing Separately the Trade with the Principal European Countries, and the Proportion which the Quantity of Trade in Each Class bears to that of the United Kingdom in the Respective Class and Country.

	France.			Germany.			Holland.			Belgium.			Other Countries.			Trade with Whole World.		
	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.
Imports—	Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£	
Articles brittle, perishable or valuable	94,198	45·84	10·52	5,977	10·59	0·61	4,867	31·67	0·93	5,939	8·52	1·76	168,261	51·31	3·19	279,242	47·34	3·48
All other articles	6,990	20·17	0·48	14,196	5·05	1·06	1,420	10·44	0·16	3,578	5·43	0·33	195,276	5·78	0·60	221,460	6·21	0·59
Total	**101,188**	**44·07**	**4·28**	**20,173**	**6·69**	**0·87**	**6,287**	**26·87**	**0·35**	**9,517**	**7·36**	**0·67**	**363,537**	**26·85**	**0·95**	**500,702**	**29·15**	**1·10**
Exports of British produce—																		
Articles brittle, perishable or valuable	1,511	65·04	0·40	111	45·04	0·02	15	116·07	0·01	35	117·03	0·02	73,304	138·98	3·04	74,976	137·34	2·11
All other articles	523	35·31	0·01	13	15·15	0·00	2	44·5	0·00	1	22·00	0·00	13,052	28·22	0·04	13,591	28·49	0·03
Total	**2,034**	**57·39**	**0·02**	**124**	**41·90**	**0·00**	**17**	**107·65**	**0·00**	**36**	**115·00**	**0·00**	**86,356**	**122·24**	**0·23**	**88,5 67**	**120·64**	**0·16**
Exports of Foreign and Colonial produce—																		
Articles brittle, perishable or valuable	1,606	56·03	2·22	2,918	73·88	2·44	89	34·95	0·16	1,048	64·19	1·87	23,204	103·72	4·06	28,865	96·41	3·33
All other articles	48	40·27	0·09	...	...	...	...	...	...	...	...	...	4,856	10·02	1·04	4,904	10·31	0·66
Total	**1,654**	**55·58**	**1·34**	**2,918**	**73·88**	**1·39**	**89**	**34·95**	**0·07**	**1,048**	**64·20**	**0·87**	**28,060**	**87·51**	**2·70**	**33,769**	**83·90**	**2·09**
Total Trade—																		
Articles brittle, perishable or valuable	97,315	46·31	7·23	9,006	31·52	0·57	4,971	31·98	0·69	7,022	17·43	1·31	264,769	80·18	3·20	383,083	68·65	3·08
All other articles	7,561	21·35	0·08	14,209	5·06	0·18	1,422	10·49	0·06	3,579	5·45	0·16	213,184	7·25	0·31	239,955	7·55	0·26
Grand total... ...	**104,876**	**44·51**	**0·97**	**23,215**	**15·32**	**0·25**	**6,393**	**27·20**	**0·20**	**10,601**	**13·38**	**0·38**	**477,953**	**47·65**	**0·62**	**623,038**	**45·12**	**0·60**

NOTE.—This Table does not include Gold and Silver Coin or Bullion.

way through Southampton amounts to 10·52 per cent. in Imports; to 0·4 per cent. in Home Exports; and to 2·22 per cent. in Re-exports. In respect of the relative values, there is a considerable drop for articles of Class 1, as compared with Dover and Folkestone, but a comparatively high figure for all articles of Class 2.

We now have to deal with the most important source from which trade may ultimately be deflected to the Ferry, viz., London. That port holds the premier position in respect of the trade with France, which, nevertheless, is a relatively insignificant fraction of the colossal total it commands. Its total trade amounts to 13,218,357 tons, but only 532,025 tons are contributed by the trade with France, viz., 151,233 tons in goods of Class 1, and 380,792 tons in goods of Class 2. That is to say, London thus carries about 11·24 per cent. of the total trade of the United Kingdom with France in goods of Class 1, made up as follows: Imports, 10·04 per cent.; Home Exports, 6·27 per cent.; and Re-exports, 52.01 per cent. Here we notice the very large proportion represented by the Transhipment Trade, and further, on comparing the values of the goods of which the trade of London consists, we see a very considerable falling off in average values per ton as against Dover and Folkestone.

If we attempt to investigate more closely the channels which convey our trade with France in goods of Class 1, we see that the four ports enumerated account for 32·11 per cent. of the Imports in that class; for 10·39 per cent. of the British and Irish Exports in that class; and for 80·56 per cent. of the Foreign and Colonial Exports in that class.

Of the aggregate trade in Class 1, we have now accounted for 28·6 per cent. To ascertain the chief contributors supplying the percentages unaccounted for, we are again obliged to have recourse to the Navigation Blue Book. This informs us that the principal ports through which the remaining 67·89 per cent. of the Imports from France is conveyed into this country, are Newhaven, Goole and Hull, as regards goods of Class 1. In passing, it may be pointed out that Cardiff, Liverpool, Newcastle, and Swansea are chiefly concerned with imports of Class 2. The chief channels for the export trade outside the four ports investigated separately, are Newhaven, Goole

Table XIV.—Average for Five Years (1899-1903) of the Trade of the Port of **LONDON** with the Whole World.

Showing Separately the Trade with the Principal European Countries, and the Proportion which the Quantity of Trade in Each Class Bears to that of the United Kingdom in the Respective Class and Country.

	France.			Germany.			Holland.			Belgium.			Other Countries.			Trade with Whole World.		
	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.	Quantity.	Average Value per Ton.	Percentage of Quantity.
Imports—	Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£		Tons.	£	
Articles, brittle, perishable or valuable	89,952	59·60	10·04	104,111	50·60	10·63	152,966	71·47	29·11	92,961	70·93	27·58	1,678,294	51·63	31·79	2,118,284	54·20	26·42
All other articles	294,821	8·08	20·09	570,382	9·08	42·63	395,129	8·25	44·87	248,848	8·74	23·18	6,943,591	6·08	21·18	8,452,771	6·54	22·52
Total	**384,773**	**20·12**	**16·28**	**674,493**	**15·49**	**29·11**	**548,095**	**25·89**	**38·98**	**341,809**	**25·66**	**24·23**	**8,621,885**	**14·95**	**22·65**	**10,571,055**	**16·09**	**23·20**
Exports of British produce—																		
Articles, brittle, perishable or valuable	23,709	47·23	6·27	26,983	56·12	5·74	22,275	24·25	15·45	21,829	56·43	15·35	572,732	68·30	23·76	667,528	65·20	18·83
All other articles	47,636	7·28	0·60	40,660	9·37	0·63	42,700	7·07	2·69	31,854	10·80	2·80	1,079,867	11·76	3·03	1,242,717	11·33	2·35
Total	**71,345**	**20·56**	**0·85**	**67,643**	**28·02**	**0·98**	**64,975**	**12·96**	**3·75**	**53,683**	**29·35**	**4·20**	**1,652,599**	**31·36**	**4·34**	**1,910,245**	**30·15**	**3·39**
Exports of Foreign and Colonial produce—																		
Articles, brittle, perishable or valuable	37,572	71·84	52·01	94,294	76·34	78·98	50,288	53·94	88·72	37,342	55·15	66·51	200,964	74·83	35·14	420,460	70·65	47·98
All other articles	38,335	14·24	75·25	44,793	16·28	49·68	27,403	17·92	41·97	36,917	13·66	57·25	169,149	15·34	36·26	316,597	15·37	42·94
Total	**75,907**	**42·75**	**61·62**	**139,087**	**57·00**	**66·38**	**77,691**	**41·24**	**63·69**	**74,259**	**34·52**	**61·57**	**370,113**	**47·64**	**35·65**	**737,057**	**46·91**	**45·68**
Total Trade—																		
Articles, brittle, perishable or valuable	151,233	60·70	11·24	225,388	62·03	14·36	225,529	62·90	31·05	152,132	64·98	28·41	2,451,990	57·42	29·68	3,206,272	58·65	25·78
All other articles	380,792	8·60	4·00	655,835	9·59	8·36	465,232	8·71	18·37	317,619	9·52	13·97	8,192,607	7·02	11·89	10,012,085	7·41	10·99
Grand Total ...	**532,025**	**23·41**	**4·90**	**881,223**	**23·00**	**9·36**	**690,761**	**26·40**	**21·20**	**469,751**	**27·48**	**16·72**	**10,644,597**	**18·63**	**13·80**	**13,218,357**	**19·84**	**12·77**

Note.—This Table does not include Gold and Silver Coin or Bullion.

and Glasgow, for goods of Class 1, and Cardiff, Newcastle, Swansea, Sunderland, and Newport for goods of Class 2.

The traffic in gold and silver coin and bullion being given separately in all British trade statistics, we devote Table XV. to showing the average of that traffic between the United Kingdom and the whole world for the five years 1899 to 1903, giving separately the traffic with the four selected countries.

Before closing, a few words may be said concerning the possible deflection of trade, and its attraction to the proposed train-ferry route. This subject has been left to the last as it is one on which opinions seem to differ, some high authorities, past and present, being strong believers in the axiom that increased facilities create increased demand, and others maintaining that nothing is more difficult than to divert traffic from routes in which it has once become settled.

Whilst the former opinion preponderates to a very large extent, it cannot be denied that the question of deflection of trade and increase of traffic must always remain a speculative one, and can be settled only by experience gained in each individual case. An interesting illustration of traffic development following on increase of facilities is given in Chapter III., page 38, in connexion with the account of the ferry service which used to exist at Burntisland on the Forth.

On the assumption that what may be termed the watershed of our trade routes lies somewhere in the centre of England, the channels through which British trade finds its way to and from France can be divided into—the Western trade routes, *via* Liverpool, Newport, Swansea, and Cardiff; the Eastern routes, *via* Hull, Goole, Grimsby, and Newcastle; and the Southern routes, *via* Southampton, Newhaven, Folkestone, Dover, and London.

The last group of ports must be separated into two divisions. Southampton stands alone, inasmuch as its situation offers advantages for certain parts of this country which it would be difficult to outweigh. London, Folkestone, Dover, and Newhaven, on the other hand, are, by geographical situation, so contiguously placed that the deflection of trade from one to the other must be mainly dependent on increased facilities—amongst which the saving of time and money will always take the first place.

TABLE XV.—AVERAGE FOR FIVE YEARS (1899–03) OF THE TRAFFIC IN **GOLD AND SILVER COIN AND BULLION** BETWEEN THE UNITED KINGDOM AND THE WHOLE WORLD, SHOWING SEPARATELY THE TRAFFIC WITH THE PRINCIPAL EUROPEAN COUNTRIES.

Country.	Articles.	Imports from—		Exports to—		Total Trade with—	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		Oz.	£	Oz.	£	Oz.	£
France	Gold coin and bullion...	300,120	1,157,228	514,154	2,035,711	814,274	3,192,939
	Silver coin and bullion	4,031,932	489,835	9,721,344	1,134,721	13,753,276	1,624,556
	TOTAL	**4,332,052**	**1,647,063**	**10,235,498**	**3,170,432**	**14,567,550**	**4,817,495**
Germany	Gold coin and bullion...	290,401	1,103,768	985,138	3,993,686	1,275,539	5,097,454
	Silver coin and bullion	3,680,120	412,326	2,748,337	321,293	6,428,457	733,619
	TOTAL	**3,970,521**	**1,516,094**	**3,733,475**	**4,314,979**	**7,703,996**	**5,831,073**
Belgium	Gold coin and bullion...	130,424	506,618	10,753	42,154	141,177	548,772
	Silver coin and bullion	1,776,961	275,823	719,090	81,606	2,496,051	357,429
	TOTAL	**1,907,385**	**782,441**	**729,843**	**123,760**	**2,637,228**	**906,201**
Holland	Gold coin and bullion...	240,047	934,822	39,160	155,336	279,207	1,090,158
	Silver coin and bullion	214,627	24,952	196,193	24,662	410,820	49,614
	TOTAL	**454,674**	**959,774**	**235,353**	**179,998**	**690,027**	**1,139,772**
All Other Countries ...	Gold coin and bullion...	5,800,073	22,242,852	3,307,330	13,187,989	9,107,403	35,430,841
	Silver coin and bullion	92,861,543	10,322,383	87,736,377	10,790,197	180,597,920	21,112,580
	TOTAL	**98,661,616**	**32,565,235**	**91,043,707**	**23,978,186**	**189,705,323**	**56,543,421**
	GRAND TOTAL ...	**109,326,248**	**37,470,607**	**105,977,876**	**31,767,355**	**215,304,124**	**69,237,962**

The rapidity and extent of the deflection and attraction which the Southern trade routes will exert on the traffic and trade of the Western and Eastern routes must be intimately linked with the rivalry between rail and water—a rivalry steady, persistent, and unrelenting—wherein industry and manufactures give their allegiance to the railways, whilst agriculture and raw products remain faithful to the sea. That in this rivalry the establishment of a train-ferry across the Channel, or, more generally speaking, of improved intercommunication, will give a further powerful advantage to the railways can hardly be doubted. At all events, one thing remains assured, namely, that any deflection and stimulation of traffic that may result can only be of advantage to the community at large, because whatever set back has to be suffered by certain ports, as regards their special trade with certain European countries, will be returned in the form of increased earnings distributed among the various railway lines running from the North and Midlands to the Southern parts of this country.

No better quotation could close this attempt to present the scheme of a train-ferry as the best means practically available for the establishment of unbroken communication with the Continent, than the words uttered by Mr. Samuel Lack Mason (the then General Manager of the North British Railway), before the Committee of the House of Lords upon the International Communication Bill of 1872 (Sir John Fowler's Ferry Scheme), when, in answer to the question, to what extent he thought the proposed service would increase the traffic, he replied: "*That is very difficult to say. One is accustomed to make estimates, but one almost always finds them exceeded.*"

APPENDIX.

APPENDIX.

OPINIONS IN FAVOUR OF UNBROKEN COMMUNICATION.

Extracts from Evidence given before the Parliamentary Committees appointed to enquire into the International Communication Bill of 1872.

Mr. Samuel Lack Mason.

30*th April*, 1872.

737. Are you the general manager of the North British Railway?—I am.

738. Do the North British Railway Company work across an arm of the sea called the Firth of Forth?—They do.

* * * * * *

748. On the average, the time occupied is very small?—Very small indeed. I may explain that in carrying traffic by this route we compete with another route to Perth. We carry traffic by the shorter route in competition with another railway route by Stirling, Nasbith, and Linlithgow to Edinburgh, and we always find the ferry route is more expeditious than the other route, trains starting at the same time can get to Edinburgh very often as quickly as by this route.

* * * * * *

750. You think there will be no difficulty in running the passenger train over in the same manner?—No, obviously not; the same operation will be sufficient for the passengers as for the goods; our machinery for getting the trucks on board the boats is perhaps a little out of date and is certainly not so good, I should say, not being an engineer, as that proposed in that case—by the hydraulic machinery you always have a level run on to the boat.

* * * * * *

759. May I ask you, as a railway manager, whether it is easy to carry on a goods traffic unless you are able to carry the trucks right through without breaking bulk?—You may say it is impossible to do that if you are to carry out anything like an effective competition; and the reason why we adopt these means of crossing the ferry is obviously to make our competition effective with the land route. We are competitors for the Caledonian line.

760. Loading and unloading will always be a very expensive operation ?—Yes ; very expensive, and occasioning delay.

761. And, to a delicate class of goods, great risk of damage ?—Yes, to a delicate class of goods great risk of damage ; and it is otherwise objectionable.

762. Have you any doubt that if goods waggons could be conveyed across the Channel in the manner proposed, that the trade between England and the Continent would be enormously increased ?—I have no doubt about that. At present you will observe goods passing from London, for example, to Paris, *via* Boulogne or Calais, are really subject to greater interference, I do not know about delay, but certainly greater interference by the railways than they are by steamer, and that may perhaps account for the small quantity of goods carried by the railway.

763. Do you think the greater part of the goods traffic could be diverted to this route if these facilities were given ?—A large portion would, but to say the greater part would be diverted would involve consideration that I have not paid attention to. No doubt a great deal of goods traffic must come this way, that is certain. To that part requiring expedition, it is of importance, and that which is fragile and which will not bear frequent transhipment.

764. In fact, you attach the greatest importance to not breaking the bulk ?—Undoubtedly.

* * * * * *

796. Do you really believe that the railway route, what I call the water railway route, across in one of these ferry boats, would be able to compete successfully between London and Paris ?—I think it would for a large portion of the traffic ; the heavy goods might go by the steamboats on account of their expenses, but there must be a large traffic in the finer class of goods, which this would be the best route for, and it would almost monopolise trade of that description.

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MR. JAMES STAATS FORBES.

1st May, 1872.

957. You are managing director of the London, Chatham and Dover Railway Company, are you not ?—Yes.

* * * * * *

972. Now, is there not a very wide step, indeed, with regard to the commercial prospects of such a scheme, between being able to carry the

trains and not being able to carry them in the boats?—Yes, in my opinion, one of the chief values of the scheme is the capacity for transporting goods without breaking bulk.

973. You know a great deal about the course of traffic all over England, and indeed all over the world; do you think that the introduction of these boats carrying trains as they are proposed to do would bring a large quantity of goods traffic in this direction?—Yes. I probably know about as much about the European traffic as any man in England. I know that traffic which now finds its way to Hamburg and Rotterdam (those are somewhat removed from Calais), to Dieppe, Havre, and to a great number of other ports, Antwerp among them, would be materially influenced by this proposition, that you should be able to do in England what you can do in any European state now—namely, load the goods at one city, and put them under the customs lock, and send them to any other city or state without trouble and formalities, and without break of bulk. From Amsterdam you can now send produce all over Europe, and out of Europe in that way.

974. This would enable the same thing to be done here, making England a part of the Continent?—This would make it possible that goods should be loaded at Leeds, Bradford, Birmingham, or London for ultimate destination in St. Petersburg, Berlin, Vienna, or any other city.

975. Take the Leeds goods?—Some of them come to London, and others find their way to Grimsby or Hull, to go to Hamburg or Rotterdam.

976. Take Birmingham goods?—They chiefly come to London and are carted to the docks, and shipped on board the steamers for different ports; and they then make for Rotterdam or wherever the port is they are destined for, with all the formalities and labour, which involve enormous cost.

977. Your Company now get very little goods traffic, I believe?—We and the South Eastern Company have been working it for a good many years, and the quantity of goods carried is quite insignificant; it was only about 40,000 tons in the year 1869 that we carried between us.

* * * * * *

996. Now, about the return to the shareholders. They may sometimes be deceived, but do you think that this scheme will produce a good return?—It is a matter for calculation. My own impression is that it is a large sum of money to lay out; but you have got some kind of data before you of the present traffic across the Channel. I mean between Dover and Calais, and Dover and Boulogne; it is worth about £132,000 a year. Well, we know perfectly well that in consequence of the imperfections of that route, and the cost of it, a good deal of traffic finds its way into France and Belgium by other routes. There is the Ostend and Dover route. We carry a considerable

traffic in Thames steamers, which run to Boulogne, Calais and so on; the Brighton Company go to Dieppe. I have no doubt whatever that the increased accommodation promised by this scheme would increase in a very considerable ratio—progressively over a term of years, perhaps, but in the end in a very large ratio—the direct traffic between London and the Continent, and also absorb a great deal of traffic that now goes by other routes from London by Thames steamers.

997. The present traffic is £132,000 a year. Would not the traffic in a short time be double?—It is a good deal to put it double; but the goods traffic is no doubt increased very rapidly.

998. *The Chairman:* Is the £132,000 a year the gross receipts?—Yes, between Dover and Calais, and Boulogne and Folkestone.

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1008. Now, you seem to lay a great deal of stress on the goods traffic. Do you think that would be increased materially?—I know it would be materially increased.

1009. It is not a matter of opinion, then?—It is a matter of opinion founded on a knowledge of the facts, and such a conviction as amounts to a certainty.

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1026. *The Chairman:* They like that?—We earned £132,000 between us in the year 1869, and it cost about £70,000.

1027. *Mr. Serjeant Sargood:* That covers the whole outlay for the whole of the boats?—Yes, about that.

* * * * * *

1083. Do you mean to say that cotton will go by these steamers?—Yes, cotton manufactures and goods of all kinds. Perhaps I had better tell you what the course of the business is. Now, take silk goods. What takes place with regard to them?—They come to Boulogne from Paris, having been carted in Paris, and loaded with all the formalities of consigning, and so on; when they get to Boulogne they have to be unloaded, and pass through the custom-house—the railway company have to check them—they have to cart them and hand them over the quays to the steamers, then they come, of course, to Folkestone, and there they fall into the hands of the British custom-house people, and the same thing has to be gone through again—more checking and more weighing, and so on. It is not only the time that is occupied, but it is the enormous cost.

1084. How much time is lost in that way?—A clear day always. There are some goods, such as bullion, vegetables, and perishable things carried by the mail trains which go more quickly, but there is serious loss of time, serious risk and serious cost. I put it down as about 10*s*. a ton.

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MR. SAMUEL LACK MASON.

5th July, 1872.

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636. Do you attach great importance to the traffic not breaking bulk?—No doubt of it. That is proved by what they do at Burntisland. It would be perfectly easy to break bulk there, but we do not see the object of doing it; and that would be *à fortiori* the case between Calais and Dover.

637. In the first place there is the expense of transhipment?—Yes: and there is the difficulty and the risk of handling the goods, which you can never overcome, and that is particularly the case with fragile goods, such as would be conveyed between England and France.

638. Supposing goods were carried through between England and France, what would be the effect of that upon the traffic?—It must very much increase the traffic, and must tend to divert from all other routes all that traffic which is fragile, and which requires rapid conveyance. It would be a very great matter for any railway company to take its goods from Manchester or Liverpool or Edinburgh, right through to any part of the Continent without breaking bulk—I think that would be an inducement to traders to use this route in preference to any other.

639. To what extent do you think that would increase the traffic?—That is very difficult to say—one is accustomed to make estimates, but one always finds them exceeded.

640. But 50 per cent. would be no measure of the increase?—It is impossible to say what number of passengers might go by this route, if you had reasonable means of conveying them.

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646. What goods traffic is it that you expect would be facilitated by this route, and would come by way of Dover?—I think that all the traffic which passes between England and the Continent would be developed by facilities such as these, especially, as I have said, those goods which require rapid transmission, and which are liable to damage by handling.

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648. Does it make any difference, saving an hour or two in crossing in comparison with the whole distance, say to Paris?—I think the time saved in

goods traffic is not of any great consequence, but the matter I attach so much importance to is the avoidance of breaking bulk, and loading and unloading, which, besides being an inconvenient process, is a very expensive one.

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669. Should you anticipate that the traffic from Leeds going to Holland and Belgium and places beyond would go this way?—A great deal of the traffic would. I know the Leeds traffic very well, and I know what importance is placed on the rapid transmission of the traffic. I know this from having conducted a railway which had a great deal of the Leeds traffic upon it, and it almost all depended upon whether we could save an hour or two to London—If we could bring traffic by the Great Northern to outstrip our neighbour the Midland by two or three hours in London, we were almost sure to secure all the traffic to London for a great number of trains.

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690. So that if such a means of communication was established as that proposed by the present Bill, goods might come up all the way from Leeds and Birmingham and avoid London and the charges there, and be shipped right through?—Yes; you need not disturb them in London at all, but they will go to their destination.

691. But, independently of that, for goods all over England it would be a great advantage if they could be taken across the sea and run to any part of the Continent without breaking of bulk?—That is my opinion.

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MR. HENRY OAKLEY.

8th July, 1872.

1346. You are the general manager of the Great Northern Railway?—I am.

1347. And you, of course, in that position are able to form an opinion as to the value that attaches to the carriage of goods from this country to the Continent?—Yes.

1348. Now with regard to the traders, with the exception of a few articles of very heavy goods, do you find generally that the preference is given by traders to railways when they can have them over water carriage, which involves the breaking of bulk?—Certainly. Speaking of one's own line (and I know from conversation with other managers that what is true of the Great

Northern is true of other lines) the manufacturing trades, such as the wool and worsted from Bradford, the cutlery and manufactured steel from Sheffield, the looms and machinery of that class from Nottingham, are sent invariably by railway in preference to water, although from all those places, in fact, water carriage is cheaper to London than rail. The reason is pretty clear. The railway brings it to London, and it is carted to the door; there is no breaking bulk until the point of delivery is reached, whereas, taking from Yorkshire for instance, by water they first of all have to load into the Aire and Calder, or they sometimes send to Goole; goods are loaded, then transhipped in London, and then again delivered. By the railway there is the element of speed, of what you may term reliability—that is an absence of dependence on the weather, and also less risk in handling and damage generally, because it is almost an axiom that the more goods are handled the greater chance there is of damage to them, and damage means interruption to a man's business because, though he may be paid, still he suffers the damages and loss from it.

1349. From your knowledge of the traffic which passes between this kingdom and the Continent, do you think that if this scheme could be carried out and goods could be taken direct without breaking bulk, as proposed by Mr. Fowler, a very large quantity of goods would find their way by that route?—Yes, I am clearly of that opinion. I have had special occasion within the last year to examine our Continental traffic, and I am free to admit that I was very humiliated to find how very small it was.

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1352. The cost of cartage in London is very considerable, is it not?—Yes; dealing with general steam traffic, we, of course, have to unload it from our trucks, cart it through London, and deposit it at the wharf, and you cannot take that cost at much less than 5*s*., because our average cartage in London is from 5*s*. to 5*s*. 6*d*. a ton; but inasmuch as these vans would take a tolerably good load and go straight to the wharf, I put it down at about 4*s*.; then there is the cost of handling, unloading from the trucks, and loading on to the carts; I think it is not unreasonable to put that at a shilling; it has been done as low as 10*d*. all round, but the increase of wages and one thing and another brings it up to a shilling. Therefore there is 5*s*. to the water side against what would be the cost of railway transit through London. Supposing it went in a through truck to either the South Eastern or to the Chatham and Dover, I think you may put that at about 1*s*. 6*d*. or 2*s*.; I am not quite sure that I am right in that figure; I think I am nearly right.

1353. Then, on the score of economy alone, this scheme would attract a great deal of trade?—Yes. Then, of course, the economy would be realised also at the coast. There the same process has to be gone through; the goods are handled and loaded into vessels down inclined planes or by crane; precisely the same operation in the converse direction takes place on the opposite side, and then the goods are only landed where the long sea route can compete. But if you can carry the goods on to their destination, either Paris or some other central point (if it does not turn out so it will be contrary to all experience), the merchants being enabled to have their goods practically at the point they require them, without necessitating the employment of an agent, or somebody or other, to look after them at Boulogne, to get the duty settled—if they do not take advantage of the opportunity through that, it would be contrary to the whole of our experience, as we know that increased facilities have increased the trade immensely.

1354. In other words, your experience of passenger traffic and goods traffic on railways goes to justify you in the belief that a large quantity of goods will find their way by this route after it is established?—Yes. I may almost say that one's daily experience justifies us in coming clearly to that conclusion.

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1356. I will ask what class of traffic you refer to?—I take the year 1869. I find that the value of imports from France into England was the enormous sum of thirty-one millions of money. Of course, the Inland Revenue returns do not go into details. I should take first of all the provisions, butter; there is £2,000,000 worth of butter imported.

1357. Expedition is necessary there?—There is no question about that; eggs in the same way; their fragility is the best evidence on their behalf. There is a good deal of oil, cattle-feeding matters, oil seed cake; another half a million there. The raw silk and the manufactured silk is, of course, the great bulk. There is about ten millions of money comes over in silk in one shape or other; eight millions is chiefly manufactured.

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1375. Do you believe that your company, the Great Northern, would, if this were carried out, send trains right through from stations on the Great Northern to places on the Continent?—Of course, that would be a matter of arrangement; but I think I might fairly say this, that if a truck of goods, say, from Manchester, or, better, from Bradford, or Leeds, could be sent to any large towns—Paris, Vienna, Berlin, or Marseilles—we could, under proper arrangements with the Continental companies, send the truck through. But that is not the way in which I should personally suggest for the traffic to be managed. We have prevailing between England and Scotland what is called a joint stock; but the same principle would apply, too, here. All the parties to the route subscribed to a capital to find stock to work it; that is, I may say, international stock between England and Scotland—the Highland and Caledonian, the North British, the North-Eastern, and the Great Northern. We have, say, 100 carriages between us. The payment of those carriages is divided in proportion to the mileage of railway owned by each company over which they pass; they are perpetually ricocheting from Inverness to London and back; so that there is no complication of keeping accounts, no disputes with the companies about sending empty waggons. The stock is worked to the best advantage. And supposing this scheme is carried out, I see no reason whatever why a Continental through stock might not be arranged, and I am quite sure Mr. Elborall or Mr. Forbes could very soon arrange it.

1376. You are of opinion that such a communication as this would increase the traffic on those two lines?—It appears to me so. I say frankly that we would get something from it, so would the Midland and the North Western; in fact, all companies that reach the place where matters are picked up for the Continent will benefit.

1377. And, of course, those more immediately on the spot will benefit more?—Clearly, because they have the passengers.

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1404. There was one advantage that you suggested, which was that you would get rid of the expense and inconvenience of custom-house examination, how would that be?—It would have to be by arrangement in the same way as you arrange now for your passengers—you enter your goods here, and they are not touched till you get to Paris. And supposing you made up a train or half a dozen waggons of goods for Paris, they would be sealed here and opened at Paris.

1405. That is done at present I take it—goods are examined at the French port, and are not again examined when they get to Paris, therefore you would not get rid of examination?—No, but you would get the examination at the point of destination, where the goods would be consumed and not on the road, which practically causes that a day must be lost. The goods that they deliver to-day, never under any circumstances leave Boulogne or Calais until the next day, and sometimes I am told they are very much delayed.

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1410. Consequently, do you attach much importance to the train going on board?—I do, and I will tell you why I do. We, as you know, have a very large passenger traffic, and the pressure upon us, I may say, is not daily, but frequently, that we should send through carriages to the points, so that they may not be subject to change. We had a very striking instance some two or three years ago. Our Board was waited upon by several large merchants and manufacturers at Halifax; at that time we had four or five through trains from Halifax. Though the average number of first-class passengers was not one per train, and we interrupted the communication and made them change at Leeds or at Holbeck, we had a deputation of manufacturers to our Board, who told us that unless we restored that through carriage they would send their goods by another route. And the same sort of pressure, not applied, of course, in the same way, is constantly put upon us. Our trains in London are made up, say, of from 12 to 20 carriages, as the case may be. You will see one for Lincoln, one for Boston, Nottingham, Manchester, and so on throughout the line. The public will not change at the junctions, and if we compel them to change, they will go by another route. And, for the same reasons, I conclude, that if you let them go through in the carriages in this case it would be a great advantage.

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1412. What, let me propose this problem to you, would you take some through carriages that are going to Paris, others that are going to Brussels, and others that are going in another direction?—Certainly. I apprehend the number of carriages the boats would hold would be made up of those going to Paris, say, in a first-class train, five for Paris, three for Brussels, and so on, to such places as they might require to go through to by express trains.

1413. Then people in London would have to get in at Charing Cross, if they were going to Brussels, into a Brussels carriage, and those to Paris into a Paris carriage?—Yes.

1414. Would that not increase the present length of the train very much? —It would depend on the arrangements. We have experience in that sort of thing in the way I have told you; but we utilise the vacant spaces in the special carriages for the purpose of carrying the passengers to the intermediate distances, and I should take the intermediate distances in that case to be the coast—Boulogne or Calais; they are stopping places, and a great number of the people stop there.

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Extract from the Draft Report proposed by Lord Lansdowne (Chairman) upon the proceedings of the Joint Select Committee of the House of Lords and the House of Commons, on the Channel Tunnel, 1883.

1. In conducting the enquiry with which we have been entrusted, we have endeavoured to limit ourselves as strictly as possible to an investigation of the points which we believed to be specially referred to us.

2. We were directed to ascertain whether it was expedient that Parliamentary sanction should be given to a submarine communication between England and France, and to consider whether any or what conditions should be imposed by Parliament in the event of such communication being sanctioned. We do not believe that it is incumbent upon us to report upon the possibility of establishing such a communication, or upon the special engineering features of the schemes which have been lately before the public.

3. The possibility of forming a tunnel under the Channel, as to which we gather that some diversity of opinion exists, could, we apprehend, only be demonstrated by the successful execution of the work.

4. There is, in our opinion, no reason for believing that the interests of this country would suffer if the attempt were to be made and were to result in a failure.

5. The enquiry, limited by these considerations, appears to resolve itself into two parts:

(1) A consideration of the commercial or other advantages which might accrue to this country from the establishment of submarine communication between it and the Continent of Europe.

(2) An examination of the effects which the existence of such communication might have upon the national security.

We have taken a considerable amount of evidence bearing upon both points.

6. With regard to the former, we have endeavoured to ascertain the extent to which a tunnel of the character contemplated by the projectors of the schemes now before the public would suffice to carry a largely increased amount of traffic.

7. There is a wide discrepancy between the estimates which have been laid before us as to the carrying capacity of a double line of railway, worked under the peculiar circumstances which will be present in the case of a tunnel line.

8. It is obvious that in the case of a railway running through a tunnel of the altogether unprecedented length of 30 miles, approached by steep

gradients at each end, and used for the purpose of carrying goods as well as passengers, extraordinary precautions would be called for; with regard to these we may express our belief that if the formation of the tunnel were to be permitted, it would be found necessary to insist:

(1) That under no circumstances should more than one train be allowed to run at the same time over the five-mile gradients at each end of the tunnel.

(2) That there should be a sufficient number of block stations in the tunnel, and that two of these should always be blocked at once.

(3) That a certain number of hours out of the 24 should be set apart for the examination and repair of the permanent-way, and for the relief of the block signallers.

The details of these arrangements would, we apprehend, be fully considered and regulated from time to time by the Board of Trade.

9. The adoption of these precautions would necessarily impose certain limits upon the traffic which might be run through the tunnel. That traffic might possibly be still further limited in the event of the ventilation of the tunnel presenting difficulties greater than those foreseen by the promotors. This subject, which we regard as inseparably connected with that of the structure of the work, is not one which we consider to have been referred to us. We have, however, during the course of our enquiries received several suggestions upon the question, and we may, without impropriety, point out that the Channel tunnel will, if made, differ from all existing tunnels in its great length and in the fact that throughout the whole of that length it must necessarily be below the level of both its entrances.

10. Under these circumstances it can scarcely be doubted that the problem of providing adequate ventilation for the tunnel will be one of some difficulty, and we do not doubt that, before Parliamentary sanction is given to any scheme for submarine communication with France, special attention will be given to the appliances for securing persons using it from risk or inconvenience caused by a defective supply of respirable air.

11. The importance of the subject will be obvious when it is remembered, that if the tunnel were constructed, and the expectations of the promoters in regard to its ventilation disappointed, this country might find itself in the position of having incurred certain liabilities (of which we shall speak presently) in connexion with the defences of the exit of the tunnel, without obtaining any, or at any rate adequate, compensation in increased facilities of communication.

12. The observations which we have to make upon the probable carrying

capacity of the Channel tunnel are founded upon the assumption that those difficulties which attend its effectual ventilation have been successfully overcome.

13. Subject to this reservation, the evidence leads us to believe that a tunnel of the character of those now projected would be capable of accommodating a very large amount of passenger and goods traffic.

14. Thus Mr. Grierson, general manager of the Great Western Railway, expresses his belief that 12 passenger trains per week-day and two on Sundays, and four goods trains per week-day, carrying 2,316,000 passengers and 375,000 tons of goods per annum, could be run with safety through the tunnel.

15. Mr. Oakley, general manager of the Great Northern Railway, considers that after setting apart a portion of the 24 hours for goods traffic, which would be conveyed at a slower rate, an average of four trains per hour might be maintained.

16. Major-General Hutchinson, one of the Railway Inspectors of the Board of Trade, states his opinion, that:

> "Assuming the speed of passenger trains and goods trains to be respectively 40 and 20 miles an hour, and the number of each to be about equal.
>
> "Assuming also that there are two block stations in the tunnel, and that two sections are blocked to increase the safety of working, 25 trains might be passed through in each direction; or, making the necessary reduction for repairs and renewals of permanent-way, about 1,500,000 of passengers and 400,000 tons of goods per annum."
>
> General Hutchinson adds that, "With speeds of 45 and 25 miles an hour for passengers and goods trains respectively, the number of trains, under the same assumption as above as regards block stations, would be 31, capable of conveying about 1,500,000 of passengers and 400,000 tons of goods, and about 1,750,000 passengers and 500,000 tons of goods respectively per annum."

17. Colonel Yolland, the senior Railway Inspector of the Board of Trade, would set apart six hours out of the 24 for the maintenance of the permanent-way, but states that in his opinion the tunnel could be worked safely with three trains an hour, or from 54 to 60 trains in the 18 hours.

18. The above estimates are, it will be observed, founded upon the assumption that two lines of rails only are laid in the tunnel; it is, however, highly probable that if the traffic were to expand a time would come when the number of lines would be increased, and the carrying capacity of the tunnel proportionately augmented.

19. We have now to consider the extent to which, if railway communication were established between England and the Continent, the traffic between them would be affected.

20. We express with confidence our opinion that it would be reasonable to anticipate an immense development of the passenger traffic.

21. The number of persons now crossing the Channel is, if we bear in mind the extent to which the population of the British Islands is connected by business and other ties with that of the Continent of Europe, remarkably small. The total passenger traffic between England and the Continent during the year 1882 is represented by a total of 464,000 journeys between English Ports and Calais, Boulogne, and Havre, and 50,000 journeys between English and Belgian ports.

22. It is to be remembered that the population of the British Islands is at the present time between 35,000,000 and 36,000,000, and that of Belgium, Holland, Germany, and France about 92,000,000, while, if the population of the rest of Europe be added to that of the four countries named above, and the population of North America to that of the British Islands, a total of 100,000,000 upon one side of the English Channel, and of 300,000,000 upon the other, is the result. The fact that with such a population some 250,000 persons only should cross the Channel (for most of the travellers either way make two journeys), establishes, in our opinion, the conclusion that large numbers of persons, who would make the journey for business or pleasure, are deterred from so doing by the inconveniences of the present passage. These inconveniences have, no doubt, been diminished during recent years, with the result of steadily increasing the number of passages recorded.

23. Further improvements in the harbours and in the vessels used would, no doubt, lead to a further increase; but we are of opinion that any route depending upon a sea passage must continue to be to some extent affected by those accidents of wind and weather which at present render the passage of the Channel so distasteful to travellers, and which account for the remarkable fluctuations in the number of persons crossing it from time to time.

24. The shortening of the journey between England and the Continent, which would result from the substitution of a train for a packet service between Dover and Calais, would also operate in the direction of increasing the number of passengers. The fact that a large section of the travelling public at present prefer the shorter and much more expensive route by way of Folkestone and Boulogne or Dover and Calais to the slightly longer but much cheaper journey by way of Newhaven and Dieppe or Southampton and Havre shows that travellers are, as a rule, disposed to give the preference to the most convenient rather than to the cheapest route.

25. The amount of the expansion of passenger traffic which might be expected is obviously a matter of pure conjecture. We observe, however, that the witnesses whom we have examined, including several of the most eminent

of our railway managers, are unanimous in expressing their belief that it would be very large indeed.

26. Mr. Grierson, the general manager of the Great Western Railway, believed that the present number might be doubled in five or seven years, and trebled in fifteen.

27. Mr. Oakley, of the Great Northern Railway, anticipates that it would be trebled in a year and a half, and would continue to expand.

28. The majority of the witnesses representing commercial interests are confident that the tunnel would be used to an immense extent by persons travelling to and from the Continent on business.

29. We take this opportunity of referring to a scheme submitted to us by Mr. J. Fowler, C.E., for the introduction of a system of steam ferries, by means of which whole trains might be conveyed across the Channel, and thus transferred from English to Continental railway lines and *vice versâ*.

30. It is claimed by Mr. Fowler for his scheme that it would secure for the public the same advantages, in the way of through communication, as those to be obtained by means of a tunnel route; that its adoption presents none of the difficulties which present themselves in the way of the latter; that the expense which it would involve would be materially less; and that by depending upon it in preference to a tunnel all possibility of additional risk to the country would be avoided.

31. We are unable to express an opinion upon these alleged points of superiority without a special investigation of Mr. Fowler's project. No proposals founded upon it are at present before Parliament, and we do not consider that the fact of such a project having been in Mr. Fowler's contemplation would be of itself sufficient to warrant us in reporting adversely upon the proposal which we have been specially directed to examine.

32. We proceed to consider the effect which the opening of a Channel tunnel might be expected to produce upon the commerce of this country.

33. With regard to this, we may observe that there is no difference of opinion as to the inconvenience of the existing route for goods traffic. The uncertainty which is inevitable in the case of communications liable to be affected by wind and weather, and interrupted by transfers from the railway truck to the steamer and the steamer to the railway, the delay, expense, and risk involved in transhipment at the ports of embarkation and disembarkation, and the cost of insurance, have all constituted serious hindrances to our international commerce.

34. The trade in certain classes of goods is especially liable to be affected by these causes. Of these the principal are:—

(1) Perishable commodities, such as fruit, fish, flowers, vegetables, and other food supplies.

(2) Fragile articles, such as pottery, the lighter sorts of machinery, and the more delicate textile fabrics.

(3) All small articles requiring careful packing, and of which the value is great in proportion to their bulk.

35. That the tunnel, if made, would be largely used by goods of these classes we do not doubt.

36. We may refer in support of this anticipation to the evidence of Mr. Slagg, M.P.; of Mr. Oakley, who has furnished us with an interesting enumeration of the commodities for the conveyance of which the tunnel route would probably be used; of Mr. Samuelson, who has described the adverse effects of the existing arrangements upon the trade in agricultural machinery; of Sir Jacob Behrens and Mr. Lee, who have given evidence in favour of the tunnel in the interest of our textile manufactures; and of Mr. Wedgwood, who has pointed out the large saving which would result to the pottery trade by the substitution of through carriage in trucks for conveyance partly by rail and partly by sea to the Continent.

37. There is, however, a large traffic in commodities not falling within these descriptions, which is, nevertheless, carried on under disadvantageous conditions from the causes to which we have referred.

38. In modern commerce speed and certainty are, as Sir Jacob Behrens has pointed out to us, not less essential than cheapness in cost. The following extract is from his evidence as to the trade in woollen fabrics:—

> 4513. *Sir Massey Lopes:* I understand that the whole of your evidence in favour of the tunnel really depends upon this: that it is a question of rates?—More of speed than of rates, and certainty of delivery. That is the greatest advantage that I expect from it.
>
> 4514. I understood you to say just now that unless you had some security that the rates were not increased for your manufactures as between Bradford and the different towns on the Continent you would be adverse to the tunnel?—I should not advocate it.
>
> 4515. So that really it is a question of rates?—Yes, but, as I have already said, it is more a question of speed than of rates.
>
> 4516. But still one of your conditions is the rates?—Yes, but it is the secondary one; it is not the highest.

39. We have no reason to doubt the statement made to us by several witnesses to the effect that of recent years it has become unusual for retail traders to retain large stocks, and that the system of ordering commodities as they are required in small quantities at a time from the manufacturers is in consequence of the keenness of commercial competition becoming habitual among the merchants both of this and of other countries.

40. To a trade carried on under these conditions the punctual and rapid execution of orders is all important.

41. We do not doubt that the delay and irregularity inseparable from carriage by sea in its present condition have operated to the serious disadvantage of English manufacturers and exporters, and that the substitution for the present route of one more rapid, more punctual, and attended by fewer risks and inconveniences, would occasion a large expansion of our trade, and enable it to compete with that of foreign countries under infinitely more favourable conditions.

42. These considerations would, we believe, affect not only those special branches of commerce to which we have referred already, but also the trade in other articles for which, from their cheapness and bulk, carriage by water would naturally present superior attractions.

43. The extent to which this will be the case must remain a matter of conjecture. There are many classes of goods for which it may fairly be presumed that conveyance by sea will always be preferred; where rapid delivery is not an object, where the goods conveyed are not liable to deterioration in transit, the sea route, so long as it remains the cheapest, must continue to hold its own.

44. It is, however, a remarkable fact that for some time past, both in the Continent of Europe and in America, carriage by rail has competed successfully with carriage by water in cases where both are available, and there is no reason why such competition should not take place in the present instance.

45. The extent to which it will be possible for the tunnel route to compete with the different sea routes across the Channel must, of course, depend upon the rates at which goods are conveyed over the former, and these charges, again, must form the subject of future adjustment. The evidence, however, which we have received has satisfied us that even if they were apparently higher than those for conveyance by sea it would frequently be to the advantage of exporters to submit to them and to avoid the delays, risks, and expenses incidental to a sea voyage.

46. We may, before leaving the subject of rates, observe that the existence of alternative routes by sea will, in all probability, have the effect of keeping within reasonable limits the charges made for the conveyance by the tunnel route.

47. We cannot doubt that the tunnel, once opened, would not only afford a profitable and expeditious route for the conveyance of a portion of the goods traffic already in existence, but would lead to a large expansion of the trade between this country and the Continent. We share the belief expressed, almost unanimously, by the witnesses who have appeared before us as representatives of various commercial interests in this country, that the introduction of improved facilities for communication between one country, or one district, and another,

has invariably led, if not to the creation of new trades and new industries, at all events to a development, often far in excess of the most sanguine expectations, of those already in existence.

48. Such an expansion of trade has followed from the introduction of through rates, and from the removal of interruptions of gauge in this country, and from the establishment of improved communication and the overcoming of physical obstacles on the Continent of Europe and in America; and we have no reason to doubt that it would follow, if the disadvantages occasioned to international commerce by the existence of the English Channel were to be successfully removed.

49. From such a development of the trade between the United Kingdom and the Continent this country would, it can scarcely be doubted, be the greatest gainer.

50. Owing to the peculiar position which it occupies in the commercial system of the world, it has, we believe, more to gain than any other nation by an improvement of its trade routes, and more to lose by the neglect of any opportunities which may present themselves for their improvement. The greatest distributor of commodities in the world, it is, above all nations, interested in the improvement of those channels through which that distribution is effected. This consideration is entitled to the greater weight, because the enterprise of our Continental competitors has, by the improvement of Continental harbours and the facilitation of through traffic in goods throughout the Continent, already been successful in threatening our supremacy in the *entrepôt* trade. We desire to express our belief that not the least material of the arguments in favour of the establishment of submarine communication is to be found in the fact that it would probably tend to retain for us a large amount of business which recent changes upon the Continent are already tending, and may still further tend, to divert from our ports.

51. The volume of the trade which would be likely to make use of the Channel tunnel, were that route opened for the conveyance of goods at rates sufficiently advantageous to induce exporters and importers to make use of it, must, as we have already pointed out, remain a matter of conjecture. It is, however, material to consider the total amount of the trade of which a portion might be attracted to the tunnel, and to ascertain the value of those sections of it which are most likely to be so attracted.

52. We learn from tables which have been prepared for us under the direction of Mr. Giffen, in the Board of Trade, that of the total trade of the United Kingdom, imports to the value of £151,000,000 come to this country from the Continent of Europe, and exports to the value of £127,000,000 are carried from this country to the Continent. These

exports and imports represent about two-fifths of the exports and two-fifths of imports of the United Kingdom to and from the whole world.

53. It is to be observed that, of the above exports, £81,000,000 are British and Irish products (about one-third of the British and Irish products exported from the United Kingdom); while the foreign and colonial produce re-exported from this country to the Continent is valued at £46,000,000, or three-fourths of the total amount of foreign and colonial produce distributed by this country. In addition to the distribution of produce to this amount, it is necessary to take into consideration the business spoken of specially as that of transhipment, which amounts to about £12,500,000 a year, of which £9,500,000, or more than three-fourths, is received from the Continent, while £2,800,000, or about one-fourth, represents commodities sent, after transhipment, to the Continent. Besides these, there is a large but fluctuating trade with the Continent in bullion, and a large traffic in securities. The total of our transactions with the Continent, including imports, exports, transhipment, and bullion, amount, in round numbers to £300,000,000, or £150,000,000 each way.

54. From other tables which have been put in by Mr. Giffen, in illustration of the movements of shipping, it appears, that in 1882 the entries of shipping in the various ports of the United Kingdom from Europe amounted to 20,000,000 tons, or nearly three-fourths of the total entries from all countries, and the clearances to 18,500,000 tons, or nearly two-thirds of the total clearances to all countries.

55. A fair idea of the total amount of the trade liable to be affected cannot, however, be formed, unless to the figures quoted above be added those representing the trade of the United States and Canada with Europe, excluding the United Kingdom. With regard to this, Mr. Giffen estimates the amount of the imports into the United States from Europe, excluding England, at £32,000,000, and the exports from the United States to Europe, excluding England, at £52,000,000. Adding to these amounts the trade between the United States and Europe in bullion, the total for the year 1881 of the trade between North America and the Continent of Europe may be taken at £100,000,000.

56. The total trade between the Continent of Europe on the one hand, and the United Kingdom and North America on the other, may therefore be set down at £400,000,000 annually, or £200,000,000 each way.

57. With reference to the prospects of the Channel tunnel, it is important to distinguish the amount of the trade referred to above which belongs to those countries of Western Europe, the commerce of which would be most likely to take advantage of improved communications between England and

the Continent. We find accordingly that, of the total of our imports from the whole of Europe, two-thirds, or £98,000,000 were from Germany, Holland, Belgium, and France; while, of our total exports to all Europe, two-thirds, or £88,000,000, were to these four countries. Of these exports, £50,000,000 were of domestic produce, or five-eighths of our exports of such produce to all Europe, while £38,000,000 were of foreign and colonial produce, or four-fifths of our exports of foreign and colonial produce to all Europe. Of our distributing trade, by far the greater portion is therefore carried on with our nearest Continental neighbours, with whom also we transact a transhipment business represented by £8,000,000 out of £9,500,000 worth of goods imported for transhipment from all Europe; and of exports valued at £2,000,000 out of £2,800,000 exported after transhipment to the whole of Europe.

58. Of the bullion trade nearly the whole imports and the great bulk of the exports are from and to these countries, with which our total annual trade, including imports, exports, transhipment trade, and bullion, amount in round numbers to £200,000,000 or £100,000,000 each way, out of £300,000,000 or £150,000,000 each way, our total of trade with all Europe.

59. Of the trade between the continent of Europe and the United States nearly the whole belongs to these four countries, the total trade of which with the United Kingdom and the United States may, Mr. Giffen considers, be taken at £300,000,000 or £150,000,000 each way, exclusive of traffic in securities and passengers.

60. The shipping statistics relating to the trade between the United Kingdom and the same group of European countries show that about four-sevenths of the total tonnage, including entrances and clearances to and from all Europe, belong to Germany, Holland, Belgium and France.

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61. The above figures establish conclusively—

(i.) That the volume of the traffic at present passing across the seas which separate the British Isles from the continent of Europe, and consequently liable to be affected by the existence of a Channel tunnel, is enormous.

(ii.) That a very large proportion of that traffic is between the United Kingdom and those four countries (Germany, Holland, France and Belgium), our trade with which would presumably be most liable to be so affected.

62. In the face of these facts it may be predicted with confidence that any improvement in the routes followed by so vast a body of trade cannot

fail to have far-reaching results in the development of existing traffic and in the creation of new.

63. This view is justified, not only by our knowledge that such an expansion invariably follows upon the improvement of trade communications, but by a consideration of the conditions under which, in the case of the Channel tunnel, the new route would compete with those already in existence.

64. In this competition the tunnel route would have the advantage which must always belong to through carriage by railway over carriage partly by land and partly by sea, with the inseparable inconveniences of transhipment, break of bulk, and terminal expenses. Those advantages, however, which must in all cases be considerable, can never be so great as in a case in which, as in that now before us, the mixed route is one of which the sea portion is short and the railway portion long in proportion to the whole length of the distance traversed. In the case of a mixed route, where the converse is true, that is, where the longer portion is by sea and the shorter by rail, the cheapness of the water carriage over the longer distance affords some compensation for the expense and inconvenience of transhipment, &c., at each end. Where, on the other hand, as in the case of the conveyance of goods from an inland manufacturing town in England to their destination on the Continent, of the total distance traversed only a small part is by sea, no such compensation is forthcoming. It follows that the removal of the necessity for transhipment, &c., is relatively far more advantageous in the latter than in the former case, and should, in the latter case, have the effect of enabling the relieved route to compete upon favourable terms, not only with those routes with which it was able to compete successfully before, but with other routes extending over a much larger area.

65. The relief of the Channel route from the hindrances which, as we have said, operate so disadvantageously to the commerce which makes use of it, is likely to have this result.

66. In this view we have to take into account the extent of that traffic which Mr. Giffen appropriately describes as the "short ferry traffic" between England and the Continent, in the case of which, owing to the shortness of the distance between the English and the Continental ports, the expense of transhipment and break of bulk are not compensated by cheap conveyance over a long mileage by sea.

67. The amount of this traffic is shown in tables which Mr. Giffen has prepared with the object of illustrating the trade between France, Germany, Belgium, and Holland on the one side, and the ports of London, Harwich, Rochester, Dover, Folkestone, Newhaven, Littlehampton, Southampton, and Weymouth.

68. We find that of the total imports to the United Kingdom from those countries, £72,500,000, or about three-quarters, are to these ports.

69. Of the total exports to the United Kingdom from these four countries £48,500,000, or one-half, are from these ports. Of these exports £16,000,000 represent British and Irish, and £32,500,000 foreign and colonial products, out of a total of £38,000,000 of foreign and colonial products exported to the four countries. The shipping movements of these ports with the four countries show entries to the extent of nearly 4,000,000 tons, and clearances to the extent of 3,000,000 tons.

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71. Of the trade shown by the above figures as following the short ferry route across the Channel, there is every reason for expecting that a large share would pass through the tunnel. In all cases except the comparatively insignificant number where the destination of the goods happened to be in seaports at which they were landed, two transhipments would be avoided, and, as we have already pointed out, the shortness of the present water transit offers no compensation for its expense and inconvenience. It is remarkable that of the wool now sent from London to France about half is at present carried by rail from London to the Channel ports.

72. We desire to insist particularly upon the importance in the interests of the large depôt trade carried on by this country of neglecting no opportunity which may present itself for the improvement of our trade communications. The figures which we have given show how large a part of the foreign and colonial produce which we import is re-exported to Germany, Holland, Belgium, and France, and that of this a large part follows the short sea route. The evidence which we have received shows that this trade is threatened by the increase of business at places like Antwerp, Havre, and Rotterdam, which are able to receive and distribute directly goods destined to the Continent. The fact that the chief manufacturing places on the Continent with which our business in the distribution of raw material is carried on are situated inland, would render it possible for direct railway carriage from this country to compete under favourable conditions with railway carriage between the same places and the Continental ports.

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Extracts from Evidence given before the Joint Select Committee appointed to enquire into the Channel Tunnel, 1883.

MR. HENRY OAKLEY.

1st May, 1883.

832. *Chairman:* You are general manager of the Great Northern Railway, are you not?—I am.

833. How long have you held that office?—Rather more than twelve years.

834. I believe you have considered the question of this contemplated Channel tunnel in its working and commercial features?—I have limited myself to those points.

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843. Assuming that communication of this kind were established, do you believe that there would be a great expansion of passenger traffic?—Yes; I cannot help thinking so, when I reflect upon the certainty that would be gained, and the improved speed, and absence of discomfort; of course, the fare must govern it largely, but, taking all the elements that make travelling bearable, the tunnel route would have the preference; and, assuming that the rates that are to be charged are such as not to deter travelling, I have no doubt that the passenger traffic would largely increase.

844. Would you say that it might increase to an almost indefinite extent?—It is very difficult to come to any conclusion upon that point, but, looking at the fact that we have the whole of England and Scotland upon the one side and the whole Continent of Europe upon the other, the number of passengers travelling between them is extremely limited, 465,000—call it 500,000—a year. I should think that number would be trebled very rapidly; within, probably a year, or a year and a half, you might see that number trebled; after that it would depend very much upon the facilities given; it would depend very much upon how the passengers were treated by the Custom house officers, and what the general arrangements were, whether this route becomes popular or not; but, given reasonable efforts to make the route popular and reasonable fares, I cannot help thinking that numbers of Englishmen would go abroad and foreigners come to see us that have hitherto not come, owing to the sea route, or any other circumstances, fearing the difficulties of transit.

845. Does your railway experience lead you to believe that increased facilities of communication are invariably followed by expansion of traffic?—Increased facilities of communication, with reduction of fares, have had a wonderful effect upon the traffic of this country in the last five or six years past, but it has been in the direction of increasing the number of third-class passengers; in fact, those who can travel at the cheapest fare. The numbers of first and second-class passengers have been reduced, but on the aggregate, and excluding the urban passengers—that is, passengers going within 10 or 12 miles of London—there has been a steady increase of about one or two per cent. in the last five years, but not more, in consequence of the falling off in the number of first-class; the increase in the third-class has made good the loss on the first and second.

846. In this case you might reckon not only upon the persons who have been deterred by the cost of travelling, but only upon the persons who were deterred by certain inconveniences which most of us have experienced in crossing the sea?—Yes; I think that many people will not cross the sea if they can help it; but, of course, much of the travelling must depend upon the expansion of trade. If the merchants in Paris, or London, or Glasgow, or Edinburgh can find that they can get readily to or from Paris without the physical discomforts that they now suffer, I think they would go more often.

847. There would be much more travelling, not only for pleasure, but for business, you think?—Yes; I think it would promote intercommunication between the two peoples.

848. In short, upon that point, you have no manner of doubt that a great expansion would follow?—I may say that I have no manner of doubt that a great expansion would follow. It is prophesying, and no man is wise to prophesy, if he can avoid it; but that is the result of my experience, I may fairly say.

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850. Do you say that of only a limited class of goods?—I do not think that we could reasonably expect that heavy classes of goods that are not manufactured or produced near the coast would be sent through the tunnel; I think the railway charges upon either side would be much in excess of the rates now charged by sea; but for all light or valuable goods, such as silk, Bradford yarns and Yorkshire yarns, which now go to some extent by rail and sea, though they go more largely by sea, the tunnel would be of great use. I do not think you would get heavy machinery, nor raw material, but you would get the lighter machinery, and you would get probably a share of the yarns, and you would get probably a share of the tea, but still the certainty of a through service induces a merchant to send by rail, even at a

slightly advanced cost, rather than by sea. We know that in the case of Yorkshire, the Yorkshire wool is carried from London by sea at a less rate than we carry it by railway; but still the rail gets a very large proportion of it, and what held good in that case should, and I think would, hold good in this.

851. You have been good enough to hand me a memorandum in which I see you refer to the following commodities as likely to go through the tunnel; eggs, fish, fruit, hops, fresh meat, new potatoes, poultry, vegetables, works of art, books, china, clocks, articles of dress, and lace, glass, manufactured leather, boots and shoes, musical instruments, pictures, manufactured silk, and probably a portion of spirits, refined sugar, and other French productions? —Yes; not being very conversant with the details of the French trade, I studied a book published by the Customs to see what the exports were, and what their relative quantities were, so as to be able to form some idea of the trade between the two countries; and knowing generally the way in which these several articles are packed and their class, and the necessity of keeping them all in the best condition, I have not a doubt that within anything like a reasonable distance of a tunnel route, the bulk of these goods would come by tunnel; but, on the other hand, heavy articles would not, unless their place of origination was so reasonably convenient to the tunnel that they could send them as well or better that way than any other.

852. That list would include the principal imports to England, and you give as the probable exports through the tunnel some portion of the manufactured linen, cotton, and woollen goods, the lighter or special articles of machinery, steel goods, and a share of the colonial goods imported into London?—Yes, I think that that would fairly represent my opinion of the probable classes of goods that would be carried.

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856. *Chairman:* Have you formed any estimate in your mind of the probable charge per passenger?—I have formed an estimate; I suppose that a first-class passenger could be carried over for 3*d.* per mile; that would amount to 7*s.* 6*d.*; a second-class passenger I put at 5*s.*, and a third-class passenger I put at 3*s.* 6*d.*; I think that those would fairly represent the proportion of the rates that might be assigned to the tunnel.

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860. You do not think, do you, that traffic which now comes to Liverpool would be more likely to remain at Liverpool if it could pass from Liverpool to the Continent without break of bulk?—No. Do I understand you mean without break of bulk in the steamer?

861. I am assuming that the improvements of some of the Continental

harbours might be likely to tempt traffic away from our ports?—Possibly, but they could do it as effectually without as with this tunnel.

862. Then you do not think it would be an inducement to importers to continue importation to Liverpool, that their goods would be carried from Liverpool to the Continent without the risk of transhipment?—I think it would rather have a tendency, in that view, to increase our trade.

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869. *Lord Shute:* I think I gathered from you that the great increase in the traffic would be in passengers and not in goods?—I think you may certainly rely upon an increase in passengers, and I should think on an increase in goods, for I cannot help thinking that the facility which insures certainty of good condition, punctual delivery, and speed must promote trade between the two countries.

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928. Why do you draw a distinction between light machinery and heavy machinery in estimating what class of machinery would pass through the tunnel? I understood you to say that the lighter machinery would pass, but the heavier machinery not, unless it was in proximity to the tunnel?—Because the lighter machinery is more valuable in proportion to its weight; the heavy machinery, being of a bulky form, goes without mischief, practically, to itself, therefore it would go better by sea than by rail, and more cheaply.

929. In what category would you class such goods as Howard's ploughs and heavy reaping-machines?—Agricultural machinery is of a light character in proportion to its bulk, and should and would go by rail.

930. You think that they would go through the tunnel?—I think they would go through the tunnel. All machines of that class, light in proportion to their bulk, or which are in themselves light and liable to damage, would go through the tunnel; that is, assuming they were within a reasonable distance.

931. Then you think that, as a rule, raw material would not pass through the tunnel?—I think not.

932. It would be the low value of the raw material that would be the governing cause?—Low value in proportion to its bulk.

933. You would not like to say, if another communication was opened under the sea, that it would not be possible at some time, and under some stress of circumstances, that a large mass of raw material would pass into this country through the tunnel?—No, if it can be carried at cheap rates; it is the rate which decides the transit of unmanufactured material.

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953. You spoke of an increase in the course of one year, and said that possibly three times as many passengers as at present would travel?—Yes, I should be much disappointed if facilities, a reasonable fare, and good service did not attain that.

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Mr. Bernhard Samuelson, M.P.

1st May, 1883.

1025. *Chairman:* May we understand that you have given some consideration to the proposal to establish a submarine communication with the other side of the Channel?—Yes, as one of the public.

1026. And as one of the public you have paid a good deal of attention, have you not, to the commercial interests of this country?—Yes.

1027. Are you prepared to give us the benefit of your opinion as to the extent to which a tunnel, such as that in contemplation, would be made use of for the purpose of carrying goods traffic?—I believe that it would lead to a very great increase of goods traffic.

1028. Do you say that of any particular class of goods traffic?—No, it may be said of goods traffic generally.

1029. The witnesses whom we have examined in this room have, most of them, laid particular stress upon the importance of the tunnel to certain categories of goods; notably perishable goods and fragile goods, and also to other goods in the case of which punctual delivery was of great moment; should you be inclined to concur in that view?—Yes; to a very great extent, and if you include amongst fragile goods, goods which require to be carefully packed; if the mode of transport has to be changed more than once, then, I think, the tunnel would be of very great importance; and I can give the Committee an instance of that. I was in Belgium at the end of last year, and I visited a large woollen and worsted mill in the neighbourhood of Brussels. I saw there a quantity of spinning machinery from Alsace, and I asked whether that machinery was superior to that which could be got from England, and they said "No, we do not think that for an instant, but it is very much more convenient, and very much cheaper, for us to get machinery from the Alsace manufacturers, because it is put into trucks there, and delivered in trucks at our door without any packing; and if we get our machinery from Oldham, or any part of Lancashire or Yorkshire, it requires to be very carefully packed, and that adds very much to the expense." I give that as an instance, and no doubt those acquainted with traffic of this kind can give many more instances of the same nature.

1030. Did your informant lead you to suppose that, but for these obstacles, he would prefer the English-made machinery?—Yes, decidedly. I do not mean to say that he was not satisfied with what he was getting from Alsace, because much depends in factories upon having at least very good machinery, but there was just enough to cause the balance to descend in favour of the Alsace machinery.

1031. Can you give us illustrations of any other class of goods traffic?—No, I am not prepared to do so; I am so convinced that this same thing would apply to others that I have not thought it necessary to inquire into the matter. I have no doubt that the same would be the case with regard to agricultural machinery.

1032. We may take it that such goods as raw material and heavy goods generally would most likely continue to be carried by sea?—Yes; there can be no doubt whatever about that; for instance, take pig-iron, from Middlesbrough; where my blast furnaces are, to the collieries, the freight is only 8*s.* all the way; it would be impossible to carry it by rail to Dover and then from Dover to Calais.

1033. We have heard it said in this room that the opening of the Channel tunnel might deal a very serious blow to the shipping carrying trade of this country; is that your opinion?—No, I do not think so at all.

1034. For the reason, I suppose, that the heavy goods, such as those to which you have referred, will continue to go by the sea route?—There is no doubt, I think, about that; you would never think of sending a bale of goods from Leeds to Hamburg by way of Dover and Calais, for instance.

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1039. Are you able to give any idea of the radius within which the attractions offered by the tunnel would operate; I am speaking now of goods traffic?—No; I think it is very difficult to form any estimate of that, because you cannot say beforehand what would be the nature of the meat trade which it would create, but we do know this: we know that fruit and vegetables, and perishable articles of all kinds, are now being sent from Italy all over Germany; if you walk about the streets of Berlin you will find in every direction strawberries, and you will find all sorts of foreign fruit, in shops only of a very poor character, and there has been an enormous development of trade of that description. I have no doubt that, although we get butter from the neighbourhood of Milan, and some vegetables and fruit and flowers from the South of France, that that is a trade which would increase very much indeed, but I look more to a very great increase in the staple trades than in those secondary and subsidiary trades.

1040. But in the case of those articles which you were mentioning just now, are they admitted on advantageous terms with regard to the tariff to Germany?—There is some duty upon them.

1041. Therefore, the development of trade in this country, presumably, would be greater where we have fewer tariffs to deal with?—Yes, and I think we are better traders, and are more ready to take advantage of any new openings than people on the Continent.

1042. You look not only to the possibility of the tunnel attracting to itself a certain amount of the existing trade, but to its positively creating new trade between England and the Continent?—I think it would.

1043. Is that an opinion which you have found generally expressed by persons having a large interest in the commercial prosperity of this country? —In this country it is; abroad, as I have stated before, I have rather avoided talking to people about it for the reason I gave. I did not like to talk about it, they thinking it an absurdity that we should have this scare in England.

1044. *Lord Aberdare:* The instance which you gave where the obstruction to the use of English machinery was offered by the sea was the one where you said that the additional cost of package was the reason why preference was given to Alsace over England?—Yes.

1045. Are there many sorts of goods where the cost of package is greater in consequence of the sea passage than it would be simply when it is intended for a railway journey?—There must be a very considerable amount of traffic of that kind which is affected.

1046. Was this machinery sent from Alsace without any sort of protection whatever?—So I was told; it was the case of mules for spinning wool on the soft system, of which no doubt you have heard, by which Bradford is being so much affected at present.

1047. Do you think that it could be sent from Oldham to a town in Belgium without any protection?—Yes, if it had been carefully haybanded, or had a protection of some sort; the package of these large things is very expensive indeed.

1048. It was not on account of any increased cost of carriage due to the fact of its having to be moved in and out of a ship?—No doubt that might contribute to some degree, but there are now arrangements made for conveying traffic where the steamship companies and the railway companies join, which reduce the carriage a good deal.

1049. *Mr. Baxter:* Is it your opinion as a man very intimately acquainted with the trade, both with this country and certain countries on the Continent, that the construction of the Channel tunnel would be a positive benefit to us instead of actual danger?—The danger is a separate question; it is one upon which I can only form the same judgment as anyone else; but even as regards that I should say that if we have skill to make the tunnel, we have skill to destroy it in case of need.

1050. You have no doubt that it would add materially to the trade of this country?—I have no doubt about it.

1051. Looking at this country as the greatest *entrepôt* in the world, do you concur with those who say that, in order to preserve our commercial importance in that respect, it is very desirable that we should have communication of this kind with the Continent of Europe?—Yes, very desirable; competition with the Continental ports is becoming more severe every year; a very little thing turns the scale at the present day.

1052. Do you think that the construction of this tunnel would enable us to hold our own?—It would contribute to enable us to hold our own. I do not think you should exaggerate the consequence of any one element in a question of this kind, but we must take account of every one of those elements if we want to hold the position that we hold now, if not to improve it.

1053. You attach very great importance, as I understand, to sending goods without breaking bulk?—Yes, in certain cases without being obliged to pack them.

1054. Does that hold with regard to agricultural machinery with which you have special acquaintance?—Yes, it would do so to a great extent.

1055. How is agricultural machinery such as you just now mentioned sent to the Continent now?—It varies very much according to the countries to which we send it, and whether it has to be sent far inland afterwards; there are a number of conditions to be taken into account; but we export machinery largely to France, and to France, I have no doubt, it would be a great advantage if we could put the machinery into trucks at our own works, and deliver them at any point in France.

1056. Do you think that a large proportion of your machines, if not the bulk of them, would be sent through the tunnel?—Decidedly, because they are very often ordered only a few days before they are wanted, and expedition is of great consequence; I know it to be the case for this reason, that where there is a cheaper route, for instance, from Southampton to Havre, our things are very often ordered to go by Dover and Calais, even if they are intended for Normandy.

1057. Merchants look greatly to celerity and certainty of delivery?—Yes.

1058. Is it, in your opinion, very important that we should have a tunnel through which, under these circumstances, goods should be sent to the Continent ?—Yes, but I look for a general increase all along the line; it is almost impossible to foresee precisely where we shall get the benefit, but I think we shall get it everywhere.

1059. *Mr. Arthur Peel:* Mr. Oakley drew a distinction between heavy machinery and light machinery; under which category would the machinery that you speak of, the Alsace mule spinning machinery, come?—As light machinery; that is, light as compared with its bulk.

1060. What is your opinion as regards heavy machinery sent from Yorkshire or Lancashire; steam engines, for instance; would they go through the tunnel?—No; they would go the cheapest way.

1061. Would that be excluded from the tunnel?—It depends upon what the rates are.

1062. What is your opinion as to the transit of raw material through the tunnel?—I do not think that that would be much.

1063. When you say it would not be much, you mean in ordinary times it would not be much?—In ordinary times.

1064. But you can conceive times when it would be convenient to have the other means of communication open for the accommodation of the raw material? Yes, I said so in answer to the noble Chairman. As to cotton, we might again suffer from a cotton famine; even such an article as hemp from India may be landed at Marseilles and be brought to this country through the tunnel under stress of circumstances.

1065. That would apply to other raw material, would it not?—Yes, raw material of every kind; when you must have a thing you are prepared to pay anything for it rather than go without it.

1066. *Sir Massey Lopes:* I think there is no machinery imported from Alsace into this country, is there?—No.

1067. And you are impressed with the idea that machinery from this country would be more used, and there would be a great demand for it in the event of the tunnel being made?—Yes, I think so.

1068. In what way do you think that there will be a great increase in goods traffic by this tunnel; you admitted, to a certain extent, that all heavy traffic would still go by steamer, as now?—Yes.

1069. What sort of increase would there be in the goods traffic of this kind?—It is very difficult to specify, but I think the tendency of increased communication between the people of the Continent and ourselves will be to very greatly increase the volume of traffic, and those goods which naturally go by the short route will go by the tunnel.

1070. *Sir Henry Hussey Vivian:* Is it the case that the transactions between France and Germany or France and Italy are larger than those between France and England?—No, I think not; but these things change from day to day.

1071. But they are in direct railway communication, are they not?—Yes.

1072. There is no silver streak between them?—No.

1073. Is there any such difference that you would assume that this country would supplant either Germany or Italy or Spain in the delivery of goods to France?—No; I do not suppose so for a moment. For instance, one of the great articles of trade between Italy and France at this moment is wine; the coarse wines of Italy are sent to France, and come to us after certain processes as claret. I do not suppose we should ever send wine to France because we had the tunnel.

1074. Are there any other goods which you think this country would send to the Continent which are either not sent at all or as to which we suffer a disadvantage from not having direct railway communication?—I think our general trade with France would increase very much, quite irrespective of what the trade would be between France and any other country.

1075. But you cannot specify any particular article which suffers from the present condition of the transit?—Every article suffers which is not carried to the same extent as it would be if the communication were easy and convenient.

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MR. HENRY LEE, M.P.

3rd May, 1883.

1099. *Lord Aberdare*: You are Member for Southampton, I believe?—Yes.

1100. Do you appear here as an individual who has taken an interest in this subject or as representing any body?—I only appear as an individual; I represent no body.

1101. Will you be good enough to give us your views on the question of the importance of this tunnel as a means of communication with the Continent?—In the first place, it will reduce the time of transit of goods. At present by the Grande Vitesse the time from Manchester to Paris is from 5 to 7 days; by the Petite Vitesse it is 14 to 20 days.

1102. For what classes of goods?—For the goods sent usually from Manchester. I am a manufacturer of fancy cotton goods, and we have a house in Paris, and are in the habit of communicating constantly with Paris; we have an agent there, and, indeed, we have a number of men constantly stationed there; we send goods to Paris every week.

1103. To what cause do you attribute the apparent slowness in the delivery of those goods?—It is because they have to be transhipped. At present we are sending goods from London by steamer to Boulogne; we send them first to London, then they are re-shipped by steamer to Boulogne.

1104. Does any delay take place in London in the first shipment?—No doubt, there is great delay; there always is in the carriage of goods.

1105. Where do you think the chief delay arises?—I should think it arises at the terminus. The goods have to be transhipped twice, and if there was a tunnel, they would only need to be shipped once, and go right through.

1106. Do you think that goods would go any faster if sent to Dover or Folkestone, and shipped from there, instead of being shipped at London?—I do not think they would be, because it would take time; but it depends very much upon the weather.

1107. Are your goods sent in sufficient quantities to load a separate waggon, or are they in the form of parcels?—It depends upon circumstances; sometimes we send them in large quantities, and load many waggons, sometimes only a few. Our goods are rather expensive goods, and do not go in great bulk.

1108. In what time do you expect you would be able to get them delivered, supposing the tunnel were made?—That I am not competent to give an opinion upon; but I should say it would save certainly two or three days, and we should not then be troubled with the slow rate of passage; and then the cost of transit would be reduced.

1109. Do you think that there would be much difference in the cost?—I do not know what the difference in cost would be, but no doubt there would be a considerable difference in the cost, because there would be only one terminal charge instead of two; then the competition would bring down the price; that is another element which we have to consider.

1110. On the other hand, we had it stated by the supporters of one of these schemes that the cost would be £8,000,000, and in order to make a proper return upon £8,000,000, the charges could hardly be very low?—That is a matter for the shareholders and those who invest their money; I am looking at it, not as a shareholder, but as a trader.

1111. Do you think that the price would practically be determined by the competition by sea?—No doubt by competition partly, and by the reduced cost of transit; there would be a reduced cost.

1112. Are all the articles you send articles that you would prefer sending direct by train, apart from the question of time?—Certainly; the less they are handled the more safely they get to their destination; sometimes we have to send them in bales. The French are not quite so difficult as they were to deal with; but some time ago we sent a large bale of prints there, and we had not declared the hoops which bound the bale; they took all the hoops off and sent the bale on to Paris without the hoops, and when they got there the goods were in a very tumbled condition; that does not occur now, because we have made an arrangement with the French Custom-house by which they do not take off hoops.

1113. Is your method of packing more expensive in consequence of this transhipment than it would be if you sent them direct by train?—No doubt; we have to pack them in stronger boxes; the more they are handled the more they are liable to be injured.

1114. Apart from this question of taking away the hoops, have you ever had goods injured by the mere act of transhipment?—That I cannot say. We have had goods that have been received in a very bad condition, but whether it was in consequence of the transhipment I cannot say. It was in consequence of handling, no doubt; where the handling took place we cannot tell, but the more they are handled the less likely they are to get to their place of destination safely.

1115. Have those injuries happened frequently?—I cannot say that.

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1118. Are you acquainted with other goods besides your own, which, in your opinion, would benefit by a continuous railway passage to an interrupted passage by sea?—As a general observation, I should say that every merchant, no matter what goods he deals in, would deem it a very great advantage to have a direct communication with France.

1119. That is with respect to manufactured goods?—With respect to manufactured goods, because England is a great depôt, and England is now becoming more and more, in consequence of our free-trade policy, the place where goods come to from all the world, and therefore we receive goods here, warehouse them, and then sell them to other countries.

1120. Do you think that the question of our being the depôt of the world would be at all affected by the making of this railway?—I think so; I think it would lead to persons sending their goods to our country instead of sending them direct to other countries.

1121. Have you no fear of a different result, and of our position as a depôt of trade in general being injuriously affected by the tunnel, if constructed?—Not the slightest; I think quite the other way; the easier we make it for goods to reach the Continent from our shores the more it would be to our advantage.

1122. We have had evidence that with the increased facilities for steam navigation, there has been a steady and large increase of communication between the Continent and this country : do you think that by the creation of a Channel tunnel there would be a very large and rapid increase in such communication ?—With regard to its being rapid, that, I think, is merely a question of opinion, but I have no doubt that ultimately it would increase the traffic very greatly.

1123. One witness, on the last occasion, I think the manager of the Great Northern Railway, stated that, in his opinion, in the course of a year or two the number of passengers coming from the Continent to this country would be trebled; do you think that an extravagant estimate?—I do not think it is, because England is the place that all Americans come to first, then they travel from England to the Continent, and go straight through, and the easier we can make the communication with the Continent, I think the more likely is the numbers of the passengers to increase.

1124. But do not you think that, in order to get any great increase of passengers, we must depend upon other nations than the Americans ?—Yes, we get Australians now; and every year adds to the number of those who approach our shores from all our own Colonies.

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1126. Apart from the steady, and what may be called the natural increase of the movement between England and the Continent by shipping, the main increase, if this large increase takes place, would be due to the increased comfort, safety, and facility of the journey by the Channel tunnel ?—No doubt of it.

1127. Do you think that that great increase, if these hypotheses are well founded, can take place, without a great increase of commercial intercourse between the countries?—I think that the commercial intercourse will be very greatly increased. A very large amount of our business in Manchester, of which I speak especially, has been conducted through middlemen; we, as a nation, have not done our own business; we have employed a large number of Germans and others to do it for us, because they have been connected with the Continent. I have no doubt it would tend greatly to do away with the middlemen, and in doing that it would, of course, render it possible for us to bring our goods more directly to our customers than now.

1128. Do you think that your goods would go by railway beyond France into Germany and Italy?—Yes, they do now go into Germany and Italy;

there is not a country in the world where we have not agents, and have not communications.

1129. I am speaking of a route through France by means of the tunnel?—No doubt they would get to Italy through France and Germany; no doubt the difficulties in respect of the tariff at the present time are very great.

1130. You mention Italy; do you think that in the case of the transmission of goods to Italy, the route by railway through the tunnel would be preferred to a sea voyage to Genoa, or Civita Vecchia, or Leghorn?—No doubt it would. I have no doubt that it would be quicker, and the goods would be less handled.

1131. Are you of opinion that speed often compensates for a certain addition of cost?—It does in the case of certain articles; those are, of course, perishable articles.

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1135. You make your calculations accordingly?—Yes, we make our calculations accordingly. We have everything to gain and nothing to lose by a free intercourse with France; that is my decided opinion. With regard to the reduction of cost, it must be very considerable; supposing that upon the £70,000,000 sterling which passes between the two countries, imports and exports together, one-half per cent. is gained, it makes £350,000 a year, and I should think the gain would be more than one-half per cent.

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1150. *Sir Henry Hussey Vivian:* Is the amount of Manchester fancy goods that goes to France large?—It is not very large; I think that we send more than anyone else, but it is an increasing trade; we send more than any other firm, I should think, of the class of goods that we send.

1151. Is it an important trade, upon the whole?—It is an important trade.

1152. Are you aware what it amounts to?—I do not know what the whole trade amounts to; I know what we send ourselves; it is considerable.

1153. And you think that it would be largely increased by the construction of the tunnel?—I think so, and besides that, I think that the construction of the tunnel, and the freer intercourse between the two countries, will lead to a considerable modification of the tariff, and ultimately that modification will undoubtedly be to our advantage.

1154. You are not afraid that it would be an argument in the mouths of the manufacturers of France, that the greater facilities of delivery ought to cause a higher protective duty to be imposed?—No; I think they have done their best in the last two years in that respect, and I think they cannot go any further than they have gone. I think every modification now will be in our favour.

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1176. Do you think the shipping interest would be affected at all?—I think it is very likely that if the Tunnel Railway was successful in carrying at a low rate of freight, the shipping interest might be affected; wherever there is competition something must go to the wall; it appears to me that the more readily we can communicate with the Continent from this country the better it will be for us, because, as I said before, as we are the great depôt, people from all countries can send goods to England without payment of duty; they can be warehoused here, and it is a sort of great shop or stock place, and people from the Continent can get the goods from this country, and if you would make a free communication, and render it easier to get the goods, and they can get them quickly, it must be an advantage. A large amount of business is done now by telegraph; we continually do business by telegraph; we have a telegram from New York in the morning for 20 cases of goods perhaps; they are sent off at night, and they are in New York in ten days; we get telegrams from India continually for goods, and those goods are packed and sent off the very same day upon which we get the telegram; that is a very considerable advantage, and a saving in two or three days is very considerable.

1177. You do not make that answer from the point of view of the carriers, that is to say, the shipping interest?—No, I am looking at it as a manufacturer and as a merchant; I did not come here to do anything else but to speak as a merchant and trader.

1178. You said, I think, that speed would compensate for the greater cost only as regards a certain class of goods?—My impression is that when the tunnel is made the cost would be reduced, and there is no doubt that upon a certain class of goods it would be diminished; for instance, vegetables would come from the Continent much more readily. Now there is one thing which we receive there continually. I was surprised the other day to find that in Manchester a very large number of flowers came from the Continent; a very considerable quantity indeed, and they are purchased in the Manchester market. You can go twice in the day, and find there large quantities of flowers that come from France; it may be a very small thing in itself, but it illustrates the fact that the quicker the transit the more likely you are to get the goods in merchantable condition, and no doubt when they are delayed that delay does injure perishable goods. I do not say that it would be beneficial to our own particular trade, except that our customers would be able to depend upon the goods coming at a certain time, and we should be able to make our arrangements more perfectly.

1179. I suppose you could not tell us at all what you consider the relative worth of heavy and fragile goods that would be likely to be carried?—It is a question of weight very much; light goods are more valuable per yard than heavy goods; goods that are worth perhaps to the manufacturer 4*d.* a yard would be very heavy; and goods that are worth 1*s.* a yard would be very light, because they are made of much finer material.

1180. Should you look to these goods being taken through to the Continent on the same trucks as they were packed in in England?—I do not see why not; it would be a matter of arrangement with the railways.

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MR. JOHN SLAGG.

3rd May, 1883.

1287. *Chairman:* You represent the constituency of Manchester, I believe, and you are President of the Manchester Chamber of Commerce?—I represent the city of Manchester, and I am ex-President of the Chamber of Commerce. I was President two years ago.

1288. The Committee is anxious to obtain the opinion of gentlemen like yourself as to the extent to which the Channel tunnel, if opened, would be made use of by merchants and manufacturers; are you able to make any statement to the Committee upon that point?—I am of opinion that the tunnel would be of great advantage to the trade of the country, inasmuch as the increased facilities of export provided by it would, probably, and I should think necessarily have the effect of decreasing the cost of transport; and the question of carriage is a very important one in relation to our trade with the Continent. Of course there are important military advantages which are to be kept in mind with reference to our insular position, but certainly the trading advantages are not so very great from it, for we suffer from the cost of transhipment in our trade to the Continent very greatly, and I should think that any argument that applies against the creation of the tunnel would apply with equal force to increased harbour accommodation, or increased facilities of communication by steamer, or any other improved process of transport. We do now only a comparatively small trade with the Continent. One reason, I think, is that the inter-communication of the peoples is not very great. The French and other Continental peoples seem to shrink from the formidable nature of the voyage, and I really believe that if we had a tunnel between the two countries it would not only constitute a communication between England and France, but between England and the whole of the Continent.

1289. Before you leave that point, may we understand that what you mean is that foreign customers would come over here and would see with their own eyes what English commodities were in the market and would do a business much more extensive than that which is done through agents?—I quite believe they would; and the effect of a large influx of foreign visitors into England, and the facilities they would have of observing our prices, and comparing them with the high rates which their protective business imposes in their respective countries, would create a feeling of discontent in the minds of customers and consumers there, which would hasten a more liberal commercial policy in continental states. Of course the more we cheapen our commodities to them, the more likely they are to become commercial rivals with us; but there are a great many classes of goods, the products of my own districts, especially heavy goods, which we seem better fitted to make in England than Continental countries are; and we might stimulate the trade in those. Of course we should never hope to compete successfully with the French, for instance, in commodities which they can make cheaper and better than ourselves; commodities, in fact, which we already import from them; but there are many things which we can sell to them at a very great advantage to ourselves in a largely increased degree, and I am firmly convinced that the French have only to come over and see what we do, and compare our prices with theirs, in order to make them very much dissatisfied with their position. I think those who visit France very frequently, as I do, cannot help being impressed with the enormous cost of every article used; the smallest thing, dress trimmings, or any article of apparel, or of daily consumption, is so extravagantly dear, compared with English prices, that the French would not be content to remain in the same state if they had an opportunity of seeing what we are doing.

1290. A witness who was in this room two days ago, mentioned the fact that within his knowledge certain classes of machinery used in France are purchased by the French manufacturers from Germany, rather than from this country, in consequence solely of the heavy cost attending the transit of the machinery from England to France; do you agree with that?—Yes, I quite agree with that opinion. The cost of packing machinery, which is a very profitable and a very large trade with us, from England for transit, and transhipment from steamer to rail backwards and forwards, is infinitely more expensive than it would be if simply put upon the railway cars and sent direct to its destination, and there is no doubt that the element of extra cost in packing does weigh very seriously in the selection of a market by Continental consumers of machinery, and for that very reason, I think that our trade in machinery, which is a very important one, would be greatly stimulated by not only a cheap and quick carriage, but also by economical packing.

1291. Do you think it would pay the English exporter to submit to higher rates in consideration of the diminished cost of packing and the diminished risk to his goods?—To a certain extent it might be the case; but I look to this new Channel communication to very much decrease the cost, and I should hope it would do that; but, assuming the cost to be the same by the tunnel as by ship and railway, I think the manufacturer would certainly give the preference in many cases to the tunnel, and it would pay him very well to do so.

1292. Would there be any gain also in respect of insurance?—Yes, I should think that there would be; there would certainly not be the marine risk.

1293. I think it has been stated to us (I will not undertake to remember the exact figures) that, assuming 5*s*. a ton was the present cost of sending goods across the Channel, the exporters would not be very sorry to pay 7*s*. or 8*s*. if they could make use of railway carriage instead of sea carriage?—The trouble and delay and altogether the cumbersome matters that surround the debarkation of goods and the transfer are so great, and the agencies and commissions involved in all those processes are of such an onerous nature, that it might pay merchants to give a little more for railway communication; how much it would be difficult to calculate.

1294. All those considerations, I presume, would apply much more in particular classes of goods than in the case of others?—Yes, undoubtedly they would.

1295. Would you tell us what classes of goods they would apply to most strongly?—Both imports and exports. I should instance machinery as a typical case of trade which would be benefited by a tunnel traffic; and fragile articles of any sort; pottery ware and things of that sort; anything liable to suffer from transhipment. Then, so far as our works are concerned, from the Continent we do a very large business in Belgian plate-glass; in fact, I am sorry to say the Belgians appear to be able to produce this article at a cheaper rate than we can produce it in England; and as our consumer is the sole person considered in our fiscal policy, we must not deplore it, as we get the article on the cheapest possible terms; therefore the Belgian glass would come to us, and similar fragile things on the Continent, on much cheaper terms to our consumers, and be more advantageous to the general commerce of the two countries. Then, a matter which is not of so much importance, though comparatively a large business, in fruits and vegetables, early dainties of the garden, and so on, would come here cheaper and better.

1296. Would you add to those all goods in respect of which punctuality and rapid delivery was a consideration?—Certainly.

1297. I have heard it said that in the case of goods carried from an English inland town to an inland Continental town there are two transhipments and four sets of railway terminal charges, and it is put to me in this way, that if we had through traffic under the sea, across the Channel, for those four terminal charges and two transhipments you would substitute two terminal charges and no more; does that strike you as an accurate statement? —You are making a comparison between the existing railway communication and what would probably be developed in the future. I think many of the barbarisms—and you can apply no other term to them—of the French railway system would subside under the exigencies of a through tariff. The French railway traffic is not well administered just now for goods; it is exceedingly slow, and the changes of carriages are very unnecessary. I think the tunnel itself would tend to civilise it in a great measure.

1298. Should you anticipate any difficulty arising in regard to the control of the arrangements between the Channel Tunnel Company and the foreign lines with which it would be in relation?—No; I do not think so. That would be a railway management problem, such as those connected with the management of the tunnel have been accustomed to deal with, and I should not think it would present any formidable difficulties.

1299. Would there be two reasons which would render any great exaction in respect of the greater charges improbable: the one the self-interest of the companies, and the other the fact that there would always be the competition of the sea route?—Quite so. So far as this country is concerned, the sea is a great safeguard against high charges of transit of all sorts. It cannot be bought or got into a "ring," and, therefore, it remains a compensating element in those matters.

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1303. *Lord Shute:* I wish to ask you a question with reference to the carriage of heavy goods. We have had it before us in evidence, from several witnesses, that the carriage of heavy goods would not be very great by this tunnel; that it would chiefly benefit light goods. What is your opinion upon that subject?—It is rather hard to say what particular trade would be developed through such a means of transit, but I should think machinery certainly, which is a heavy trade, would be largely increased in its export to the Continent by the tunnel.

1304. And agricultural machinery?—And agricultural machinery, too, very largely; we do a very considerable trade now with the Continent in agricultural machines; that would be largely increased.

1305. And you think the passenger traffic would, of course, be largely increased?—That I have not the slightest doubt of. The communication between the various Continental peoples now is absurdly small, considering the close relations in many ways of Continental nations with ourselves, and I think there is no reason to suppose that it would not very greatly increase.

1306. But in a mercantile point of view, you have no doubt it would be a very great advantage?—I quite believe it.

1307. You have not considered the other question as to the military matter?—I do not think that my opinion would be very valuable in a military point of view.

1308. *Sir Massey Lopes:* I do not quite understand what class of goods you have been speaking of that you are more particularly interested in. Your evidence is with respect to your own experience. What is the class of goods with which you are most conversant, and speak of?—From my own district we do a considerable trade in cotton goods, yarns, and to some extent in printed and fancy goods.

1309. Do you send them in large quantities?—Not in very large quantities.

1310. I suppose a great proportion of it goes in small consignments?—In small consignments, of course. The high French tariff prevents the development of a large trade.

1311. When you are sending goods in large quantities could you use the tunnel in sending them across?—It would be a question of cost; but I am sure that a route which enables you to load waggons in Manchester, and deliver them to the consignee in any village or town in France, would be preferable to transhipment.

1312. Then must you not send those goods in very large quantities, in something like four tons; could you send a less quantity in one truck to be delivered at the same place?—I do not think that it would necessarily be so. If you are sending a truck to Paris you may load it with a variety of things.

1313. But all from the same place?—Not altogether.

1314. Sending from the same place, and to the same place?—Yes, I think so, taking the truck as a unit; we should have no difficulty at Manchester in filling up that quantity.

1315. You said that you thought a great deal of machinery would be sent across in that way; what class of machinery would it be; you mention agricultural implements; but would there be any other class of machinery which would go in that way?—In the district of Lancashire we manufacture an immense quantity of spinning, and weaving, and other machinery for France and other parts of the Continent; I think that increased facility of transport would cast the balance in our favour as machine makers.

1316. If we are sending our best machinery to the Continent, and they are using it, would not it cause competition as against their own manufactured goods?—If you were to concede that it would be undesirable to send our machinery there, it would be an argument for Protection as against Free Trade; it is perfectly certain that if we do not supply the Continent ourselves with machinery, they will be sure to get it from somewhere else, or make it themselves; therefore we might as well have the trade.

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1321. As to prices in France; you talked of the dearness of a certain class of goods; I suppose that would refer to *articles de luxe*, and things of that description?—I think articles of all sorts are dearer; if you wish to conduct the supplies of a house in France you have to pay for articles that relate to dress, and to almost every item of house-keeping, distinctly more, I should say, in many cases a third more, than you have to pay in this country.

1322. Then as to the cheapness of these fragile goods; you say that they would be brought over more cheaply by the tunnel; would that apply unless you could command a sufficient quantity of heavy goods to be brought over at the same time, which we were told by the promoters of both the tunnels would be necessary in order to make the tunnel pay?—No doubt it would require a very large traffic of both light and heavy goods to make it remunerative; but I have not gone into the question of the tunnel paying, I only accept it upon the assurance of the promoters; it would have to be considered in relation to cost, and many other matters which I have not had placed before me.

1323. You also told us that the sea was a great safeguard against high charges, and therefore anything that would damage that traffic by sea would also damage this protection against high charges; have you considered the question whether this would interfere with the shipping interest?—I have considered it, and I do not see any reason to believe that it would injuriously affect the shipping interest; on the contrary I look upon England as a great depôt the world, and in a large measure so for raw materials, and it would continue to be so. We should receive shipments from various parts of the world, and I think the tunnel would enable us more readily, and to a larger extent, to distribute that raw material afterwards, and also that material in a manufactured form, to all Continental kingdoms.

1324. May I take it that you represent the general feeling in Manchester, that this tunnel would not affect injuriously the shipping interest?—I have declined to speak in a representative capacity. I am only giving my own opinion.

1325. *Mr. Arthur Peel:* You said you thought that machinery would be a typical trade which would benefit by the opening of the tunnel?—I instanced machinery as one of those commodities to which the packing question would apply in a most favourable way.

1326. Then you are not disposed to draw the distinction which was drawn by a previous witness as between light machinery and heavy machinery? It was given in evidence that heavy machinery would not pass through the tunnel unless it be produced, so to speak, in the immediate neighbourhood of the tunnel; that light machinery such as light agricultural implements, might pass through the tunnel; but heavy machinery like engines would not be likely to benefit by it. Is that your opinion?—Yes, but the machinery which I had in my mind when I spoke of machinery upon this occasion was for cotton spinning, and other intricate machinery employed in the textile industries. Then another thing I may mention, and that is that heavy engines are largely made upon the Continent; we do not export many of the big stationary engines, they make them themselves; we send locomotives to a certain extent.

1327. You would expect a large increase in the exportation of textile machinery?—Yes, I should.

1328. As I gather from your evidence, you would be disposed to say that independently of machinery, there would be a large class of special British produce which we could produce better than the Continent, and which would be the subject of export through the increased communication between the two countries?—Undoubtedly.

1329. Can you give us that in any detail?—Speaking generally, all those commodities, cotton and printed articles, even silks, which are produced in large quantities at a low price; the French excel us in the production of tasteful articles, where science and art are brought to bear in the highest degree; but we compete successfully in the matter of large quantities at low prices; that would apply to the cotton trade, and to other industries as well.

1330. *Mr. Baxter:* With reference to any injury which might be suffered by the steam shipping trade from having the tunnel, is it your opinion that the trade would be so much stimulated and increased as to leave ample margin for competition, and that very probably the steam shipping trade would not fall off?—Yes; I quite think it would not.

1331. We may take that as your general opinion?—Yes; we have had that point tested already, I think, through the influence of shipping bounties.

The French Government, as is well known to the Committee, decided some time ago to give large bounties upon the building and manning of ships, and a bounty for mileage for their voyages. The object of it was to stimulate the building of ships by French workmen, and in French dockyards; but it resulted very largely in orders being given to the Clyde and other shipbuilders to build ships on French account. These ships were sent to Havre and other places, and sailed under the French flag to earn the French bounty. When we have those facts in view we cannot be very apprehensive of our shipping trade being destroyed by any ordinary French competition.

1332. You do not contemplate that any British interest would suffer from the construction of this tunnel?—I cannot see that any interest can suffer from an influence which would be likely to greatly augment our trade with the world. The more trade we do the more profit we should try to make, and any argument against this increased facility seems to me an argument against increased trade.

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1335. *Chairman:* I think your evidence comes to this, that this country being a great manufacturer and distributor of commodities, you would regard with satisfaction any change which will bring an increased number of customers into the English market, and give us increased facilities for distributing English goods?—That is so.

1336. And, in your opinion, the opening of a tunnel under the Channel would have those effects?—I believe it would have those effects.

1337. And it is generally regarded in that light by those with whose opinions you are familiar?—It is, I think, generally so regarded by those who are not affected by the scare.

1338. I am keeping to the commercial point of view, and excluding the military idea?—From a commercial point of view, I think those points are generally admitted.

MR. GODFREY WEDGWOOD.

8th May, 1883.

1396. *Chairman:* I believe you are senior partner of the firm of Wedgwood & Sons?—I am.

1397. I believe last year you were President of the North Staffordshire Chamber of Commerce?—I was.

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1398. I believe you have turned your attention to the statistics relating to the Continental trade in pottery?—I have, for the last 10 years.

1399. We have heard it stated that goods of that class are peculiarly liable to risk from transhipment, and that those who are interested in sending them out of England are very desirous of avoiding those risks?—That is so; the goods undergo some 10 unloadings between here and their destination, from waggon to truck and from truck to waggon again; on an average they have to be loaded from one vehicle to the other 10 times, and some of these unloadings are exceedingly rough; for instance, in the London Docks they sometimes shoot a lot of crates down on to the lighters. Again, in stowing cargo aboard ship where freight is charged by measurement, they make use of a crowbar to force the crate into the allotted space, and if they cannot get it down, half-a-dozen men will jump upon the top of it; with a brittle class of goods such as ours, frequent complaints of breakage ensue.

1400. Can you give the Committee any idea of the stages at which those 10 unloadings take place?—I can. In the first place, the crate is loaded on to a lorry at the works; it is unloaded at the goods station; it is loaded on to a truck; it is taken to Camden or to Poplar; Poplar, if it is for export; it is there unloaded, and has to wait for other goods to go down to the docks; it is then loaded again and taken to the docks; it is unloaded from there into lighters frequently, and from the lighters into the ship. At the port on the other side, at Genoa, for instance, one of the many ports abroad, it is unloaded again into a lighter, and from the lighter on to the quay, from the quay on to a waggon; sometimes the railway comes alongside, that saves one unloading; from the waggon into the railway; from the railway into a waggon at its destination at Milan, or wherever it happens to be, and from there to the shop or warehouse of the buyer. That makes a good deal more than 10, but I take an average of 10 unloadings.

1401. How many of these removals would be avoided if you were able to send your goods through the Channel Tunnel?—We should have to carry the goods to the railway truck; this truck would be a covered truck, with spring buffers; then if there was communication by a tunnel, they would not be unpacked until they came to the town abroad where the customer resided; there the van would have to be unpacked by the customer's own men.

1402. In that case the truck would run from the station at your works to, we will say, Milan?—Yes.

1403. And you would contemplate using a special class of rolling stock for that trade?—No, the present vans would do; it might be, probably, when the trade came to be established, advisable to divide the van by a small ledge all round it, so that you could put boards across to carry the weight of part of the load ; but that is quite a matter of detail.

1404. In the case of Continental manufacturers, I presume that there is nothing like the number of removals ?—The Continental manufacturers have beaten us out of several markets; for instance, our market in Italy was five times what it is now eight years ago ; and that is entirely due to the fact that the German manufacturers are able to pack in bulk, and have no transhipment, and no unloading from their works to the destination of the goods, where the duty is charged on the net weight of the goods.

1405. You are charged duty on the weight of the package ?—Yes, we are charged duty upon the weight of the package as well as on the weight of the goods; that is, we are charged duty upon the gross weight.

1406. Can you give us any idea of the proportion which the weight of the package bears to the weight of the goods it contains ?—That varies almost to an extraordinary degree; for instance, take plates which will pack close one within another, the tare will be from 18 to 20 per cent. of the gross weight; but in the case of ewers and basins, and soup tureens, hollow ware we call it, the tare will be 60 to 70 per cent. of the gross weight.

1407. And you are charged upon that ?—We are charged duty upon that.

1408. Can you give the Committee any estimate of the amount of your trade upon the Continent ?—No, I have not got the figures; but it is absurdly small compared with what we suppose it ought to be if it was not for the hindrances which we have to put up with in consequence of the heavy charge for carriage and package and duty ; it has very much fallen off of late years.

1409. Has there been any alteration of the duty ?—The duties have been raised in some cases; in Italy they have been raised; in France they have been raised upon some goods and lowered upon others; on the whole, it is about the same, I think. But it has been changed from an *ad valorem* to a specific duty; it depends upon the weight of the goods, and the value of the goods, whether it is increased or whether it remains as it was.

1410. Do you consider that the change has been one adverse to you upon the whole ?—Yes, adverse to the whole trade. I speak for the whole of the Potteries now.

1411. Therefore, the falling-off in your Continental business is, to some extent, chargeable at all events to that ?—Yes, I think so.

1412. I presume the packing itself is a costly operation ?—It is. I have got a table here, which I intended to bring in at the end of my evidence, but I may as well bring it in now. I have calculated the cost of delivering 80 dozen of plates at 1*s*. 3*d*. a dozen, that is the cheapest sort of plate; these plates go to Paris, and are generally used by the poor there, who put their mutton chops upon them and cook them upon the fire, and our ware will stand use upon the fire which the French ware will not. These 80 dozen plates come to the value of £5. I have calculated the cost of delivering them in Paris, as they go at present, packed in a crate, and also as part of a truck-load of goods packed in bulk. A crate with the straw and packing costs 14*s.*, that is almost a dead loss to the buyer; he can make little use of it on the other side, and has to use it for firewood; the straw he can re-use in packing. I calculated that the straw and packing used in packing a truck would be only 4*s.* instead of 14*s.* The freight on the gross weight of that crate, 600 kilos., from the Potteries to Paris, is £1 8*s.* 10*d.*; the freight on the nett weight of ware if packed in bulk, plus a certain weight of straw, would be 17*s.* 4*d.*; but I must here explain that there is a certain suppositious element in this; the difference of the rate for crates and for ware packed in bulk, between the Potteries and London, is 25*s.* on crates and 20*s.* on ware in bulk per ton. I understand that the same variation of rate holds good abroad, and therefore this ware carried in bulk would go at a cheaper rate to Paris than it does packed in a crate; that I have allowed for in the estimate of what it would cost to send this 80 dozen of plates to Paris packed in bulk; I calculate the carriage at 17*s.* 4*d.* instead of £1 8*s.* 10*d.* for the crate. Insurance is lower for carriage by land than by sea. I cannot estimate the saving, because I do not know what is the rate of insurance. There is less risk of breakage. I have not calculated that either. Duty at 8 francs per 100 kilos. on the gross weight would come to £1 18*s.* 4*d.*, and on the net weight £1 8*s.* 10*d.* The whole of the figures come to £4 1*s.* 2*d.* on the crate, and £2 10*s.* 2*d.* if packed in bulk, but we must add to this a charge of 10*s.* a ton for the use of the tunnel, which is a full allowance, because I have taken off nothing for the sea freight, which would be deducted; that makes the total cost of the ware packed in a truck £2 14*s.* 8*d.*, or 54½ per cent. upon the value of the goods, whereas if packed in a crate it is 81 per cent. upon the goods; therefore there is a saving of 26½ per cent. on the value of the goods in charges, that is in carriage, and package, and duty, between the Potteries and Paris; and if there is this saving upon the flat or the heaviest goods, it would be considerably more upon mixed flat and hollow ware, where the package is very much more heavy compared with the net weight of the goods.

1413. Do you believe that that saving would enable you to compete to an extent to which you cannot compete now with Continental pottery wares? —Yes. There is a fairly large importation of this class of goods at present into Paris. If you take into consideration that these plates are 1¼*d.* apiece, if you can save one quarter of the cost in delivery, it is a very considerable saving and one which I believe would enable us to compete with Continental makers.

1414. Upon what system are the present Continental duties levied; are they *ad valorem*?—No, they are mostly specific. As I had such very short notice, I have not been able to ascertain what they are precisely at present; but in France and in Italy, and in Germany, and, I think, in Holland, they are specific; in Belgium they are *ad valorem;* in Russia they are specific.

1415. And you believe that, even in the face of the hostile tariffs of the Continent, such an improved facility of communication as the tunnel would give would very largely develop your Continental business?—I have not a doubt of it. An objection might be made that I have calculated this saving upon a short railway route, and that sea carriage to such a country as Italy would be so far cheaper than land carriage that it would nullify any advantage that could be obtained; but just before I came into the room I got the present rate of carriage for earthenware from the Potteries to Milan. I find that the cost of delivering two large sendings of 21 tons of goods by railway would be £166, and the cost by sea was £223; the reason is that the cost of packages is greater, and the duty is very much greater when goods are packed for transhipment than when packed in bulk.

1416. Do you export your goods largely to the East?—No, not to the East; it is a cheaper class of goods that goes to the East, and I am not acquainted with the figures.

1417. To what parts of the Continent do most of your goods go?—France, Holland, Belgium, and Germany.

1418. With reference to that part of your trade which tends towards Belgium and Germany, I presume you would not be satisfied unless facilities of access were given to the Belgian lines, so that they might be in communication with the tunnel upon the other side of the English Channel?—No doubt the railway companies upon the other side would arrange it at once; it would be their interest to do so.

1419. Do you think that it would be safe to depend upon the companies acting upon what we believe to be their interest in that matter?—There is no difficulty in getting a through route anywhere in England, and I presume there would be no difficulty upon the Continent, but I have not gone into the matter.

1420. *Lord Aberdare:* Do you send much to Germany?—No.

1421. What ports do you send to?—My own firm does not send very much to any part of the Continent, but the Potteries generally send chiefly to France, Holland, and Belgium, and in some considerable degree to Russia.

1422. You have taken Paris for the purpose of your calculation; is it likely that your products go much beyond Paris?—They do go to Lyons and to Bordeaux, and some to Marseilles.

1423. Take Bordeaux and Marseilles, being ports, do you think the railway route would compete with the sea route to those two ports?—It is a question of figures. I only had notice to attend here on Saturday, and I have not had time to get figures.

1424. You have given the reasons why your products would successfully compete as far as regards Italy?—Yes.

1425. I suppose, Italy being a little further than Marseilles, and a great deal further than Bordeaux, the reasons are all the stronger in favour of the railway route to those places?—They are.

1426. You mentioned that one of the reasons why the cost of sending by sea to Italy was larger was that the duty was larger; do you mean by duty the tariff?—No, the tariff is the same. You have to pay duty upon the package as well as upon the goods; if sent in bulk, you only pay duty upon the nett weight of the ware. I may say that with our goods the packages form a considerable share of the gross weight; thus a 44-inch oak hogshead, with the straw, will weigh some 4 cwt.

1427. You have suggested that the great depression of the trade to Italy is due to the advantages enjoyed by certain manufacturers who escape transhipment; now, have they any advantage with respect to dues also?—This advantage, that they only pay on the nett weight of the ware instead of upon the gross; I have got it all in percentages here.

1428. That you have explained; but is there any other difference; is the duty the same upon German and French products?—Exactly the same, except that when packed in bulk it is upon the nett weight of the goods.

1429. That runs through the whole of these calculations, in fact?—Yes.

1430. Some witnesses whom we have had before us supposed that the effect of this improved communication with the Continent would be to reduce the tariff charges and lead to a more liberal policy; have you any such expectation?—I have formed no opinion upon that.

1431. Do you think it is possible that in those countries where the protective interest is strong, the diminished charges, and therefore the increased competition, might lead to increased duties?—It is rather a large subject, and I have not considered it.

1432. *Earl of Camperdown:* Can you tell the Committee about what proportion your foreign trade bears to your home trade; I am taking the case of your own firm?—The Continental trade is 10 per cent. of our whole trade; when you say foreign, the American trade is a very large portion of our trade.

1433. About what proportion does your foreign trade bear to your total trade ?—It is 45 per cent.

1434. And how much of your foreign trade do you think would go to the Continent ?—22 per cent.

1435. Do you ascribe that to the tariff, or do you ascribe it chiefly to the difference in the cost of carriage ?—It is due to a variety of causes. It is due partly also to the heavy charges for carriage which I have just explained, and the extra duty we have to pay ; it is also due to the fact that Continental manufacturers are good potters.

1436. In those remarks which you made just now upon your calculations as to the cost of conveying goods to Paris, would you tell us how you calculated the cost of freight in bulk. Supposing a truck to pass direct from you to Paris, upon what data did you make your calculation ?—I know the present freight from the Potteries to Paris : it comes altogether to about six francs per 100 kilos.

1437. If there is no tunnel ?—I added for the tunnel afterwards. Then I take off one-fourth of the weight, because we should not have to send the crates ; the ware would be carried in a much lighter form in bulk. We save directly one-fourth of the carriage by that ; we also save about one-fifth in the difference in rate ; but, as I have explained, I have not had time to get into communication with the French lines, and I do not know whether the same saving holds good, whether it is more or less. I know there is a difference of rate upon the foreign lines between ware packed in bulk and ware packed in crates.

1438. But we do not know at all what the rate through the tunnel would be ?—I have taken it at what I heard it stated in this Committee-room, at 10*s.* per ton.

1439. Five shillings, I think it was ?—If it is 5*s.*, so much the better. I took it at 10*s.*, which amounts to 5 per cent. upon the value of the goods.

1440. *Mr. Arthur Peel:* What is the course which the Midland pottery traffic takes when it is exported now ; what port does it leave ?—It goes from London to Dieppe, or from London to Boulogne.

1441. It goes mostly to London in the first instance, does it ?—Always, I believe, except what is sent by the Grande Vitesse. It all goes to London, and from there to Dieppe.

1442. In the event of the tunnel being made, it would still go to London ?—It would have to pass through London to the mouth of the tunnel, of course.

1443. There would be no diversion of traffic between the Midlands and London ?—No ; it would go all through London.

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1450. *Sir Massey Lopes:* I think one of your complaints is with regard to the transhipment of your goods?—Yes.

1451. Could you tell the Committee whether you have much complaint to make of any damage which has been caused to your goods by those transhipments?—We have so constantly complaints of the breakage, that it is the custom with us, in our Continental trade, to allow 5 per cent. discount from the invoice, in lieu of all claims for breakage and pilferage.

1452. Is that taking into consideration ready money?—There is another discount for cash as well.

1453. Independent of that?—Yes.

1454. I think you said just now that at present your trade is absurdly small with France?—Yes.

1455. And you hope it may increase by improved communication?—I should rather put it that, if I can show you 25 per cent. probable saving upon the ware between here and Paris with the cheapest class of ware, with the better class of ware there would be a larger saving, and no doubt a very large increase of trade.

1456. I think you also told us that the Continental manufacturers were good potters; I think those were your words?—They are.

1457. Are not they likely to come into competition still with you?—They do their best now; and I presume, if we get 25 per cent. advantage, it will be all to our advantage; they will not make goods 25 per cent. cheaper in consequence of the tunnel being made; whatever advantage the tunnel will afford will be all in our favour, and 25 per cent. is a very considerable advantage.

1458. But if you were going to send any of your goods, we will say to Leghorn, or any of those distant ports, you would not send them through the tunnel in preference to steamer, would you?—That is a question of calculation.

1459. It is a question of rates, I suppose?—Yes; it is also a question of great risk of transhipment for our fragile ware, and of the duty upon the package.

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1465. To what extent do you think the trade with France would increase, supposing you could deliver by the tunnel?—I cannot give any opinion further than this, that if we can do a fair amount of trade, which is the present case with France, I take it that we should do a very much larger one if we could save one-fourth of the value of those goods in carriage.

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1472. You do not know what the amount of trade with France is?—No.

1473. Or what the relative cost of manufacture in France is?—Yes, I could give the figures, but I have not got them here with me, of what the relative cost of ware in France is against ours.

1474. You have stated generally that the French potters are producing ware as cheap or nearly as cheap as you are?—They are not able to produce ware as cheap as we are at our own works; they are able to produce ware as cheap as ours is delivered in France, but ours has the advantage of quality; the French ware will not stand use in the way the English ware will, and we also have a great advantage in the variety of design, which the French do not go in for so largely as English potters.

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1480. Can you tell at all what the transactions with Italy are?—No; I cannot give you that at present; I can only say that our own have fallen from what they were eight years ago to one-fifth, mainly in consequence of the competition of the Germans, and I presume if we could stand upon a par with the Germans, or anything like on a par with them in the expense of carriage and the duty, we should regain the ground we have lost.

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1495. *Earl of Camperdown:* You said just now that you would save 25 per cent. of the value of the goods on the way to Paris?—Yes.

1496. Did you not mean 25 per cent. of the cost of carriage?—No; I calculated it all upon the value of the goods as the best way of showing how it would benefit us. Our goods vary so much in price and weight, and in the variety of articles that are made up, that I do not see any other good basis of calculation, except upon the value of the ware.

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Mr. Robert Giffen.

24th May, 1883.

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1878. You think it would have the effect of creating new branches of trade?—The tendency of the trade being itself to go on steadily increasing, and the tendency of the new facility being to create new branches of trade, you may have a considerable traffic through the tunnel without any diminution in the traffic going by other channels, and possibly an increase of the traffic going by other channels. Still the tendency of the tunnel must be to attract a considerable amount of traffic of the kind which now passes between these nine ports and the Continent.

1879. Is that the conclusion which your experience generally suggests—that improvement of communication invariably does lead to great expansion of this kind?—It is a conclusion arrived at from general experience, and I think also that one may say about the tunnel that it is in the nature of a bridge over a ferry, which is universally recognised to be one of the most important improvements which can be effected in transit; you see wherever there is a short ferry, the desire of those connected with traffic is to substitute a bridge for the ferry, and it seems to me that a tunnel under the Channel would be of an analogous nature.

1880. May we take it that the shorter the ferry the greater the gain in bridging it?—That seems to me the nature of it, because if you have a very long water distance to cover, the cheapness of water carriage compensates less or more for the expense of transhipment at both ends; but where you have only a short distance there is nothing to compensate for the expense of breaking bulk and transhipment at both ends. That seems to me a general proposition which is beyond dispute with reference to bridges and the improvement which bridges effect in transit.

1881. And that would apply particularly, I take it, in the case of those classes of goods, which suffer from handling and transhipment?—It would apply to fine goods, and goods of that kind; to perishable goods, and others, which may suffer in transhipment, or which may suffer by delay; and it would also apply to even some kinds of heavy traffic, where expedition happens to be of great importance. I may say that, having looked at all these figures in detail, that is the traffic to and from the different ports which I have mentioned, the difficulty I have in giving an account of them is that the trade is so very miscellaneous; that is, especially with reference to exports from this country to the Continent. You have a great number of different articles, but very few very large items, if I may say so.

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1952. It is your opinion that there would be a diversion from those nine ports of the traffic in the event of the tunnel being made, that it would become more centralized?—I think there would be a diversion to some extent from the nine ports; a certain amount of traffic would go through the tunnel, especially traffic which now goes by the mail route; it would go by the quicker route, if created.

1953. There would be a greater concentration of traffic from England to the Continent through the tunnel?—Yes.

1954. More would pass through London?—Yes, and to some extent it would develop London.

1955. It would develop London, you think, at the expense of the other eight ports ?—I can hardly say at the expense of the other eight ports, because my impression is, from a long acquaintance with such matters, that they might all increase simultaneously.

1956. I was going to ask you that question, whether you think there is room for all ?—Yes, there is room for all; the ports might not get as much as they otherwise would, if the tunnel is made, but it is quite likely that they would get more than they get now.

1957. *Mr. Baxter:* Several witnesses have told us in this room that they do not anticipate that any heavy traffic will pass through the tunnel; that is not your opinion, is it ?—It is not my opinion. From what I have observed of railway traffic, in different parts of the world, of the competition of railway traffic with water traffic, my opinion is that some heavy traffic will undoubtedly go through the tunnel.

1958. Are you aware of the proportion of coal sent from the north of England by water and by railway ?—Not beyond knowing that the railways bring a large amount; I cannot give any figures now.

1959. Is it the case that the proportion sent by railway is largely increasing over the proportion sent by sea ?—I believe that is so.

1960. Do you anticipate even bulky and heavy articles of that sort being sent through the tunnel ?—I think it is very likely, and one reason is this: if the tunnel can accommodate a large traffic at all, then, if it gets all the fine traffic and light traffic that is available for it to take, there is no reason why the people who have the tunnel in charge, and those managing the railways connected with it, should not take the heavy traffic at any price at all that would give them a nett return; it does not follow that they should have the same nett income out of every description of article which goes through the tunnel.

1961. Our merchants nowadays attach more importance to expedition and certainty than they did in former times ?—I think that is the case, as expedition and certainty are very important matters in trade.

1962. Is it not the case likewise that much smaller stocks of goods are kept in all parts of the world than formerly ?—Yes, that is undoubtedly so, and it has been observed very much lately in reference to financial matters as explaining the non-increase of the quantity of bills in Lombard Street, which has certainly not increased in comparison with the trade during the last ten years.

1963. And the new mode of conducting general business throughout the world would give a great advantage to all improved means of communication ?—That is so.

1964. So that the rate of freight charged is not the only element to be considered ?—By no means the only element.

1965. And in certain cases, I believe, merchants have not even asked the rate of freight in shipping by steamers to foreign ports where there was a great demand for goods?—I cannot say that I am aware of cases so extreme as that.

1966. But you would not be surprised if I told you that I know that of my own knowledge when a demand suddenly arose, and goods were telegraphed for, that the freight was a very insignificant item indeed?—That might well be in the case of many articles.

1967. And you think from that point of view that the construction of this tunnel would very largely facilitate business and increase the trade of this country?—I think considerably. I do not know that we could say largely with regard to the aggregate income of the country; if you take the income of the country at something like £1,400,000,000 or £1,500,000,000, what we could trace as given by the tunnel might be only a few millions by comparison, but the indirect effect upon the trade might be very great; we might be enabled to keep hold of many branches of trade which might otherwise go away, so that such a facility as the tunnel might be of indefinite value.

1968. Having regard to the position of this country as the great *entrepôt*, and the competition which is continually increasing on the Continent with us, do you think it of great importance that we should have a communication with the Continent without breaking bulk?—Yes; we must have and keep every advantage that we can.

1969. Would you go as far as saying that in your opinion it is indispensable to our keeping up our position as the great *entrepôt* of the world?—I could hardly say that I would go as far as that, but it is indispensable for us, in order to keep our position, that we should score every point in the business game; we cannot afford to neglect anything; and looking at it from that point of view, I should say it is unsafe for us to begin to consider whether we can refrain from making any point or not; and that we ought as a nation to do as an individual—take every advantage we can lay hold of. If we get into the habit or acting otherwise, we shall be in great danger.

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MR. GEORGE ROBERTS BLANCHARD.

31*st May*, 1883.

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2380. The Committee will be glad to hear what you have to say?—The exports and import business of the railway that I have the honour to represent with both the Continent and England, is constantly growing, and one of the objects of my being over here is to examine as to the best routes for it. I have discovered from a stay recently of two months in Paris, and interviews with people connected with the transportation by direct lines from Havre, the new and continual efforts that are being made to divert travel by the routes by way of England. I should hesitate, as an American, to appear before an English Committee, were it not for the fact that this is in the line of my profession, and at the same time if my humble views in any manner influence your deliberations, so as to accommodate the American public and afford prompter and quicker facilities, it will justify me in saying what I have to say. The intercommunication of the people of the United States with those of England, by reason of the community of language and fellowship and tradition, is, of course, very intimate and close, and it is the desire of everybody that I know that it should continue so; but the days having gone by when such great fortunes have been made in the United States, the great necessity for economising both time and money, and the much greater increased expense, taking Paris as a local point, passing from the United States to Paris, by way of England, as compared with the route by the direct French coast, is every day attracting more and more attention. The steamship lines to and from the Continent that use it are of course doing everything in their power to bring it to the attention of all classes of travellers and all classes of shippers both eastwardly and westwardly; and it is within my knowledge that an officer of our Government who started last Friday for the United States, told me on the morning of his departure that the reason he went by Havre was, that he would leave Paris at four o'clock, be on board the ship at Havre at eight o'clock, which would make it the same distance as from Liverpool; that his vessel and the car were within short distances of each other, whereas if he came from Paris he would have to come from Folkestone and Boulogne, or Calais and Havre, making a transfer, encountering weather that might influence his health, possibly missing the connexion, and being compelled possibly to make another transfer at Dover or Folkestone, and then coming to London, paying an expensive transit across the City, going to Liverpool, and then being further from the vessel at Liverpool than he would be at Havre when he started. The same considerations influence the bulky goods westward; the grain that goes must follow the cheapest route in competition with the trade from India and Russia. I am not here (our company doing everything it can to press its influence as to our American companies in every direction) to particularly favour one route or the other. Our lines are seeking to push American commerce wherever they can go to, and to follow the cheapest route, but the cheapest route cannot be through

England, except these charges and this delay in time are limited and abridged in some manner between London and the Continent. It is a matter, perhaps, that will astonish most members of the Committee to be told that we are in daily receipt at New York of goods which are shipped at San Francisco in the same length of time that it took me to send freight from here to Paris on the day I first arrived in London, 13 days; on the afternoon of the 13th, 14th and 15th days our company is delivering freight in San Francisco 1,400 miles away. If by reason of this tunnel trains could start at the different magnificent stations in London, and land passengers in Paris, or, what is much better, start at Liverpool and land them in Paris, as we start from New York City and land them in Chicago, St. Louis and Omaha, and other cities, varying from three to ten times the distance from London to Paris, I think that the effects could not but be, first, to retain all the traffic you have; secondly, to greatly increase that which you have, by reason of the cheaper transit which the absence of this transhipment will certainly enable you to achieve. Briefly stated, that is my view.

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Sir Jacob Behrens.

19th June, 1883.

4452. *Chairman:* I believe you have paid some attention to the question which we are investigating in so far as it affects the woollen industry of this country?—Exclusively so.

4453. Have you come to any conclusion with regard to the probability of a part of the wool imported into or exported from this country following the tunnel route, if the tunnel were made?—I have never considered the question in relation to raw wool; I have considered it entirely with reference to the manufactured article.

4454. Do you believe that any part of the manufactured wool would take that route?—In my belief, the majority of it would. Perhaps you would permit me to read a statement which I have written, and then I shall be happy to answer any questions that may be put to me.

4455. We shall be glad to hear any statements that you are prepared to make to the Committee.—I am in favour of the construction of the Channel tunnel, because, in my opinion, it will have a most beneficial effect upon our trade and industry. I cannot share the fear expressed by a valued friend of mine who was examined before this Committee a few days ago that the tunnel will encourage the invasion of foreign workmen and the displacement of English labour. On the contrary, I am led to believe that it will help greatly to promote British industry in all its branches, and thus give additional employment to capital, with the necessary consequence of still further improving the condition of our working-classes. A commercial experience of more than sixty years has taught me that every new facility given to locomotion or transport has benefited trade far beyond the expectations of the most sanguine promoters. If former improvements in that direction have done so much for trade, what may we not expect from the opening of a road without a break of line connecting the 35,000,000 of this country with the 200,000,000 and more of Europe? Small as that break is at present, and short as is the time for passing over it, it prevents vast numbers from visiting England for business or pleasure who now stop short at Paris. Remove that impediment, and London will become the world's mart for retail transactions, and new outlets will be found for British produce in every direction. It is probable that, like all former innovations, the tunnel or tunnels (for we are certain to require more than one in time) will change the course of trade, and it is likely that we may see a reduction in the number of large transactions in manufactured goods. But an immense number of smaller ones will take their place, forming an aggregate amount many times greater than that which we are accustomed to at present. Our present imports and exports from and to France amounted in 1881 to the large sum of £78,700,000, of which £14,500,000 merely passed through France from and to other countries. Of this vast trade £19,600,000 represented textiles (exclusive of ready-made clothing), of which £5,600,000 worth were sent in transit. Included in that sum are £1,000,000 worth of British wool fabrics sent through France to countries beyond; and £1,300,000 worth of silk goods came to us in the same way, mostly from Switzerland. An unbroken line of rails connecting every part of Great Britain with all parts of the Continent will, according to my opinion, have a more powerful effect upon the development of our export than upon our import trade, for it will attract a large number of buyers to London and the provinces who are now kept away by fear of sea-sickness, a consideration which not frequently prevents Englishmen from crossing the Channel in search of foreign goods, though I have known instances even in that direction. What the trade mostly would be benefited by is the closer and more frequent personal intercourse between producer and consumer, and by the quicker and more certain transport of goods. It is the long time now required for goods reaching their destination on the Continent which prevents many purchases which otherwise would be readily made, particularly by retail houses who are accustomed to supply their daily wants from the wholesale dealers in their own neighbourhood. I had obtained a list of the principal cities and towns on the Continent with the through rates at present charged from Bradford, and the time required for their delivery; but I am sorry to say that I have mislaid that paper, or left it at home. However, I believe that, under favourable circumstances, 8 days was mentioned for Paris and 18 for Rome. If your Lordship requires it, I could supply that paper by sending it afterwards. The routes that our goods now commonly take is that of Grimsby and Dieppe. It takes no more time to carry goods to London than to Grimsby. The passage from Grimsby to Dieppe would, I presume, require 36 hours of steaming. I have no experience of that, but from the map I believe that would be the time it would take. However, quite apart from the effects of adverse winds and bad weather, the unavoidable delays caused by the frequent loading and unloading, with the accompanying Custom-house formalities, render the time of delivery very uncertain. Our cases or bales are thus exposed to frequent, and sometimes rough handling, and this necessitates careful and costly packing, which in some articles I am told, renders competition impossible with Germany and Belgium, where the privilege of unbroken transit is already enjoyed.

4456. Does that statement refer to the woollen trade exclusively?—No.

4457. As to that, you speak from your own experience?—All these hindrances to trade will be avoided by the completion of the tunnel; for goods would be sent from Bradford, and in a few hours after be delivered in London, and then forwarded in sealed waggons, and not removed or examined until they arrive at the Custom-house of their destination. I thus expect a saving in time alone of 75 per cent., and, possibly, of cost of carriage; that is to say, instead of taking eight days to go to Paris, I expect that the goods will be there in two days.

4458. *Earl of Devon:* Is Grimsby your point of departure?—Yes, commonly. Some goods are sent through London, but they are mostly sent to Grimsby, and then to Dieppe, which is the cheapest way. Though expense is an important item, I myself attach more weight to the shortening of time, and I should insist upon the most stringent conditions being attached to the concession to prevent these advantages being jeopardised by combinations, or by the abuse of an acquired monopoly. I should, therefore, like the French railways to be bound to co-operate with the English by establishing quick goods trains in connexion with the arrivals through the tunnel, such trains not only to run to the important towns and cities of France, but also to those of Italy and Switzerland. Secondly, I should propose that the goods should be free from custom-house examination, and from delays *en route*; and, thirdly, that low maximum through-rates be also a condition of the sanction to be given to the scheme by England and France.

4459. *Chairman*: I think you have dwelt upon the probability that there would not only be a saving of time, but a considerable saving of expense, subject, of course, to the rates charged?—The rates are very low at present, and from what I have seen in that paper (which I am sorry I have mislaid) I do not think that it will be possible for a great saving of expense to be effected.

4460. But you think there would be a considerable amount of saving in respect of what you call hindrance to trade?—Yes.

4461. That is to say, hindrance occasioned by transhipment, loading, and unloading?—Yes.

4462. Are you able to state what the expense of loading and unloading woollens is per ton, or per thousand pounds?—I cannot, because we have nothing to do but with through rates. We pay the rates from Bradford to Milan, to Bâle, or to Paris, or wherever the goods go to. We have nothing to do with any other rates; but they must add to the expense.

4463. And, of course, it would depend upon the intrinsic value of the goods themselves?—Yes.

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4477. If the Channel tunnel existed do you think that you would, as a rule, send those goods, or any large proportion of them, by railway instead of by water, taking into consideration the necessary difference in the cost of the carriage?—I believe there is not a single pound that would go by water; it would all go by rail unless the rates were prohibitive; and decidedly they should not be higher than they are now.

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4498. *Mr. Arthur Peel:* You contemplate a large increase of traffic between this country and France by the creation of the tunnel?—Yes, not only with France, but with the countries beyond France.

4499. You contemplate a similar increase of traffic with countries beyond France?—Perhaps more.

4500. With other countries than Germany and Belgium?—Germany and Belgium I do not think would be served by the tunnel so much as Spain, Italy, Switzerland, and sometimes the East. Germany and Belgium are well served by the direct steamers.

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4529. You seem to think that the construction of this tunnel would not cause in any respect a displacement of English labour, and that it would improve the condition of the working-classes; could you tell us in what respect it would improve the condition of the working-classes?—By increasing trade and giving more employment to them.

4530. Would it not be bringing competition to this country from the Continent, where the hours of labour are much longer and the wages much smaller; and would that tend to improve the condition of the working-classes of this country?—I am still of opinion that the tunnel would be much more in favour of our export than of our import trade, for we already ransack all countries to find cheaper manufactures than our own, and therefore the tunnel would not increase that; but it would enormously increase the number of small transactions in goods here to be sent to the Continent.

4531. But surely if the tunnel is going to give you the opportunity of largely increasing the manufactured goods which are imported into this country, that could be no great advantage to the working-classes of this country?—I do not apprehend that more goods would be sent here, but I expect that we shall send more goods abroad, and therefore I have no fear but that it will tend to the improvement of the working-classes, and to the employment of capital as well.

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OPINIONS AS TO THE ADVANTAGE OF A TRAIN-FERRY OVER OTHER SYSTEMS FOR EFFECTING UNBROKEN COMMUNICATION.

Extract from Evidence given before the Committee of the House of Commons appointed to enquire into the International Communication Bill of 1872.

Mr. John Fowler.

30th April, 1872.

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140. Had you before this time had your attention directed to various projects which had been talked of; for instance, the tunnels and tubes and bridges for bridging the Channel?—Yes, I was applied to by some of the parties who are now proposing a tunnel, to consider it, and I did consider it very carefully, and I came to the conclusion that at all events it was premature.

141. It would be an enormous undertaking, and it would require many years and an enormous amount of money?—Yes, and I declined to take the responsibility of adopting it. I thought it very much better that we should begin with something which at all events we could see our way to the end of; it may lead in the course of fifty or a hundred years to a tunnel being seriously proposed, but we are certainly not ready for a tunnel yet.

142. Not for the present generation?—No, not for the present generation.

143. Now, as regards the iron bridges and tubes?—The bridge is too ridiculous to discuss, as the bridges would consist of a number of piers which would be rocks, and dangerous to navigation.

144. I would ask you to tell me this; you have not discarded all these schemes without giving them due consideration?—I considered the tunnel very carefully as being the only form of doing it at all as compared with the tubes and bridges; the tube was only practically a form of tunnel. Tubes and bridges, I consider, have been abandoned, in fact, the bridge itself is an

absurdity, and as regards the tunnel it could not be done financially unless the two Governments guaranteed the money, and that I do not think that it is at all likely in the present generation.

145. The other improvements for the Channel communication would, of course, include some improvements to the harbour, and giving better and additional boats of the ordinary character?—Yes, my proposal is parallel to a tunnel in this sense, that it is a continuous communication. The very essence of my proposal is that carriages, goods, trucks, and mails should be carried across without breaking bulk; that would be accomplished by a tunnel, but it will be accomplished much better, in my opinion, by proper boats.

146. That is to say, you think that by your scheme, if carried out, you would secure that which was the object to be attained by the tunnel?—Yes; and it would also accomplish something else which is very important indeed in considering this question; that in passing across the Channel in boats of a proper size to accomplish the object thoroughly, you would enable all the work of the Custom house to be performed during the journey, therefore the time which must otherwise be lost at London, Dover, or Paris is entirely saved, without any loss of time whatever, because the operation is performed during the passing of the vessel across the Channel.

147. As the Post Office clerks sort letters by mail trains going at night, so the Custom-house officers would deal with passengers' luggage?—Yes.

148. And the effect of that would be not only a saving of time, but it would save that delay which is very often harassing?—Yes; and there would be no hurry or confusion about it, but it would be done in proper rooms for the purpose.

149. One of my learned friends suggested yesterday that the people would be cooped up in their carriages all the way through, and that they would not be saved from the effects of sea-sickness?—That is the only objection—and a very silly and childish objection it is—which I have ever heard to the scheme, because the effect of that would be that the train would be put into a comfortable station, with everything belonging to a station—lights, waiting-rooms, platforms, means of reading, or anything else, besides attending to the Custom-house business—and why a man should be supposed to be such an idiot as to sit in a railway carriage instead of taking the opportunity of sitting in a comfortable room I cannot conceive.

150. A person would be as free to get out of the carriage when he got to the vessel as he would be in a railway station?—Yes; it is just the same as if when you go to York on your way to Edinburgh, instead of going to the lavatory to wash your hands, you should sit in the carriage, except that there is also this to be said, to which I attach great importance: the number of

invalids who have to travel abroad is very great indeed, and I think it would be a very great object to them to be able to remain in the same carriage or bed instead of being moved about from their beds or their carriages. I think that is a very valuable consideration, and many people have impressed it upon me very strongly.

151. There would be an opportunity offered that a person need never move from the carriage if he were travelling from London to Paris?—That is so, and, again, in the night train a great many people avail themselves of the opportunity of going to bed, and if proper bed carriages were to be provided, a man could go to bed at the London station and get out of his bed at Paris.

152. Take the case of persons going to and fro between Dover and Calais; there is sometimes a separation in families, which causes great inconvenience?—Yes; everyone who has travelled must have seen very painful scenes at Calais in members of families being separated from each other, and perhaps young ladies being put into carriages where men were smoking; things of that sort are of daily occurrence.

153. In this way you would secure the same advantage that a person now has in taking a journey from London to York, only it would be between London and Paris?—Yes.

154. I will not ask you to dilate upon sea-sickness, because that is present to everybody's mind, but, as regards goods, you propose to carry goods by those boats?—Yes; we should have goods boats in addition. We should have a couple of passenger boats, which might, perhaps, also carry goods; but, in addition to that, we should have boats especially built for carrying goods, because it is the opinion of others, and it is my opinion, that the goods traffic which would be created by a through communication would be extremely important and valuable to both countries; it is now non-existent from the difficulties attending it.

155. Would the size of these boats, in your opinion, have the effect, at all events, of preventing the sea-sickness which people suffer from now?—There is no doubt that the size of these boats, looking at the smaller seas in the Channel, would, perhaps, not do away with it altogether, because some people when they see the sea are practically ill, but, practically, it would very greatly diminish it.

156. Is it not the fact that people who cross from Holyhead to Dublin, who feel ill in small boats, do not suffer in the mail steamers?—Yes; and these boats would, in my opinion, be as superior to the Holyhead boats as the Holyhead boats are to the present Channel boats.

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Extracts from Evidence given before the Joint Select Committee appointed to enquire into the Channel Tunnel, 1883.

SIR ARTHUR J. OTWAY, BART., M.P.

7th June, 1883.

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3430. Would you give the Committee the reasons which incline you to think that other means of improvement are preferable to a tunnel?—I think that those that I have indicated, viz., the improvement of the steamers both for passengers and for goods, will make the traffic with the Continent almost as good as it possibly can be; there may be some exceptions, to which I will allude presently when speaking of the tunnel, but there has been another plan proposed; I do not know that it could be carried out, but we have the highest authority for it, Mr. Fowler. That is Mr. Fowler's scheme, by which vessels so constructed should take a portion of the train on board at once; not necessarily a train in its whole length, but portions divided, and run through; there would be no breaking bulk or change at all, and they would run on the lines on the Continent when arriving on the other side.

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3502. Did Mr. Fowler's plan of loading trucks on board the vessel ever come before you as a practical operation?—Yes; I was asked at one time to link my fortunes, to a certain extent, with that.

3503. And I suppose you believe that something of that sort will take place?—I have always thought so, looking at the improvements in the construction of vessels, and the improvements going on in French ports.

3504. Virtually, a railway train may pass over the Channel or a succession of railway trains in the course of the day?—So I think; in sections.

3505. Commercially speaking, is there any difference in principle that you can see between a series of railway carriages passing over the Channel and a series of railway carriages passing under the Channel, in a tunnel?—There seems to me to be this difference, that you combine all the advantages of the former without any of the disadvantages of the latter.

3506. I am speaking now only in a commercial point of view?—I see none.

3507. You see no difference?—No, I see no difference; there would be no break of bulk.

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3523. You were asked with regard to ferry steamers, have you faith in that proposal that I think was suggested some years ago by Mr. Fowler, with regard to ferry steamers crossing?—I have not knowledge enough to have faith in myself, but I have great faith in Mr. Fowler. I think he is an engineer whose reputation would command respect, and I should be very glad to see his scheme carried out.

3524. If his scheme was ever carried out, would it in your opinion do away with an argument which has been very much used before this Committee, namely, the difficulty of transhipment, and of breaking bulk?—Yes, entirely.

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MR. JOHN FOWLER.

12th June, 1883.

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3857. *Mr. Baxter:* I was not able to be present on the last occasion that you were here, but I have carefully read your evidence, and I think rather too much was taken for granted; we have read your article in the *Nineteenth Century*, but it appeared to me that we ought to have your plan stated concisely and clearly upon the evidence given before this Committee; I know it perfectly well myself, and I daresay all the members of the Committee do; but I think it would be for the public advantage if you would state in a very few words the exact nature of your plan, so as to have it down upon the notes. I should like to ask you to state, in as few words as you can, your alternative plan as against the Channel tunnel, which you think preferable under the present circumstances at the present time?—My opinion is that in consequence of the nature of the harbours upon both sides of the Channel, the capabilities of the water have never been properly developed, and could not be. The service, considering the importance of it, has been certainly backward, and that is the opinion of all engineers, especially Americans; but the difficulties having become decreased by the works now in progress, the means of communication by water should be exhausted before a tunnel is seriously thought of; and with a view to that, I should suggest that special works be made inside the harbours, say at Dover on the English side, and at Calais or Boulogne, or probably at both places, upon the other side, so that vessels specially constructed for the purpose of taking passengers and goods, with great comfort and swiftness as regards passengers, can be worked with perfect certainty. I mention the harbours particularly for this reason, that in order to give effect to a thoroughly efficient ferry service there must be practically still water, not absolutely still water, because a lift of one or two feet would not, in fact, inconvenience the working of the ferry, but the harbour should be sufficiently good, and sufficiently large to secure practically still water. The moment the trains arrive at the harbour where the works are constructed, on either side, they should be placed on board under all circumstances and all weathers; I should lay it down as a *sine quâ non* that there never should be under any possibility a moment's delay after the arrival of the train at the boat; the boat would be arranged with regard to its mechanical contrivances to get the trains rapidly on board from the railway, by the simple operation of hydraulic lifts, all of which were explained in great detail by Sir William Armstrong to the Committee on the Bill, with proper working drawings, and which are actually the same as those in operation now upon the Central Pacific Railway, a drawing of which is before the Committee. The Committee will observe that one essential part of the scheme is that the carriages shall not be upon a deck, because that would be, in my opinion, a fatal objection. They should be enclosed in the manner shown by the drawing before the Committee, with a deck extending the whole length and width of the vessel above them, so that, in point of fact, the carriages should be, as it were, in a floating station, and that floating station should have all the comforts and conveniences of an ordinary station, with an additional arrangement for dealing with the luggage in passing across the Channel. I attach great importance to that, because I think the whole of the time occupied in Paris and London, in dealing with the luggage, could be saved by that operation being performed in crossing the Channel. The drawing before the Committee will show that there are two special rooms of 50 or 60 feet long each for that work. The boats, besides being large, must, of course, be swift and of great power. I think the size of the boats should be about 7,000 tons, and have about 12,000 horse-power, to enable a speed of 20 knots to be maintained. Of course a greater speed could be maintained, but I think 20 knots would be satisfactory, that is to say, less than an hour to Calais, and an hour and a few minutes to Boulogne.

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3898. As to the practicability of your own scheme, you back it by saying that you could raise the capital in 24 hours?—Certainly; and I think the Committee ought to have before them the very unusual combination of names of those who supported the Bill in committee: Mr. Ward Hunt (the Chairman), Sir William Armstrong, Sir Edward Reed, Mr. Laird (the great shipbuilder), Mr. Samuda, Sir James Anderson, Mr. Sherrard Osborne, Admiral Robinson, Captain Halpin (of the Great Eastern), Mr. Lyster (the engineer of the Liverpool Docks), Mr. Thomas Elliott Harrison, Mr. Abernethy, Mr. William Wilson, and myself. The Committee will agree with me that it is rare indeed that you get such a combination to come forward and say that there is no doubt of the practicability of any scheme in all its parts.

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3906. Have you carefully examined all the proposals for international communication?—I think I am acquainted with everything that has been said or written upon the subject.

3907. I think you say you had been consulted by Lord Richard Grosvenor with regard to this tunnel in 1867, and that you declined to have anything to do with it?—Yes; Lord Richard Grosvenor induced me to reconsider my views, which, as he knew, were in favour of the ferry.

3908. The great advantages which have been put forward in favour of his tunnel have been, in the first place, the saving of transhipment, both for passengers and goods; and secondly, the saving of physical disturbance, which has been spoken of; you are of opinion, from what you have stated, that the vessel which you have proposed to construct would obviate both those difficulties?—Yes, it would entirely obviate transhipment, and, excepting in very rare cases indeed, of peculiarly sensitive people, the discomfort of sea-sickness.

3909. I suppose that vessel is so long that she would almost drive through instead of riding over each wave?—She would rest upon several waves.

3910. Upon three instead of one?—Yes; that would be the effect of a large vessel; in the short chop of the sea, she would almost have a level keel.

3911. You gave an opinion with regard to the practicability of the tunnel; you said that those people who are promoting it expect only to have to pass through the lower chalk; but is there any certainty, in your opinion, with regard to that; is it the fact that nothing but soundings have been taken, and no borings?—That is so; borings could not be taken, therefore it never can be made a certainty until the tunnel has been completed; that opinion would be agreed to by all engineers and practical people.

3912. And there might possibly be fissures which no one could foresee; and there might be some difficulty in construction even after a certain part of the tunnel had been completed?—I think that is quite probable; the only difference of opinion with engineers could be as to the greater or less degree of probability; no man would be justified in saying that it could be done, or that it could not be done.

3913. What were the objections to your ferry-boat system when it was first contemplated by you and brought before the public?—The only serious difficulties that ever occurred were not connected with the work itself, or its perfect feasibility, but with the matter of harbours, which I have described to the Committee.

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3942. In answer to a question put to Sir Edward Watkin, No. 198, in his evidence, he made his reply: "Nobody will ever find any money in it." Now as I understand you think there would be no difficulty in regard to that?—I am quite certain that there would not be.

3943. Then he went on to say: "And when it is done nobody will go by it"?—Exactly, the same thing was said of the Metropolitan Railway. People said it never would be made, and if it was made, it would never be worked; and if it was worked, nobody would ever travel by it. It has been made, it is worked, and a great many people travel by it.

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Extract from the Draft Report proposed by Sir Henry Hussey Vivian upon the proceedings of the Joint Select Committee of the House of Lords and the House of Commons, on the Channel Tunnel, 1883.

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43. Your Committee did not feel called on fully to enquire into this and other alternative schemes, but it may be right to mention that Mr. Fowler's proposals have been twice investigated and approved by Committees of the House of Commons. In the first case the Bill was withdrawn after passing the Commons, owing to the assent of the French Government to the construction of works on the French coast not having been obtained in time; in the next case the Bill passed the Committee of the House of Commons, but was rejected by the Committee of the House of Lords in 1872.

44. The scheme was supported by 13 of the most eminent men of the day, whose experience as naval officers, engineers, and shipbuilders is entitled to great weight. Sir George Elliot stated, in answer to Question 4358, that in his opinion steamers could be constructed to take a load over to France without breaking bulk. He said, "you would get in at Charing Cross and run right away to Paris without getting out of the carriage, and it would be the pleasantest way of going."

45. The chief difficulty which existed in 1872, viz., the absence of harbours of sufficient size and depth to accommodate vessels of this class, will shortly be removed by the completion, at Calais and Boulogne, of the great works now in progress at those ports, whereby a depth of water of 25 feet will be obtained, while Mr. Fowler's vessels require only 12 feet, and by the construction of an extensive deep water harbour at Dover, which will enable ships of any size to enter at all times of the tide, and thus facilitate and enlarge our commercial and social relations with France in time of peace, and will shelter our fleet in time of war.

46. Whether the full advantages contemplated by Mr. Fowler will be ultimately realised or not, there can be no doubt that upon the completion of these harbours the inconvenience to which passengers are exposed will be minimised, and the length of time taken in the transit will be still further reduced. So far as goods are concerned, either the trucks will be taken over as Mr. Fowler proposes, or as Sir Arthur Otway described to the Committee, by the use of boxes exactly fitting the truck, and lifted on to and off the steamer by steam cranes as now used at Folkestone, but not on the French side, the disadvantage of breaking bulk will be avoided. Sir A. Otway further pointed out that except in the case of full truck loads bulk must be broken on the French side, in order to distribute goods consigned to various places.

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Extract from the Draft Report, proposed by the Earl of Camperdown, upon the proceedings of the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, 1883.

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17. Mr. Fowler, the eminent engineer, advocates a system of steam communication by means of very large ships, which would be able to transport a whole train, being, in fact, very similar to the scheme which he proposed to Parliament many years ago, when the condition of the harbours on both sides of the Channel was the great impediment to success.

18. With regard to Mr. Fowler's scheme, the Committee have heard nothing from his opponents, which inclined them to doubt its feasibility, or to think that a Channel tunnel would possess much advantage in point of speed.

19. Very competent witnesses who are uninterested parties agree with the Committee on the latter point.

Extract from the Draft Report, proposed by Sir Massey Lopes, upon the proceedings of the Joint Select Committee of the House of Lords and the House of Commons on the Channel Tunnel, 1883.

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14. Some consideration was given to a counter-proposal of Mr. Fowler (the well-known engineer) for establishing *a steam ferry* across the Channel, which, by means of large vessels, would give a through communication for passengers and goods, without any change or transfer, and in which there would be comparatively very little motion. Mr. Fowler's scheme is not a novel one; it twice passed the House of Commons, in 1870 and 1872 (the last time unanimously), after a most elaborate investigation, and was only thrown out in the House of Lords by the casting vote of the chairman.

Since that time improved harbour accommodation at Calais and Boulogne, and the recent determination of the Government to construct a harbour at Dover, has tended much to facilitate the scheme, and difficulties which then existed have been removed.

Mr. Fowler expressed the greatest confidence in the facility of carrying out such a steam communication. He said there would be no difficulty in obtaining the requisite capital; that the passage to and from the Continent would be equally expeditious as by a tunnel; that arrangements might be made with the Custom-house for dealing with luggage *in transitu*, and that in two or three years the whole project might be accomplished.

This proposal seems to be free from the obvious objections of the tunnel scheme; it would involve no national risk; the military difficulty would be avoided, and the safety and security of the country would in no way be compromised by it.

It does appear only reasonable that, before attempting a submarine communication, which involves so many serious difficulties, the capabilities of steam communication should be thoroughly exhausted.

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