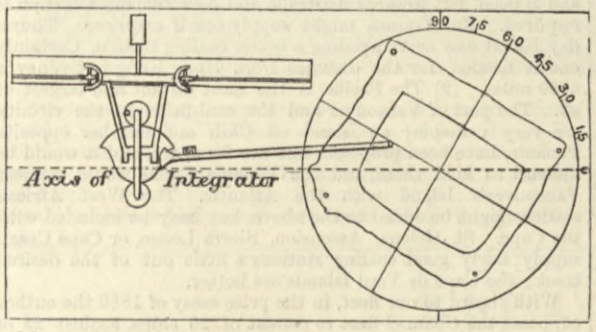
THE INSTITUTION OF NAVAL ARCHITECTS.

ON Thursday, the 3rd inst., the meeting of the Institution of Naval Architects was resumed at twelve o'clock, and, except a short interval for lunch after two o'clock, those present had perforce to convince themselves that few things could be much more interesting than the graphic and combined graphic and analytic methods of estimating and depicting the stability of ships. The first paper read was by Mr. W. Denny "On Cross Curves of Stability, their Uses and a Method of Constructing them, obviating the necessity for the usual Correction for the Differences of the Wedges of Immersion and Emersion." Ordinarily, a stability curve gives the stability of a ship at an assumed draught, and the length of the righting arm varies with the angle of inclination. These cross curves, on the other hand, are made each at a given and invariable angle, and have the righting arm varying with the draught. The cross curves are constructed for a number of angles, either 10, 15, or 20 deg. apart, and each ranging throughout all the draughts of the ship from the launched to the fully loaded condition. The curves so made for all positions at all draughts are circumscribed by Amsler's integrator for area and moment of area, which are plotted off as ordinates at the distances apart of the assumed transverse sections on a base line representing the length of the steamer between extreme displacement ordinates. Curves being drawn along the top of the ordinates, the integrator is again employed. The quotient obtained by dividing the area of the curve of moments by the area of the curve of areas, is the length of the righting or upsetting arm, as the case may be, with the assumed centre of gravity. The product of the area of the curve of areas and a suitable multiplier is the displacement at a given draught. Doing this for each of the draughts at a given angle of inclination, the necessary figures are obtained for setting off upon a horizontal base line as abscissæ the calculated displacements, and at these points ordinates representing lengths of righting arm. A curve through these points is the cross curve of stability for the given angle. To avoid having to move the integrator for each angle, the tracing of the ship's section is mounted, as shown in the annexed diagram, on a turntable disc. Mr. Denny's paper credited

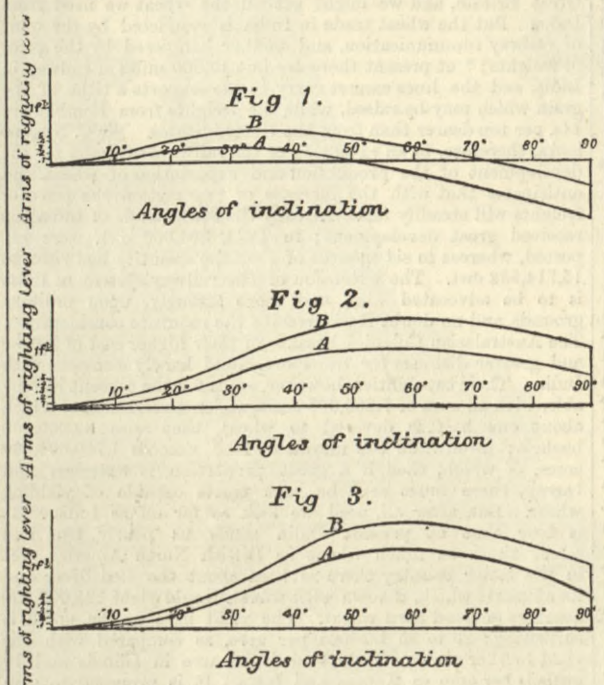


this method to Mr. Fellows, and explained that great improvements had been made upon it by Dr. Amsler and by Mr. Purvis, by which the whole operation was much simplified. The discussion on this paper was taken with that of another by M. V. Daymard, "On a New Method for Calculating, and some New Curves for Measuring, the Stability of Ships at all Angles of Inclination." This paper commenced with a short account of what had been done in stability calculations before the recent epidemic on the subject, and part of the discussion was occupied with a little zealous outburst as to priority; but this was sufficiently absurd to become uncomfortable for one or two speakers, and it was stopped. Dr. Woolley pointed out that the cross curves method and M. Daymard's were merely developments by repetition and integration of the simple stability diagram. Sir E. J. Reed, Mr. John, and Mr. White took part in the discussion, and Mr. Biles observed that what was required was a system of typical curves by which the stability of any ship could be immediately gathered.

After a few minutes' interval, a paper was read by Professor F. Elgar

ON THE USE OF STABILITY CALCULATIONS IN REGULATING THE LOADING OF STEAMERS.

Professor Elgar said he had found no shipmasters who could or would apply stability curves, and that in advising upon how a steamer should be treated and loaded so as to be kept safe in respect of stability, he stated, first, the quantity of ballast, if any, that is required to enable her to stand up when quite empty, without water in boilers or tanks, coal in bunkers, and with a clean-swept hold, and to be stiff enough for all working requirements in dock or river; secondly, if she is to be employed in carrying homogeneous cargoes, what proportion of the space in the 'tween decks it is safe to fill with such cargo, after the holds are full, and what weight of ballast is required in the bottom to enable the vessel to be loaded to her maximum draught with such cargo; thirdly, if required to carry two or more kinds of homogeneous cargo, such as grain and cotton, grain and wool, grain, meat, and wool, &c., the best mode of stowage, and whether or not the space in the 'tween decks can be filled with the lightest of the cargoes; and in what circumstances ballast, and how much of it, will be required; fourthly, if not intended for homogeneous cargoes, but for general cargoes, or partly homogeneous and partly general, the average densities of the general goods for various ports is arrived at after a little experience, and the same system adopted. The main point is, to state what space, if any, must be left unfilled in the 'tween deck cargo spaces, with the different descriptions of cargo, and what ballast, if any, is necessary if the vessel is to be loaded to her maximum draught; fifthly, if the consumption of the coal diminishes the stability materially, as is often the case in some classes of steamers, to call prominent attention to this fact, in order that the captain may not be misled by finding his ship appear to be rather stiff on commencing a voyage. The possible consumption of coal is, of course, taken into account in fixing upon the limits that should be imposed upon the stowage in all the conditions named; and, sixthly, if there appear to be any circumstances in which a tendency towards unstability may arise they are described, and suitable precautions suggested. The main points discussed in Professor Elgar's paper were:—(1) The form in which the results of stability calculations can be put before owners and masters of mercantile steamers, so as to be of the greatest practical use in loading such steamers, and regulating their stability in accordance with the requirements that may arise; (2) the fundamental difference which exists between the relation of righting moments at large angles of inclination and range of stability to metacentric height in the various



types of steamers—as shown by Figs. 1, 2, and 3—such relation making it necessary to fix the minimum metacentric height that should be allowed with due regard to the righting moments at large angles of inclination in some cases and unnecessary to do so in others; and (3) the minimum metacentric height that may be regarded as consistent with safety in cases where range of stability and the righting moments at large angles of inclination are so ample as not to call for consideration.

On the whole, the discussion on this paper leaned, as far as numbers are concerned, towards the conclusion that it was not desirable that captains should have stability curves to consider or to be guided by, as greater mistakes might be made through want of complete knowledge in this respect than by following the dictates of experience merely. Some whose opinions are likely to carry weight, including Mr. Rothery, were distinctly in favour of supplying captains such stability curve information with respect to their ship as would form what Mr. Martell cynically designated "directions for use," though he expressed himself in favour of providing captains with that which would show them their margin of safety under different conditions of loading. Mr. Denny said that he had been in the habit of providing shipowners with full information of this kind with his ships, and especially with reference to the stability as affected by the burning out of the coal, which he believed had sometimes brought the centre of buoyancy below the centre of gravity of the ship, and suddenly caused unexplained loss. Mr. Macfarlane Gray relieved the dulness of the stability discussion by showing how, by reference to a child's cradle, he had been able to make it clear to captains what metacentre meant, and how it was that the metacentric height should be kept as great as possible. Mr. Rothery referred to the apparent value of Taylor's indicator for captains' use; and Professor Elgar replied on the general question, repeating the difficulty he saw in the use of any form of stability curves, and referring to the instructions he had been in the habit of giving, as he had found that even the most intelligent captains were averse from the use of stability curves. He also referred to the difference between the stability of a ship when still and when under way.

The proceedings of Thursday were resumed in the evening at 7 p.m., when a paper was read by Mr. J. Howden on the combustion of fuel in furnaces of steam boilers by natural draught and by supply of air under pressure. In this paper the object of the author was to give some account of what he had done with an experimental boiler with forced draught, and to compare what he thinks he probably may be able to do after further experiments with what is done in coal consumption of steam boilers at sea. He assumes, amongst other things, that by using air under pressure from a fan that he will be able to do with less air, and that his products of combustion will pass away at about 300 deg. lower temperature than when natural draught is used. Upon the latter assumption, and also assuming that but 15 lb. of air are consumed per 1 lb. of coal consumed—12·2 lb. are chemically necessary to convert 1 lb. of carbon into carbonic acid—he makes calculations and arrives at conclusions which are as remarkable in the fact that they have found publication, as for the recklessness of the assumptions on which they are founded. Taking the boilers of one large ship as an example, he finds that heat, equivalent to 1191-horse power, is required to obtain natural draught, while upon his assumptions he can do the same work with fans with 18·6-horse power. His assumptions were not supported by any experimental facts or figures, and yet the Institution of Naval Architects invites members to waste time by going to hear such a paper read. Has the Institution no one to check such papers before putting them into print? It is almost unnecessary to say that the discussion on the paper was entirely against the author, and it would be useless for us to occupy space by reproducing the well-known facts with which those who took part in it expressed their disapproval of the baseless conclusions set forth.

The second paper read was by Mr. A. B. Brown on the application of hydraulic machinery to the loading, discharging, steering, and working of steamships. This paper we shall publish in full, and the first part of it will be found on page 274. The discussion upon it was brief, and was in favour of the kind of machinery described. Mr. Percy G. Westmacott referred to the accumulator described—Fig. 1, page 277—and said that some years ago he had employed, instead of a steam accumulator, air under a pressure of from 700 lb. to 800 lb. per square inch in some screw hopper barges. This had been entirely successful, and had given no trouble from 1865 until now. Mr. Denny remarked that the economy in repairs with hydraulic machinery was so great that the time alone saved in steamships from this cause was soon worth the whole extra cost of the machinery. Mr. Brown briefly replied.

The third paper read was by Mr. J. F. Hall,

ON CAST STEEL AS A MA ERIAL FOR CRANK SHAFTS.

In this paper the author commences with some reference to the cause and results of the imperfections in steel ingots, but all this has so frequently been dealt with that we may omit it. Speaking of the effect in steel forgings of the blow-holes and bubbles in ingots, he said:—It is a well-known fact that a number of the "blow-holes" have an oxidised surface, and oxygen is a foe to successful welding. In a small ingot they may be successfully treated in a variety of ways, but in the larger ones they are very often not welded at all, but simply so closed together that a careful inspection cannot perceive them. To illustrate how easily this may be done, he showed a drawing of a piece of ordinary steel boiler plating bent over cold twice, and flattened under the hammer so close that when polished on the face the division lines were partly lost sight of to the naked eye. No one would presume to say, however, that these parts were even stuck together. The difficulty is generally got over, both for forgings and castings, by leaving a sufficient length and size of head to feed the lower portion of the casting, which, by its action of consolidation, sucks away from the top part, or head. This head is subsequently cut off. In forging, however, this is seldom done till after the article is finished, and it is then a pure matter of guess-work, whether the whole of the pipe left in the central part by closed blow-holes be cut off or not. At the place where it is cut off, the pipe may have been closed, either by the forging, or the very action of cutting, and appear sound, whereas a few inches further would develope a hole considerably enlarged. This enlarged hole is probably caused by the action of hammering on a round body, drawing away from the centre what at first was only a small cavity. The author had seen such an opening in a 20in. ingot, which at first was not 1in. diameter, enlarged by the time the ingot was reduced to 14in. to such an extent that a man could get the whole of his arm into it. There is no fear of anything of this kind in a plain casting, provided, of course, sufficient head has been given it. The pipe is either cut clean away, or, if any of it is left, it is clearly perceivable as a small round hole, that can be dealt with as deemed advisable. In the case of a crank web, it would, of course, entail the casting being thrown on the scrap heap. In the case of crank shafts which would be cast on end, it should not necessarily do so. Many engineers prefer to have small holes through the pins and journals of their shafts, and the author had used them in sheet and rod rolls for some time past. Therefore, if a small portion of pipe is left in the end of a shaft, all that is required to do is to bore it out smooth, and continue it right through the shaft if thought advisable. Many of the objections to forging of large masses of steel for crank shafts also apply to tempering in oil, a practice which in some quarters is adopted both in conjunction with and in place of forging. The danger of contracting an outer skin on to an expanding interior in this method is even more intensified than by cold forging. Besides, it is unnecessary, as the action of the oil can never penetrate far into the material, and if it is intended as an annealing operation, there are far better plans than this when dealing with large cranks, &c. As for that fascinatingly-worded theory, "fluid-compressed steel," the author thought he was not wrong in saying it is now entirely exploded and proved to be a delusion. As before remarked, he had had abundant opportunities through his connection with the firm of William Jessop and Sons, of Sheffield, for carrying into practice these theories regarding the casting of solid crank shafts, parts of crank shafts, connecting-rods, and propeller shafts. Examples of different types made by that firm as simple castings without any forging or further manipulation whatever were illustrated by diagrams. Altogether there are over forty of such shafts made by W. Jessop and Sons, at work, which, up to the time of writing, are all doing well, and giving every satisfaction. In fact there has not yet been a single failure with any cast shaft of their manufacture. In conclusion, he would warn the members of that Institution that he did not wish it to be understood that any kind of steel castings will do for such important parts of a marine engine. By far the larger proportion of the so-called steel castings would be perfectly useless for these purposes. The paper concluded with tabulated results of tests of the steel castings referred to.

In the discussion on this paper Mr. Reynolds objected to cast shafts, because his experience had shown that cast shafts would crack in the journals. He thought forged steel shafts as cheap as cast steel, although low carbon steel could now be cast, and he objected to the statement that the action of the steam hammer did not penetrate to the centre of large forgings. But he afterwards went on to speak of the successful use of cast iron in mill shafts, and in rolling mill fly-wheels, one of which he knew had been in use many years weighing sixty tons, that had been brought from speed to standstill on cast iron shafts in two revolutions. He further said that he would undertake to make successful cast iron shafts for propellers, provided he were supplied with flexible couplings at intervals. Mr. Martell spoke in favour of cast steel, and remarked that steel castings would, he believed, give good results, unless they were partly forged, in which case they would break where forged. He believed in the future successes of steel castings for the purpose referred to, although few manufacturers could yet make them successfully. Mr. W. Parker referred to the results of his experiments with forged and cast steel engine parts, as described in a paper read before the Institution, and Mr. Hall replied to the discussion, saying that a good deal depended on the care taken with the ingots in cooling when intended for forgings, and expressing his belief that although for many things forged steel was better than cast, yet that cast steel in crank and propeller shafts, when properly founded, was less liable to those internal differential stresses which initiated destruction of large forgings.

There is much that might be said in favour of Mr. Hall's conclusions. This paper concluded the proceedings of Thursday.

SIR CHARLES NUGENT ON IMPERIAL DEFENCE.

In another page we have commented on the address recently delivered by Sir C. Nugent. We give here the substance of his argument. Sir Charles Nugent observes that the most efficacious method of protecting our commerce and Colonies in war would be to shut the enemy's ships in his ports, but this is harder than in former times. Vessels are generally fewer though more powerful. Steam is against the blockading ships who have to use coal and suffer from fouling, while the vessels in port use none and remain clean. Should vessels be free to attack our commerce, high speed and manœuvring power would enable a cruiser to do mischief even to shipping escorted by powerful but comparatively slow armour-clad ships. To meet such attacks "auxiliary cruisers" might be instituted by arming swift merchantmen with long range guns of moderate calibre. The naval authorities have in view the selection and engagement of such ships, but it is a question if anything has been done to secure a supply of guns, yet this would be a waste of many months, if not years, at the lowest estimate. This step would be in accordance with the principle advocated in his first paper of depending upon local means for local defence, and leaving our fleet free to act in masses. Under any circumstances the defence of our territories beyond the seas will demand all our energies. How completely our existence is bound up with our commerce, the figures below will show, and the tendency is ever in the direction of relying more and more for food on foreign countries. In 1882 the importation of wheat reached the figure of 186 lb. per head of population,* flour and other grain about as much more, and meat provision 50 lb. per head.

The exact figures are—

		£
Wheat, 64,171,622 cwt.	worth	33,690,105
Flour and other grain	worth about	30,000,000
Meat and meat provision		35,934,221
Live cattle		9,214,417
Total		108,687,953

The rate now is £3 1s. 7d. per head, whereas twenty years ago it was only £1 14s. 5d. per head of population.† Now, this matter of food supply is of the utmost importance; for what is to become of us, if it be stopped even for a short time? Moreover, it is likely to become year by year of more and more importance as the tendency of farming in this country is from grain to pasturage; thus within a comparatively short period, 1,000,000 acres,‡ about one-fourth of our grain land has gone out of cultivation in England, and in the same period about 1,200,000 of root crop land in Ireland. Precarious as is this supply, it is rendered more so by the places from whence it comes, the distance it journeys, and the number of lines by which it travels. Take a few of the most important items:—

	£	£
Wheat, United States—Atlantic	13,759,939	
,, ,, Pacific	6,323,029	
Maize ditto	7,420,292	
Flour ditto	5,968,746	
		33,472,006
Wheat, Russia	2,168,462	
Oats, ,,	1,975,836	
		4,144,298
Wheat,§ British India (10s. 6d. per cwt.)	3,844,822	
,, ‖ Australia	2,108,636	
,, British North America	3,021,677	
		8,975,125
Oats, Sweden	1,241,623	
Maize, millet, Roumania	1,981,942	
		49,814,974

Of this large total, which is four-fifths of the annual importation, little more than one-fourth is imported from our own possessions; or the remaining one-fifth being imported in small quantities from foreign countries, four-fifths of our annual imports of food are derived from foreign countries. This is not a felicitous condition of things, and the question arises, is it inevitable? Some will no doubt reply that it is a consequence of the universal law of supply and demand, and cannot be altered without recourse to some form of protection. Nevertheless it appears as if the streams of food may, by a little management, be directed to this country mainly, if not altogether, from our own possessions.

India has unrivalled facilities for growing wheat—vast fertile plains, upon which some of the most nutritious wheat in the world is grown, and practically an unlimited quantity of the cheapest labour, with an enormous population, living principally on millet and rice, wanting none of the luxuries and but little of the necessaries of life. Wheat can be raised in India at a prime cost so low that, in this respect, no other country can compete with it. In 1879 20,000,000 acres were under wheat, and produced 26,000,000 qrs., yet in the Central Provinces a new wheat field of more than 17,000,000 acres may be found, and in the Punjaub are 9,000,000 acres available for, but not now devoted to, wheat. In other parts of India also are large areas available for growing wheat; in fact, the wheat area of India is seven times as large as that of Great Britain, and we might get all the wheat we need from India. But the wheat trade in India is restricted by the want of railway communication, and farther hampered by the price of freights;* at present there are but 10,000 miles of railway in India, and the lines cannot carry to the seaports a tithe of the grain which may be raised, while the freights from Bombay are 14s. per ton dearer than from the United States. Sir C. Nugent looks, therefore, to an extension of the railways of India for the development of the production and exportation of wheat, and anticipates that with the increase of exportation the price of freights will steadily fall. Already the wheat trade of India has received great development; in 1873, 394,000 cwt. were exported, whereas in six months of 1883 the quantity had risen to 15,714,982 cwt. The extension of the railway system in India is to be advocated also, and more strongly, upon military grounds, and no doubt it will receive the requisite consideration. The Australasian Colonies, because of their higher cost of labour and greater distance for transport, could hardly compete with India. Their capabilities, however, seem for the present illimitable, with an area of 7,000,000 acres under cultivation, of which about one half is devoted to wheat, they raise 39,000,000 bushels; meanwhile the unowned land exceeds 1,700,000,000 acres, of which, though a great proportion is waterless and barren, there must still be vast tracts capable of yielding wheat. But, after all, need we look so far off as India? It is true that at present India sends us nearly two and a-half times as much wheat as British North America, yet in the latter country there is land about the Red River and its affluents which, if sown with wheat, would yield 125,000,000 quarters of good hard wheat. The yield here in the north is surprising; 23 to 35 bushels per acre, as compared with the yield further south, viz., 17 bushels per acre in Illinois and 10 bushels per acre in Kansas and Iowa. It is proposed to gain access to this region, *viâ* Hudson's Bay, entering at Churchill Harbour, and thence by railway, 350 miles in length—to be made—to Lake Winnipeg, so that the distance from Liverpool to the edge of the wheat-producing area is 1500 miles shorter than *viâ* Quebec, and 200 shorter than *viâ* New York. The distances by water are—

Churchill Harbour to Liverpool	2926 miles.
Montreal *viâ* Cape Race to Liverpool	2990
New York to Liverpool	3040

Already there is uninterrupted water communication, 2384 miles in length, from the mouth of the St. Lawrence to Duluth, the great emporium for northern grain at the point of Lake Superior, and rail and water communication as far as the Saskatchewan, with the exception of a gap in the line of rail between Lake Superior and Sturgeon Falls on Lake Nepissing. The Hudson's Bay route possesses the advantage of being so far to the north, never coming further south than the 60th parallel of north latitude, that it is more easily protected from attacks from the south, while there is no chance of its being assaulted from the north. It is evident, then, that it is not absolutely necessary to look to foreign countries for our food supplies; we should be able to obtain all we want from our own resources; and there is this further advantage to us in this position, that when the emergency arises we are in no doubt about the sources of supply. We have both ends of the lines of supply in our hands, and can concentrate all our energies upon keeping these lines open. For this purpose it is probable that steam confers certain advantages; at least, it seems to render convoy sailing more certain, and with freight steamers selected for speed, and for uniformity of speed, there may be comparatively little occasion for fighting.

The food supply is here considered in preference to other branches of commerce, as we could not exist long if it failed. The problem of keeping the seas open is difficult because our small number of ships could not be increased suddenly, especially our armour-clads, whereas combinations of unfriendly nations may be effected with startling rapidity. General Collinson attributes our twenty years' war, dating from 1790, and our national debt, to our navy being allowed to fall too low. In 1797 we were actually shut up in these islands although we had 500 ships afloat. Mobility at all events must as far as possible do duty for ubiquity, and for this we must have fortified coaling stations, and some of these should be refitting stations where ironclads could be docked. These would form as it were naval entrenched camps either in mid-ocean like Malta, Bermuda, or Hong Kong, or on the coast of extensive possessions, as Halifax, Trincomalee and Simon's Bay. Failing this an injured ironclad may easily remain useless to the end of a war. The cost of the necessary docks for our ironclads is considerable, but steam at all events enables a smaller number to suffice. The cost of these strategical points in mid-ocean should fall on England herself. So in a greater or less measure should that of all the strategical bases. Beyond this the Colonies should be encouraged to take measures for their own defence. Some have already done so. Canada by the construction of fortresses and the enrolment of a militia; Australia by the construction of coast batteries, by the provision of coast defence vessels, and the enrolment of volunteers; the Cape by the enrolment of a mixed force. We can supply munitions and aid in organisation. One most important matter is the telegraph. It is no doubt a great evil to have a War Minister who fancies himself a military genius in direct communication with a general, but direct communication not laid through possibly hostile countries should be secured as far as possible with our principal stations. Surely the surplus revenue of the postal telegraph department, at present about £300,000, might not unfitly be devoted to the work of completing the gaps in our present chains of communication.

As to the application of our principles of defence, the waters of the world may be divided into nine portions, or naval stations:—(1) The Channel; (2) the Mediterranean; (3) North American station; (4) South American station; (5) the Cape; (6) Indian; (7) Australian; (8) China; (9) Pacific. These are provided for refitting as follows:—(1) Channel, by the home ports. (2) The Mediterranean, by Gibraltar and Malta; but a port is needed about Port Said. (3) The North American station, by Halifax, Bermuda and Jamaica, and Antigua. This is a specially important station. The trade over it represents £201,500,000, and some day, by means of the Canadian Inter-Colonial Railway and the Panama Canal, it may contain the best route to the North and Mid-Pacific. (4) The South American station has only the Falkland Isles, but the Cape may assist. The trade is £45,000,000. (5) The Cape is important, as well as all the Cape and also the Australian and Straits trade in part pass. Docks are wanted at Simon's Town, as well as increased defences. In case of the Suez Canal being closed, the Cape becomes specially valuable. The coalfields should be developed at the Cape and Natal. A submarine cable should be laid from England. The Cape has special difficulties; she has 3500 regulars, but she has a native population of 3,000,000 natives of a troublesome kind, as well as the complication of the Dutch element, which would be much more serious if Holland fell into the lap of Germany. (6) Assuming the defence of India proper to be provided for by the Indian Government, with its army of 190,597, and its harbours attended to, India concerns us here as a link in Chinese and Australian trade. Bombay is an admirable fortified harbour, and we chiefly need to secure the southern outlet to the Red Sea, through which and the Suez Canal pass what has been estimated as £152,000,000 worth of trade, but which is probably considerably under £100,000,000—that is, above three-eighths of our total trade—as well as 12,000 to 15,000 soldiers annually. For this Aden is available; it is well fortified, but something may be done at Perim. In Ceylon, Trincomalee is well fortified, and Colombo is receiving attention. Mauritius, with Port Louis, is valuable, lying between the Cape and Ceylon, but it has not been developed so as to keep pace with our increasing wants. Events at Madagascar might have invested it with special importance. As long as India is held from Russia we need hardly anticipate very serious interference in this part of the world. The Asiatic seaboard of Russia is a long way off. European Powers would come by the Cape, so that for this reason that station should be strong. A neutral canal has been talked of, but it would practically be in the hands of the Power that held it; but it is so easily blocked that we cannot afford to ignore the Cape. (7) Australia calls for most attention. It is rich enough to tempt other Powers. It is peopled by 3,000,000 of our own countrymen, which should double in twenty-five years. It has an annual trade of £100,000,000. The nearest coaling stations are Ceylon and Singapore, both over 4000 miles distant from Melbourne. St. George's Sound, 1200 miles from Melbourne, might be fortified. Melbourne and Sydney, 650 miles further east, are well defended. (8) China has Hong Kong, but it should be improved. The Chinese, Japanese, and Strait Settlement trade is important also; the action of Russia in this region necessitates care in us. It is hardly worth while to establish a station much nearer to Japan, but something might be done by making a closer alliance with Japan. Singapore, 1500 miles from both Ceylon and Hong Kong, is being improved, and is good, but towards Australia and New Zealand a station is required. New Guinea might supply one if acquired. Thursday Island may serve pending a better coaling station. Certainly one is needed, for the distance from Hong Kong to Sydney is 6000 miles. (9) The Pacific is the most distant and largest of all. The port of Vancouver and the coal-fields in the vicinity are very valuable; an island off Chili and another opposite Panama, have been proposed, but are far apart, and it would be difficult to hold them, and the Panama Canal would connect Vancouver's Island with the Atlantic. The West African station might be added to the above, but may be included with the Cape. St. Helena, Ascension, Sierra Leone, or Cape Coast, supply fairly good coaling stations a little out of the desired track; the Cape de Verd Islands are better.

With regard to our fleet, in the prize essay of 1880 the author supposes the Channel fleet to consist of 20 ships, against 25 of the enemy. He has 10 in the Mediterranean and 10 elsewhere. Our actual armoured fleet is about 11 ships stronger than this. Nevertheless, we could not safely detach more ships abroad, so that the foreign stations would have to content themselves with 10 armour-clads and 32 cruisers. Say that there were in all:—(1) A Channel fleet of 20 ships; (2) a home fleet of 7 coast ships, 9 auxiliary armoured ships, and 31 cruisers; (3) 10 ships in Mediterranean; (4) 10 armoured and 38 cruising ships for all other foreign stations. In 1805 England had (1) a Channel fleet of 29 liners and 35 frigates, &c.; (2) a home force of 4 liners, 74 frigates, &c., besides 18 liners in port fitting; (3) a Mediterranean fleet of 12 liners; (4) off Spain and Portugal 14 liners; (5) America and West Indies, 8 liners; (6) East Indies, 8 lines; besides 10 frigates in the Thames, 46 gunboats at the Nore, and a special flotilla for general coast service of 660 vessels. England was then roused thoroughly. France, Spain, and Holland brought 48, 29, and 15 liners respectively, so that England was superior to these, and we had no stations at the Cape, China, &c., and we had only about one-seventh of our present commerce to protect.

Our present navy is sometimes said to be actually inferior to that of France. The "Statesman's Year-book" gives England forty-four ironclads and ten building; France thirty-six and twelve building. We have seventy-nine unarmoured and France thirty-four. Our Iris is swifter than her Tourville. We have gun boats in the proportion of 3 to 2; but we have 3800 miles of coast, France 1260. Our respective navies, on the whole, appear to be in the proportions of 6 to 5 about, but it ought to be as 3 to 2. Our coaling stations and auxiliary cruisers deserve special attention; the manning of the latter is a difficult matter.

The lecturer then specially considered the defence of Australia and New Zealand, and the efforts made as to coast ships, and volunteers, and militia. The whole question appears specially serious when the tendency of large Powers to absorb small ones is remembered. When France, with 37,000,000 inhabitants at 183 per square mile, and Germany with 45,000,000 at 213 per square mile, to say nothing of Russia with 84,000,000 at 40 per square mile, increase to England's rate of 445 per square mile, the fate of Holland and Belgium may well be questioned, and our existence as a first-class Power must surely depend on our relations with our Colonies. The only way by which Colonies can be made to have a strong interest in our Government is to give them a share in it, either by direct representation, or by agents-general, or some Council. Without going into this, the importance of federation may be easily seen. Canada has wonderfully accomplished a federal union of British North American colonies. With its active militia of 40,000, and 600,000 reserve, it is a real source of strength. India is a tremendous question. The difficulty of holding a native population of 250,000,000 by 130,000 English is such that it can only be possible by a most firm, wise, and conciliatory administration.

* Value 19s. per head.

† Other articles of food—

	£
Sugar and dried fruits	27,000,000
Tea, &c.	10,000,000
Wine	7,000,000
	£44,000,000

So that we import £153,000,000 worth of food products, whereas France only depends upon foreign countries for £11,000,000—

	£	
She imports	54,500,000	food products.
exports	43,500,000	,,
Difference	11,000,000	,,

‡ Great Britain, land under cultivation—

	1883.	1882.
Wheat	2,613,147 acres.	3,003,960 acres.
Barley	2,442,234 ,,	
Oats	2,975,377 ,,	
Total	8,030,758 ,,	
Potatoes	543,456 ,,	

§ Last year there was a marked advance in Indian wheat, and this fraction rose to one-third; thus, the exports which in 1881 were 7,327,666 cwt., in 1882 were 11,243,497 cwt., in 1883—ten months only—19,500,000 cwt., of the value of £11,327,000.—*Morning Post*, 15th March, 1884.

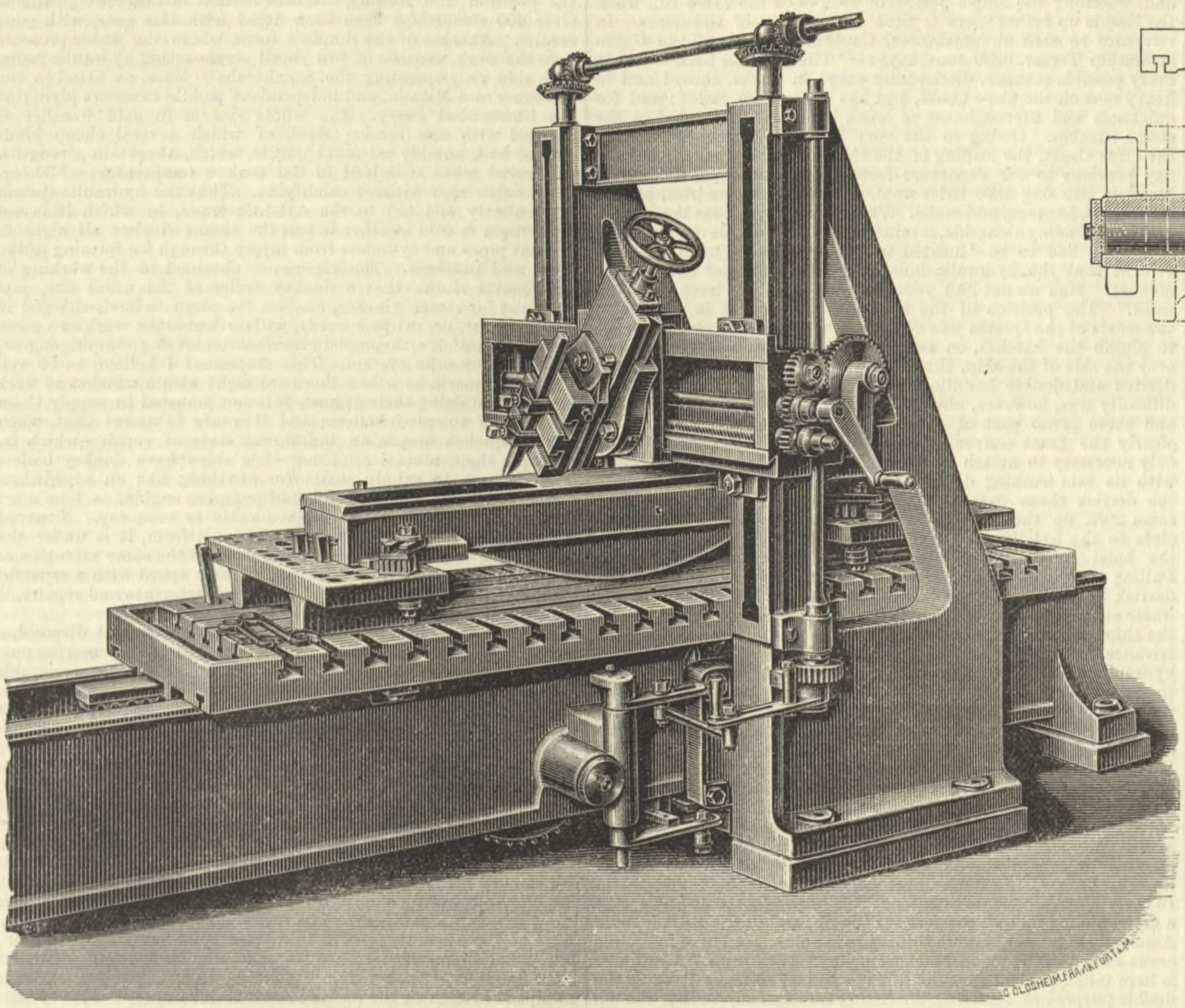
‖ New Zealand is far above the others in quantity and average; viz., 22·5 bushels of wheat, 28·75 oats, 22·25 barley; Tasmania follows next after New South Wales.

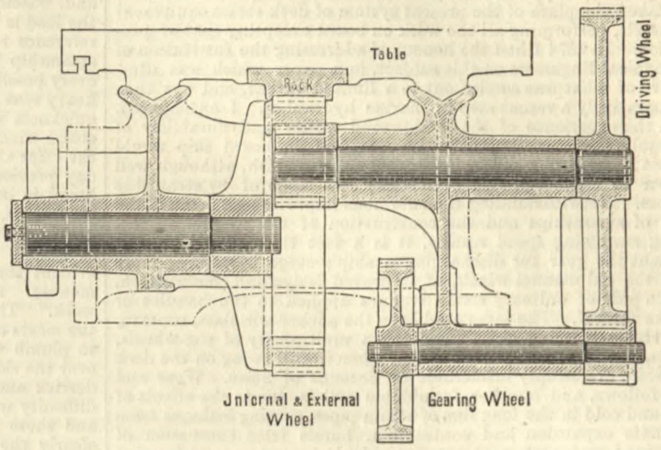
* Bombay, £1 1s. per ton; United States, 7s. per ton; San Francisco, £1 2s. 6d. per ton.

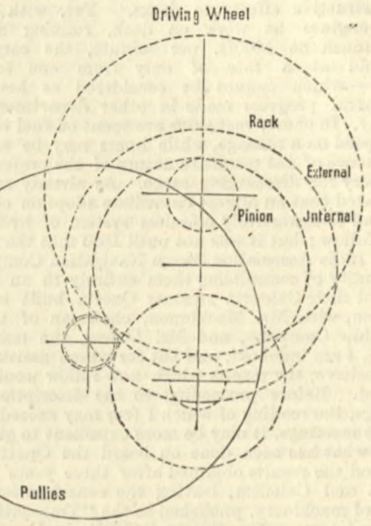
In the lead production of different countries Spain still holds the first place, the amount reaching some 120,000 tons in one year, or one-sixth more than America, which comes next on the list, while Germany follows with 90,000. Of Spain's total production some 67,000 tons are derived from one district, that of Linares, in which more than 800 mines are registered. Of this large number, however, only a comparatively small proportion are actually worked on a large scale, and there are only about fifty in which steam power is used. The total number of steam engines employed is stated to be 130, nearly one-half of this number belonging to English companies; in fact, most of the mining machinery and pumping engines in all the mines are of English make.

PLANING MACHINE.

MESSRS. WILKINSON AND LISTER, KEIGHLEY, ENGINEERS.



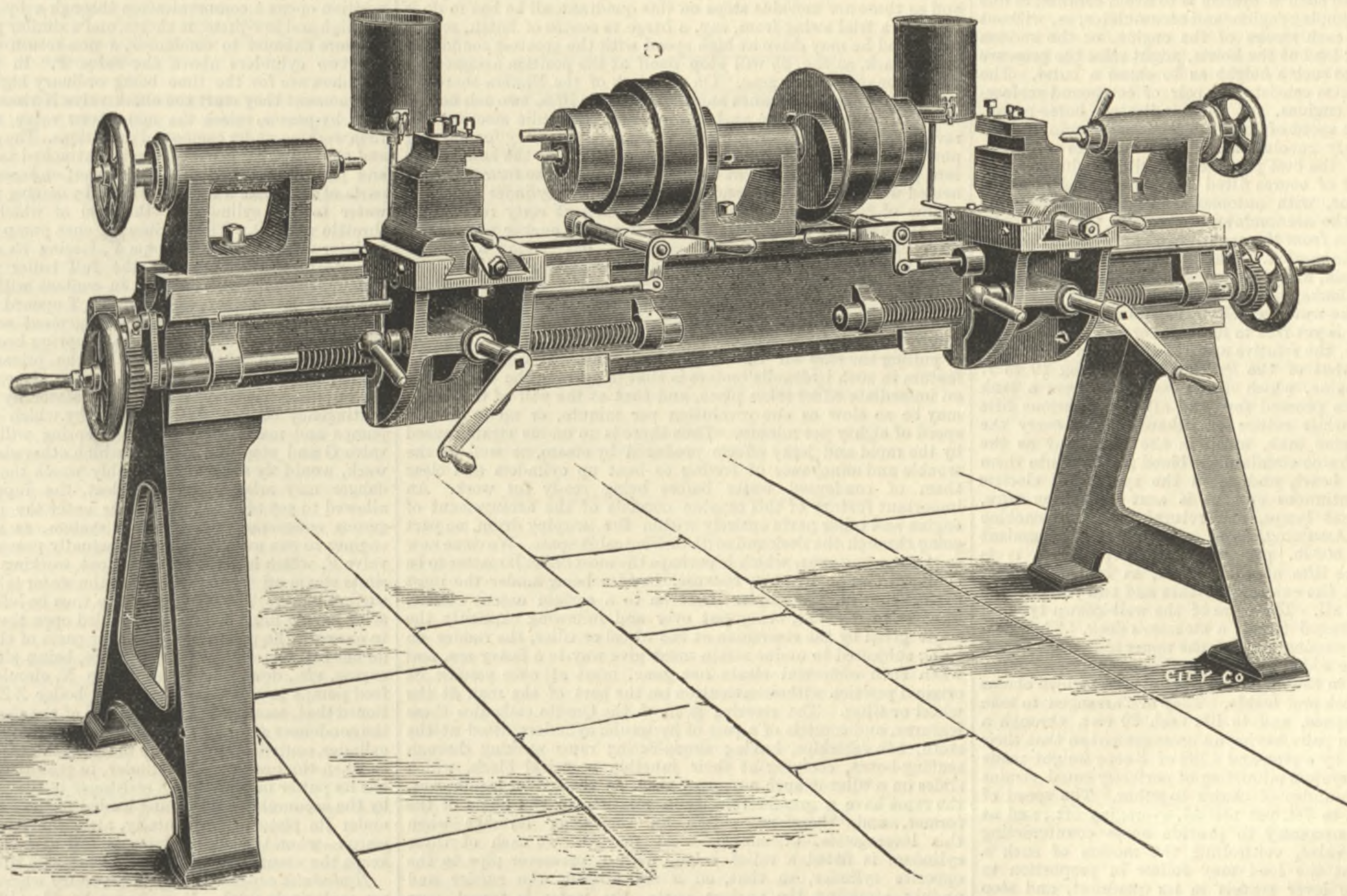




THE accompanying engravings show an improved planing machine, by Messrs. Wilkinson and Lister, of Keighley. This machine has a new system of gearing, which we think will be interesting to our readers. In this gearing a large internal and external wheel are employed, the external portion of which wheel is in gear with the rack of the table, and the great number of teeth in gear, and the direction of force being brought nearly horizontal by reason of the large size of the wheel, ensures, it is claimed, a steadiness of cut equal to that obtained with a screw without the excessive amount of friction caused by the latter. In the internal portion of the wheel more of the teeth of the pinion are in gear, and this without any loss of power, the double wheel being simply an intermediary and having very little strain of any sort on its shaft, which has but to support the weight of the wheel. The makers have found this system very successful, and are altering all their rack machines to it, as they find them to possess all the good qualities of those driven by screws, and to require less power to drive them.

SELF-ACTING DOUBLE STUD LATHE.

MESSRS. SCHISCHKAR AND HARRISON, ENGINEERS, HALIFAX.



THE above engraving represents a double stud lathe fitted with self-acting dead stop motion, adjustable in either carriages to any part of the bed. The fast head cones work round on a conical steel spindle adjustable by steel nuts at back and front to take up the wear and to insure a perfect fit, whilst the centres remain stationary. This lathe is specially adapted for turning up large quantities of studs, short shafts, or any class of work in straight or taper lengths where quantities are used. To illustrate the amount of work that can be turned out of this lathe, we might mention that 120ft. of $1\frac{1}{16}$in. iron in foot lengths was turned down to 1in. template size in ten hours. The centres are 6in. high, the bed 7ft. long, and each end of the lathe will take in 16in. in length, and will turn anything up to $2\frac{1}{2}$in. in diameter. The lathe is supplied with two overhead motions, spanners, &c., and weighs 16 cwt.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending April 5th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8582; mercantile marine, Indian section, and other collections, 2123. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 1486; mercantile marine, Indian section, and other collections, 180. Total, 12,371. Average of corresponding week in former years, 15,830. Total from the opening of the Museum, 20,887,540.

GENERAL ENGINEERING CONSTRUCTION.—The seventh of a course of lectures on "General Engineering Construction," by Mr. J. W. Wilson, jun., vice-principal of the Crystal Palace School of Practical Engineering, was delivered on the evening of March 27th, in the reading room of the Society of Engineers, Victoria-street, Westminster; Mr. A. T. Walmisley, member of council, in the chair. The lecturer, in introducing his subject, pointed out into how many different parts it was capable of subdivision. He then spoke of the various materials in use for bridge construction, and went on to consider more particularly brick and stone bridge work; and, in connection therewith, the nature of piers, abutments, and wing-walls with their foundations; arrangements for roadway, centreing, &c. After this he spoke of the employment in arch form of cast and wrought iron work, and then proceeded to the consideration of girder bridge work of different kinds, showing the arrangement of plate, Warren, lattice, and other types of construction. Proceeding to the details of girder work, with cross girders, road bearers, suspension links, compression and tension bars, roller plates and other accessories, the lecturer pointed out the improvements effected in modern work, both as regards design and manufacture. The question of testing was then touched upon, and the lecture, which was illustrated by diagrams, concluded with particulars of several special bridges of different types and of large spans.

ON THE APPLICATION OF HYDRAULIC MACHINERY TO THE LOADING, DISCHARGING, STEERING, AND WORKING OF STEAMSHIPS.*

By Mr. A. BETTS BROWN.

THE object of this paper is to describe a somewhat comprehensive system of hydraulic machinery, which, with great advantage, has taken the place of the present system of deck steam equipment in vessels, performing all the work on board excepting that of propulsion. In 1874 I had the honour of addressing the Institution of Mechanical Engineers on this subject, in a paper which was illustrative of what was carried out to a limited extent, and was then comparatively a recent step in marine hydraulics. I anticipated, from the experience of the well-proved utility and durability of hydraulic power on shore, that its adoption on board ship would almost immediately ensue, for many reasons, which, although well known to engineers, had been sadly lost sight of by steamship owners. Notwithstanding the enormous improvement made in the form of steamships and the construction of the marine engine, giving surprising speed results, it is a fact that at the present moment the gear for discharging a ship's cargo is nothing more than the old manual winch, of improved design and construction, with a pair of ordinary steam engines applied to the handles or cranks thereof. The same applies to the anchor-windlass, capstan, and steam steering gear, involving a multiplicity of cog-wheels, shafts, bearings, and joints, which, when in full swing on the deck of a ship, are simply intolerable on account of noise. Wear and tear follows, and another formidable evil is due to the effects of heat and cold in the long line of steam pipes, causing leakages from alternate expansion and contraction, bursts from concussion of condensed water when steam is suddenly turned on, and freezing in cold climates, with other disadvantages, namely, loss of heat, and destructive effects to decks. Yet, with all the noise of steam engines at work on deck, running at piston speeds of as much as 1000ft. per minute, the cargo is lifted from the hold at a rate of only from one to two feet per second — which cannot be considered as keeping pace with the general progress made in other departments of steamship economy. In short, vast sums are spent on fuel to gain half a knot extra speed on a passage, while hours may be wasted in port in consequence of the primitive nature of the present system of deck machinery for discharging cargo. As already mentioned, it was anticipated that an almost immediate adoption of a more expeditious and comparatively noiseless system of hydraulic machinery would follow; but it was not until 1880 that the enterprise of the British India Association Steam Navigation Company gave me an opportunity of committing them entirely to an hydraulic system on board their Calcutta steamer Quetta, built by Messrs. Denny, to whom, with Mr. Mackinnon, chairman of the British India Steamship Company, and Mr. Dawes, the managing owner in London, I am indebted, and but for whose assistance and sympathy, I believe, the results which now follow would not have been obtained. Before proceeding to the description of the various drawings, the reading of which I fear may exceed the allotted time at these meetings, it may be more expedient to give a general outline of what has been done on board the Quetta, the objects in view, and the results obtained after three years' running between London and Calcutta, leaving the consideration of the various details of machinery, published in the "Transactions" to members at their leisure. The Quetta is 380ft. in length, 40ft. breadth, depth of hold 29ft., and 3302 tons gross, built by Messrs. Denny and Brothers, Dumbarton, and owned by the British India Association Steamship Company. The ship is fitted with a complete system of hydraulic machinery performing the following functions: Steering, heaving the anchor, warping by capstans fore and aft, taking in and discharging cargo, lowering the derricks to clear cargo over side, hoisting ashes, reversing main engines, and shutting tunnel water-tight door in engine room.

The peculiar advantage in the use of water for transmitting power for such various purposes, and ramifying throughout the ship, lies in the fact that it is nearly incompressible, and therefore the machinery is under perfect control by the most unskilled of men. It is also much more easily conveyed in pipes than steam, at pressures ten times as great. The only precaution necessary, however, in dealing with such a system is to avoid concussion due to momentum of the pumping engines and accumulator, as, without some elastic medium, each stroke of the engine, or the sudden arrest of a descending load at the hoists, might raise the pressure of water in the mains to such a height as to cause a burst. The prime mover in the Quetta consists of a pair of compound surface-condensing pumping engines, of 100 indicated horse-power, working at an average speed of forty revolutions per minute, and never exceeding seventy revolutions. These engines are constructed on the lines of the best practice of similar engines used in propelling the ship, but of course fitted with pumps, and attached to a steam accumulator, with automatic starting and stopping gear, under control of the accumulator piston, and therefore independent of any attention from the engineer in charge beyond oiling and once setting them in motion. The pressure of water obtained is 800 lb. per square inch, and, being produced by the steam pressure from the main or donkey boiler, acting on a piston and ram, it follows that, while the water which transmits the power is in itself incompressible, it is yet free to move under an elastic force of steam of 80 lb. pressure, the relative areas of the steam cylinder of the accumulator and that of the hydraulic ram being 10 to 1. From this pumping engine, which draws its water from a tank overhead, pressure pipes proceed fore and aft to the various lifts and other machines; while return or exhaust mains carry the water back to the engine tank, much in the same way as the arteries of the human frame circulate the blood pumped into them by the action of the heart, and as in the system of electric lighting, where a continuous current is sent along one wire, lighting up incandescent lamps, and returning to the machine by the other wire. Assuming, now, a steady and abundant supply of water at 800 lb. per square inch pressure, it is only necessary to place lifts at each hatch, as in the Quetta, two single lifts being at the extreme hatches and two pairs at the main hatches, or six in all. These are of the well-known type on shore, but specially arranged to suit a steamer's deck. They consist of long cylinders passing through the upper and main decks, and contain lifting rams which carry each three pulleys, a similar number being arranged in the upper deck plate, round which chains pass in the order of block and tackle. They are arranged to take up a very small deck space, and to lift each 30 cwt. through a height of 70ft., those in pairs having an arrangement so that their valves may be coupled by a pipe and a lift of 3 tons weight made by both, the hydraulic system admitting of perfectly equal strains on both chains or any number of chains together. The speed of lifting varies from 3ft. to 7ft. per second, averaging 5ft., and at this high speed it is necessary to provide some counteracting closing action of the valve, controlling the motion of such a rapid machine, so that the load may follow in proportion to the distance the valve lever travels in its quadrant, and stop there. Without such arrangements accidents might happen—in the case of breaking out cargo—if a box or bale being jammed is suddenly released. This is accomplished by a twisted rod, which is attached to the lifting ram, causing a nut to spin round, and so screwing back the lever upon which the starting handle has its fulcrum, so that the driver can always rely on the lifting chain following his lever and stopping automatically both in heaving and lowering. As this principle of variable and automatic motion pervades the whole system more or less, it will be noticed again under the subjects of steering, engine reversing, and slewing of cranes. In these hoists there is only one handle to control each, and on board the Quetta their capacity is shown, according to the testimony of Captain Templeton and officers, by the fact that at two hatches working four lifts, 1166 tons of rice were discharged and 150 tons of coffee taken in in ten hours. It is also reported that "in the open roadstead of Madras sixty wild Australian horses were discharged in four hours—a very difficult thing to do with two steam winches, as the noise would have made the horses frantic"—a tribute not only to the speed of the system, but absence of jar and noise. In extremely bad weather, when the ship is rolling most, as at Madras, the hoists are seen to greatest advantage, as it is only necessary to float the weight to be raised, and, watching the ship's period of roll, open the valve full when the load is up before there is time to foul any of the decks. In reference to such circumstances, Captain Travers, of the Union steamship Tartar, 4339 tons, says:—"The gear has been tested in every possible manner, discharging cargo in docks, abroad and in heavy seas on the Cape Coast, and has never once failed; and for quickness and thoroughness of work I consider it far before the steam winches. Owing to the very bad weather experienced on the Cape Coast, the loading of the ship did not commence till the day previous to our departure from Algoa Bay, when we took on board in one day 1900 bales wool, 400 packages sundries, besides passengers, baggage, and mails. When I inform you that there was a nasty sea running alongside, it rained heavily the whole day, and that everybody had to be 'hoisted in' in baskets, it must be quite evident that the hydraulic hoists worked in a most satisfactory manner. Had we not had your gear we could not have done the work." The position of the fore and aft hatches in relation to the masts of the Quetta was such that, while the derricks were set to plumb the hatches, on swinging round they would not reach over the side of the ship, thus necessitating the use of a subsidiary derrick and double handling, as in steam winch practice. This difficulty was, however, obviated in the simplest possible manner, and there is no part of the ship's gear which demonstrates so clearly the great convenience of the hydraulic system. It was only necessary to attach to the mast a small hydraulic cylinder with its ram working downwards, carrying a pulley round which the derrick chain passed. From this cylinder, which is placed some 20ft. up the mast, a small pipe is led to a valve placed close to the hatchway. The driver with his right hand works the hoist lever, and operates with his left the derrick lever. Pulling it to him admits water to the cylinder, and causes the derrick to plumb the hatch, while pushing it from him lets the water out of the cylinder and lowers the derrick over the side of the ship. It was proposed at the time to add another simple contrivance for the purpose of swinging the derricks by a pair of hydraulic cylinders, as shown in the accompanying drawings; but the consideration of attempting too much at first and increasing the cost, prevented me carrying this out, and all these derricks are pulled round, as in steam winch practice, by tackles, involving the service of about twelve men, and an obvious waste of money. When the derricks are so fitted they will perform more than all the functions of the steam crane with but three handles, and two where they clear the side, without being lowered, while the deck space saved and general appearance favour very much such an arrangement. Moreover, in the hydraulic system, all the motions being effected by separate cylinders, the lifting, swinging, heaving, or lowering jib may be done simultaneously with corresponding despatch. In certain arrangements of hatches it is impossible to dispense with a crane having its own support for the jib, and in the British India Association steamer Manora this led to the arrangement of hydraulic crane shown in the model and accompanying drawings. Advantage is here taken of the hydraulic lifting cylinder to make it serve the double purpose of receiving the lifting ram and supporting the jib and load. For that purpose it is stepped through the upper deck bed-plate and carried down and secured to the main deck, somewhat similar to the posts of steam cranes. On the upper deck, however, much less space is occupied; there are no cog wheels, or shafts, or clutches, with their various levers, but simply a pair of slewing cylinders with two wheels and a heavy chain encircling the casting carrying the jib. The lifting ram has its pulleys arranged similarly to the hoists previously described, and the various movements are controlled by two levers. The swinging of the crane is under similar control to the lifting gear of the hoists. When the driver opens the valve in either direction, it is closed again by the slewing ram causing a spiral rod to revolve, and so arresting the swing of the crane. Thus the driver can depend on the jib always swinging to positions corresponding to those on his lever quadrant, without any attention on his part; and as there are movable steps on this quadrant, all he has to do is to make a trial swing from, say, a barge to centre of hatch, set his stops, and he may drive at high speed with the greatest confidence in the dark, as the jib will stop itself at the position assigned by the automatic cut-off gear. On the deck of the Manora there are two such hydraulic cranes and six hydraulic lifts, two ash hoists, two hydraulic capstans, anchor gear, and hydraulic steering and reversing gear. The hydraulic capstans are necessary for warping purposes and for raising heavy weights. That at the bow has 15 tons power, and the other at the stern 10 tons. The former is connected with the windlass, and consists of a four-cylinder hydraulic engine of 50 indicated horse-power, running at sixty revolutions per minute, and easily disconnected from the anchor gear. The after capstan is on a similar principle, but having a smaller hydraulic engine, which, through the intervention of differential tooth gear, gives a strain of 10 tons on the lower and slow-moving drum, while the upper or quick-moving part gives one ton strain, and is available for rapidly taking in a light warp preparatory to getting the heavy rope round the lower drum, as in the case of pulling the ship off the Suez Canal bank. The advantageous feature in such hydraulic motors is that in opening the stop-valves an immediate effect takes place, and that at the will of the driver may be so slow as one revolution per minute, or up to the full speed of eighty per minute. Thus there is no undue strain caused by the rapid and jerky effects produced by steam, as well as the trouble and annoyance of having to heat up cylinders and clear them of condensed water before being ready for work. An important feature of this capstan consists of the arrangement of engine and other parts entirely within the warping drum, no part going through the deck and so disturbing cabin space. We come now to the steering gear, which is perhaps the most difficult matter to be dealt with on board ship, because, besides being under the most perfect control, the rudder must be to a certain extent elastic. That is to say that, being put over and following explicitly the angle given by the steersman at the wheel or tiller, the rudder on being subjected to undue strain must give way to a heavy sea, and when such abnormal strain has gone, must at once assume its original position without attention on the part of the man at the wheel or tiller. The steering gear of the Quetta embodies these features, and consists of a pair of hydraulic cylinders fitted at the stern, athwartships, having single-acting rams working through stuffing-boxes, carrying at their junction a swivel block, which slides on a tiller in such a manner that, as the rudder is put over, the rams have a greater velocity in relation to the angle of the former, and, therefore, obtain an increasing leverage when this leverage is, of course, most needed. To each of these cylinders is fitted a relief valve, with a crossover pipe to the opposite cylinder, so that, on a sea striking the rudder and unduly straining the various parts, the water is forced over these safety valves, and for the moment the rudder is let go, but returns at once into its former position, which is assigned to it from the bridge. We now leave these cylinders aft, and follow their pipes along the waterways in port and starboard sides, up to an ordinary double-acting slide valve placed in the steering-house. These pipes are $\frac{3}{4}$in. diameter, and take the place of the steering chains, or ropes usually met with in steam steering gear. Alongside of these pipes light wire ropes are carried, which communicate to a quadrant in the wheel-house from the steering rams aft. This quadrant serves the double purpose of contradicting, so to speak, the steersman's actions, and serving as an indicator of the exact position of the rudder aft. This automatic shutting of the steering valve is accomplished by the introduction of what I have termed a "floating lever," first applied to a Birkenhead ferry steamer in 1872. It is fully described in reference to the accompany drawings; and as the character of work to be done in reversing the links of the main engines is much the same in moving from ahead to astern as in port and starboard, the same lever cut-off is employed in both cases. The most general type of reversing arrangement, and that at work in the Quetta, consists of a steam cylinder giving the motive force, with a controlling hydraulic cylinder, with one piston-rod common to both. The water is here used in a passive capacity for controlling the position and locking the link motion in different positions. Over 400 steamships have been fitted with this gear, with good results. Another of the simplest form, where the water pressure does the work, consists of two small single-acting hydraulic rams, with side rods operating the weight shaft lever, as fitted to the Bessemer and Mikado, and independent paddle steamers plying at the Birkenhead Ferry. The whole system in cold weather is charged with non-freezing fluid, of which several cheap kinds may be had, notably calcium chloride, which, at certain strengths, will resist when dissolved in the tank a temperature of 30 deg. Fahr. below zero without solidifying. Thus the hydraulic system is peculiarly adapted to the Atlantic trade, in which it is not uncommon in cold weather to run the steam winches all night to prevent pipes and cylinders from injury through ice forming in the ports and passages. The experience obtained in the working of the Quetta shows that a donkey boiler of the usual size, just sufficient for steam winches, enables the cargo to be discharged in half the time, or, in other words, will do double the work on a given coal consumption with compound surface condensing pumping engine, and the hydraulic system. This statement I believe to be well within the mark, as where there are eight steam winches at work rapidly, and doing their utmost, it is not unusual to supply them from one of the main boilers; and it is safe to assert that, when steam winches are in an indifferent state of repair—which is, perhaps, their normal condition—few ships have donkey boilers large enough to supply steam for anything like an expeditious discharge of cargo. The compound pumping engine, as herein set forth, is in every respect more favourable to economy. Situated in the engine-room, close to the starting platform, it is under the eye of the engineer in charge, and receives the same attention as the main engines. It runs at a moderate speed with a constant load, and therefore, with the slightest adjustments and repairs, it cannot fail to give good results.

Having thus endeavoured to describe, in the time at disposal, a part of what I have done in hydraulic machinery for marine purposes, it may be mentioned that, notwithstanding the considerable increase in cost—more than double that of steam equipment—of the hydraulic system, the British India Association have seen their way to fit the succeeding steamers they have built similarly to the Quetta—namely, the Bulimba, Waroonga, and Manora—the two intervening ships having their emigrant quarters ventilated by fans driven by hydraulic engines, as well as the usual deck equipment. In addition to the above, there have been nine other steamers fitted by my firm successfully with such hydraulic machinery, and there is every prospect now of its taking the place of the noisy steam machinery in at least our most important passenger lines.

Compound surface-condensing pumping engines and steam accumulator.—These are shown in Figs. 1 and 2, Fig. 1 being a side elevation, and Fig. 2 plan. The following are the general dimensions of the apparatus:—High-pressure cylinder, 16in. diameter; low, 26in. diameter; stroke, 20in.; accumulator steam cylinder, 36in. diameter, 60in. stroke. This is shown at A; steam entering at pipe B presses on the piston shown in dot lining, the lower part of the cylinder communicating with the surface condenser D by pipe C. The top of steam accumulator is thus constantly open to the boiler, and from its side communicates by the stop valve E and throttle valves F and G, with the valve chest of the high-pressure cylinder H, this in turn exhausting its steam into the low-pressure cylinder I. These cylinders work each a double-acting water pump K, fitted with usual valves, L being suction, M delivery, and N check. The latter serves the double purpose of preventing a return of water to the pumps, and when the high-pressure engine stops on the centre—the accumulator being full—admits a jet of steam from the accumulator direct into the low-pressure casing, turning the high-pressure crank off the centre. This valve is down in its seat when the engines are stopped, and rises about $\frac{3}{4}$in. when they are in motion; it is connected by a rod O to a piston valve P, which when at its lowest position opens a communication through a by-pass pipe Q between the high and low-pressure chests, and a similar pipe R from the high-pressure exhaust to condenser, a non-return valve being between the two cylinders above the valve P. In this condition both cylinders are for the time being ordinary high-pressure ones, but the moment they start the check valve N rises and instantly shuts both by-passes, raises the non-return valve, and the engines are then working under compound conditions. The accumulator starting and stopping gear consists of a rod attached to the former's piston, and passing through the lower cover, engages at different desired parts of its stroke a lever S, which, by moving a slide valve, admits water to the cylinder T, the ram of which in turn opens the throttle valve G. The engines at once pump water into the accumulator cylinder U by the pipe V, forcing its ram with piston into the steam cylinder against the full boiler pressure, until the starting-rod and collar comes in contact with the lever S′, when the valve is reversed, the cylinder T opened to exhaust, and the throttle valve G closed. This arrangement serves also as a most efficient governor, as the adjustable spring keeping valve G shut is only held open when required by the pressure of water in the mains; therefore the degree of opening depends on the resistance at the pumps. Should the accumulator by any burst or other contingency be suddenly emptied, by which the pressure in the pumps and mains disappears, the spring will instantly close the valve G and stop the engines, which otherwise, being relieved of work, would fly away and probably wreck themselves. A similar danger may arise if, from neglect, the supply tank should be allowed to get too low, and let air enter the pumps, causing dangerous concussion in the whole system, as well as allowing the engines to run away. This is effectually prevented by the throttle valve F, which is actuated by a float working in the tank, which shuts steam off the engines when the water is within 1ft. of top of suction pipes. The apparatus may thus be left to its own charge after having filled oil cups and pulled open the hand starting lever to once get the pressure. The other parts of the engines, as shown, do not call for any particular notice, being similar to the marine engine, viz., double-acting air pump X, circulating pump Y, and feed pumps in duplicate supplying boiler Z Z. It may be mentioned that, connecting the lower end of the steam accumulator with the condenser and at the same time the exhaust of the low-pressure cylinder, contribute materially to the steadiness of the engine's speed, as when the low-pressure cylinder, in gradually getting its vacuum, has its power increased, the resistance in the pumps similarly rises by the accumulator ram being loaded to the extent of the vacuum under its piston. Incidentally, also, the large space under this piston—when the accumulator is full and the engines at rest—keeps the vacuum steady for a considerable time.

Hydraulic capstan.—This is necessary where reciprocating hoists are exclusively used. It is shown by Fig. 19, a vertical section, and Fig. 20, a cross section and plan of differential gear. The foundation plate A is securely fastened to the upper deck, and carries at the centre boss a hollow steel shaft B. Upon this the lower warping drum C freely revolves, its lower part having a conical turned ring, supported by a series of live rollers D, which in turn run upon a similar ring formed on the foundation plate just above the bearing of the drum C. A wheel E is keyed fast to the post, having internal wedge-shaped teeth of wide pitch. Above this a similar wheel, but with two fewer teeth, is bolted to the warping drum C. Gearing into both is a planet or messenger pinion G, which is in turn driven by the hydraulic engine pinion H, attached to the upper drum I. In this drum are placed, at equal distances apart, four single-acting pendulous cylinders J J, oscillating in bearings at their outer ends K K, and through the concentric trunnions water is admitted. Each cylinder is fitted with a ram L, carrying at its inner end two steel rollers M, which

* Read before the Institution of Naval Architects.

bear upon the steel excentric N keyed fast to the post, and therefore to the deck. Water is alternately admitted to, and released from, these cylinders by the rotary four-ported valve O, each port being connected to its cylinder by the pipes P P. The cylinders, therefore, with drum and face valve revolve, while the excentric slide valve is stationary, similar to the driving excentric N. The pressure water is admitted to the valve O by a pipe Q, which passes through the hollow mast, leaving, however, an annular space, through which the exhaust water returns to the tank by the pipe R. The excentric slide valve inside O is fast to the pressure pipe Q, but free to turn half a circle by applying a key at S. By moving the valve against either stop the capstan is made to run in either direction. It was with some reluctance that cog gearing was introduced into this capstan, as otherwise—windlass excepted—the ship would not have had a toothed wheel. It was, however, impossible to get a strain of ten tons with anything like a convenient size without gearing, and the differential form adopted gives a strain of ten tons at the lower drum, while the upper one has one ton force with proportionately quicker motion; at the same time there are only two wheels and pinions.

Hydraulic windlass gear.—This consists of an hydraulic engine of about 50-H.P., applied as shown in Figs. 25 and 26, Fig. 25 being side elevation with engine on deck, Fig. 26 a plan. As opinions differ so much amongst captains and owners as to which principle of windlass is best, it is necessary that the hydraulic system may be applied to all. That shown as applied to the Manora is placed on the forecastle, at A, and is of the usual type, the anchor being raised by a worm wheel B and worm C geared together. The worm is driven through two pairs of bevel wheels by the hydraulic engine contained in a square bed-plate D. The engine is precisely similar to that described under the subject of capstan, only reversed, that is, cylinders stationary, but excentric E and shaft F revolving. In like manner the slide valve G revolves, being reversed by the cross handle and clutch H. On the top of the engine shaft is a warping capstan, having a power of three tons at its periphery, and fitted to receive the usual manual bars. For higher-powered strains the ends of the windlass may be used, which, as arranged, are more powerful than necessary, and will break any rope on board. Fig. 25 will be given in our next impression. As, however, the hydraulic engine can be regulated to go at one revolution up to sixty with the greatest ease, and when unloaded does not fly away like the steam engine, strains on ropes can be easily managed without breaking them.

Direct-acting hydraulic windlass.—The object of this form is to dispense entirely with gearing. It is shown in plan at Fig. 2A, and in elevation at Fig. 2B. The windlass shaft, with its brakes and cable whelps, are of the ordinary well-known construction, as shown at A[1] A. Keyed to the shaft are two friction wheels B B, similar to the prevailing hand gear, where it is actuated by a double lever like that of a fire-engine. Each wheel is provided with two friction gripping reversible clutches C[1] C, one above, another below, connected in pairs to the hydraulic piston of a hydraulic engine at D[1] D. These work in corresponding cylinders E[1] E which are double-acting. Each cylinder is fitted with the usual slide valve F[1] F, which is actuated by a lever G[1] G, connected to centre D[1] D by rods H[1] H. These valves partake of the motion of the engine pistons to a reduced extent. The admission ports of these valves do not communicate with the cylinders upon which they are placed, but the pipes cross over to each other's cylinder. Thus the port cylinder valve serves the starboard cylinder, and *vice versâ*. The effect of this is, the motion of the engines keep at right angles, similar to a double cylinder steam engine, and they have no dead centres. This being so, a nearly continuous rotation is given to the friction wheels of the windlass, and, as the clutches are reversible in either direction, warping can be effected by the ends shown on the windlass shaft, the chain whelps being disengaged in the usual manner. Such a windlass was fitted to two hydraulic paddle steamers, built by Messrs. Denny and Bros., namely, Apollo and Minerva, and they worked very smoothly, and, excepting a rushing sound of water through the ports, noiselessly.

(*To be continued.*)

LETTERS TO THE EDITOR.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

THE THEORY OF MAGNETISM.

SIR,—In your very kind remarks upon my theory of magnetism, contained in your last number, you notice that I have stated that the "molecules *or their polarities*" can be rotated, and you ask why the words in italics should have been used when all my demonstrations have been to prove the rotation of the molecule itself?

In a preliminary note to the Royal Society, Jan. 27th, 1883, I wrote the sentence as you quote, as I had not at that time sufficient evidence as to the distinctive character of the rotation; but in my second and full paper to the Royal Society, April 5th, 1883, the words, "or their polarities," were suppressed, and I stated what I still firmly believe, viz., that the molecules themselves rotate. I find, however, that in my late paper to the Royal Institution, by some oversight these suppressed words reappear, and my sincere thanks are due to you for pointing out an error which I had certainly overlooked. This will be corrected in the paper when issued in the "Proceedings" of the Royal Institution. The question you have raised is an all-important point, for, after tracing the cause of magnetism to the molecule itself, and finding that rotation of the magnetic molecule, or *of their polarities*, is the cause of evident magnetism, it is of the highest importance to know if it is mere polarity which rotates, or the molecule itself.

I have no doubt that it is easier to conceive of mere polarity changing its relative position than an actual rotation of every molecule of a mass of iron. My work would have been extremely easy if I adopted this view; but all the experimental evidence points to the fact that however wonderful and impossible it may appear, the molecule itself turns and gives strong experimental evidence of its rotation:—(1) We have a decided frictional resistance to rotation upon magnetising or demagnetising a bar of iron. The molecules turn with difficulty in hard iron and with comparative freedom in soft iron; but in each case there is a lagging behind, not only in time, but in force, which can be vanquished by vibrating the rod by blows from a mallet. Heating the bar to red heat, or, in point of fact, any treatment of a bar of iron which would necessarily allow greater freedom to an assumed rotating molecule, produces the effect desired. (2) The magnetic molecule has true inertia. It requires more force to start it from a position of repose than sufficient to rotate it if given a slight previous impulse. It has also true momentum, for if rotated rapidly it rotates further than if slowly rotated by the same force. (3) The molecule appears to float in an elastic medium or ether surrounding each molecule separately, in which it has a well-defined period of elastic rotation without frictional resistance. Allowing a certain increase or decrease in the external evident magnetism of a bar of iron without in any way changing the permanent set of the molecules as held by the frictional resistances of their elastic mediums.

These three effects are demonstrable with all pieces of iron, and require no special apparatus. They agree with known properties of matter, and point conclusively to the fact that when the polarities rotate, matter itself in the form of a molecule rotates also. We are forced to a similar conclusion by the numerous researches which have preceded my own, indicating at least a mechanical motion of a molecule during magnetisation. In "Page's effect" we hear the molecules in motion during rotation. As at each magnetisation or demagnetisation of a bar of iron, a distinct sound is heard peculiar to itself, and which has no relation in tone to the length of the bar; a bar of iron becomes quickly heated by rapid changes of polarity, due in great part to the frictional resistance of the elastic medium surrounding each molecule against each other. In "Joule's effect" we find that a magnetised bar is longer than when neutral, indicating that a change in its mechanical structure has taken place during magnetisation.

In "Kerr's effect" we have a ray of polarised light rotated by reflection at the end or sides of an electro-magnet, whenever the bar becomes magnetised. The condition of magnetism through an iron rod placed upon a magnet depends upon its frictional resistance to rotation. I have demonstrated this by means of allowing molecular freedom of motion by mechanical vibrations. We can thus increase its conduction 400 per cent. The maximum conduction can take place in a fraction of a second by a single violent blow from a hammer; or it can be increased gradually during several minutes by frequent but gentle mechanical vibrations. We can superpose one magnetism upon another exactly similar to any stratified structure. I have thus superposed twenty contrary magnetisms upon a steel wire one millimetre in diameter, and afterwards rendered each structure evident by dissolving the exterior in dilute nitric acid, or rendered these structures evident at will by a simple torsion of the wire.

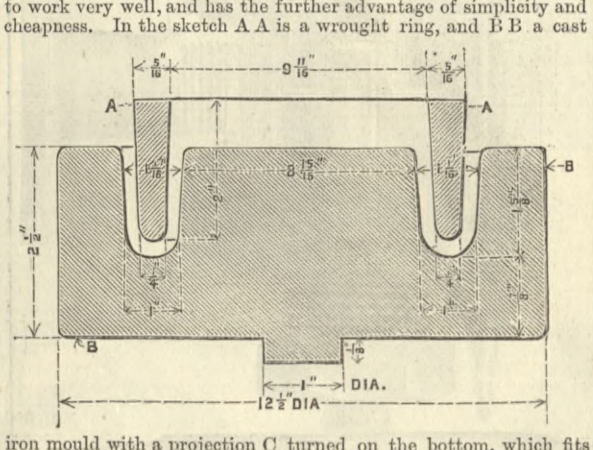
It may be possible to explain some of these effects upon the assumption of a rotating polarity; but if we study the whole of the phenomena, including the numerous effects I have obtained by the use of the induction balance, we are forced to admit the rotation of the molecule itself, for we have clear evidence of a movement of matter, and it would be wrong in me to ignore this evidence. Consequently, in full knowledge of my own researches, as well as those who have preceded me, I desire to state clearly in my theory of magnetism that each molecule is an independent magnet, and that it is by its rotation that all the effects of magnetism are produced.

D. E. HUGHES.

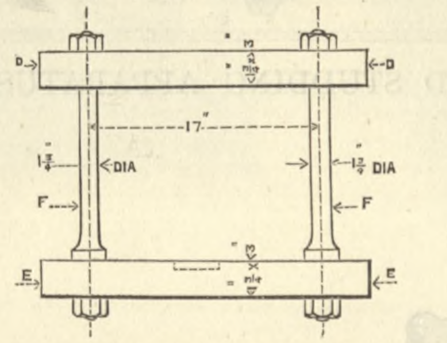
April 5th.

MAKING CUP LEATHERS.

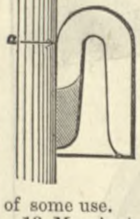
SIR,—In answer to a query in this week's ENGINEER, I hand you the enclosed sketches of a leather press, which has been found to work very well, and has the further advantage of simplicity and cheapness. In the sketch A A is a wrought ring, and B B a cast



iron mould with a projection C turned on the bottom, which fits into a similar recess in the bottom of the press, which consists of two cross bars D D, E E, connected by the bolts F F. The action of the press is so obvious, that I hardly think any explanation further than the above will be necessary.



Touching the depth of the leathers, it appears to me that 3in. or 3½in. is an excessive depth; I have used leathers for 20in. and 21in. rams, which have only been 1¼in. to 1½in. deep, and have given every satisfaction at pressures of two and a-half and three tons per square inch. The tightness of the joint in hydraulic work does not, I may say, depend on the depth of the leather, the joint being made at the point *a* in sketch; thus the shaded portion of the leather might be dispensed with without impairing the joint. I have sketched the above for leather ⅜in. thick, but should say that leather half the thickness would be ample. I hope the above may be of some use.



13, Mornington-terrace, Upper Duke-street, Liverpool, March 25th.

T. L. M.

THE CREATORS OF THE AGE OF STEEL.

SIR,—With reference to the first use of manganese in the Bessemer process, will you please allow me to state that the difference between oxide of manganese and metallic manganese, as well as the experiments by which Sir H. Bessemer reduced the former to the latter, are clearly set forth in my book, page 60; and the reason why I did not add a line to my last letter to that effect was because I did not think any one would charge me with ignorance of that which is contained in my book. The point at issue being whether Sir Henry Bessemer or Mr. Mushet was the first to see the utility of adding manganese to pure molten iron to convert it into steel, I quoted Sir Henry's patent of January 4th as evidence of his priority in perceiving the need of manganese and appreciating its effect. Mr. Carulla speaks of metallic manganese as necessary "to take up oxygen;" but this "elementary chemical lesson" of his is open to question on respectable authority. "I don't think that the deoxidising action of manganese is the essential effect of that substance" in making steel; and "oxygen at very high temperatures does not seem to go out of the steel again, notwithstanding the addition of manganese." Such was the opinion expressed ten years ago by Sir William Siemens, to whom probably Mr. Carulla will not impute ignorance. But as the question of reducing the oxides has been raised, it may interest Mr. Carulla to know who was the first man to start that point. In his patent of March 15th, 1856, Sir Henry Bessemer said:—"Towards the completion of the process of decarbonisation and refinement of the metal it will be found that a portion of the iron is converted into an oxide; I therefore put into the chamber—converter—suitable carbonaceous matter, such as carbonate of iron, that is rich in carbon, &c., in order to reduce the oxides." It will be recollected —as I have already shown—that ten weeks previously he spoke of manganese as necessary to convert his molten iron into steel. Now, carbonate of iron, with manganese, are the very substances which Mr. Mushet patented as his triple compound for the unused process of Martien six months after Sir Henry had first mentioned the use of these substances as requisite in the Bessemer converter. Mr. Mushet, in his patent of September 22nd, did not claim the method or manner by which the triple compound of these substances was to be produced; but Sir Henry Bessemer did invent a method of reducing them to the metallic state known as ferro-manganese. It thus appears that five months before ever Mr. Mushet heard of the Bessemer process Sir Henry not only knew that it was partly by the use of these substances that English iron could be converted into steel in his converter—in certain foreign countries the addition of manganese was not necessary—but he was the first to propound the theory which in later years has found general acceptance as to one of the most important functions of these substances.

May I add, in conclusion, that in justice to Mr. Mushet, my book contains his own account of his "discovery even more valuable than that of the Bessemer process"—his triple compound!

Brixton, April 7th.

W. T. JEANS.

THE EFFICIENCY OF FANS.

SIR,—I am not sure that I understand your Bilston correspondent of last week, unless he questions the established fact of the compensatory action of a fluid flowing through a constricted conduit. I do not feel justified in occupying your columns with a formal demonstration. But I may refer "C. T. W." to several "books" in which he will find the principle of action amply established by experimental evidence. Weisbach in his "Mechanics of Machinery and Engineering," 1847, page 144, acknowledges the compensatory action in the case of a constriction formed in a water pipe. Other books could be named—by Neville and by Morin, for instance—but I shall content myself with a reference to M. Péclet, who, in his masterly style, exhaustively experimented on the flow of air in pipes, and rendered the results in full detail in his "Treatise on Heat."* He proved that when a current of compressed air from a reservoir was delivered through a smaller pipe suddenly into a larger pipe in continuation of, and having about twice the diameter of the smaller pipe, the velocity of the flow through the smaller pipe, thus supplemented, was above one-third greater than when the current was discharged directly from the smaller pipe into the open air. He further proved that when a divergent conical adjutage of small taper was fitted to the smaller tube, or when the larger tube was connected with the smaller tube by means of a conical junction piece, the velocity of flow through the smaller tube was multiplied two and a-half times. These augmentations of velocity were in both cases effected without any increase of absolute head pressure for propulsion; and such results have a direct bearing on the case in question. The smaller tube in Péclet's experiments corresponds to the suction tubes of the exhausting fans that were tested, and the conical continuation corresponds to the radial expansion of the fan. The expanding vent of the Guibal fan is analogous. It was found in one case by Messrs. Swindell and Daniel to have nearly doubled the efficiency of the fan when worked without the vent.† The *rationale* of this is easily comprehended, and there need be no haziness about it. If you will allow me, I may return to the question. But let me remind your readers of something quite as paradoxical, that by adapting a suitable diverging or expanding adjutage to an aperture in the side of a vessel full of water, the velocity of outflow becomes one-half more than the theoretical velocity. How would he of Bilston like to account for this?

"C. T. W." is mistaken in his assertion that "the flow of elastic fluids is unaffected by opposing fluid pressures until these pressures fall to about 48 per cent. of the impelling pressure at the other side of an orifice or contraction." The case is precisely the reverse.

Mr. Hearson, your other correspondent, appears to claim for the blast fan work in duplicate—for pressure and for velocity. In my report I stated the formula which I employed for calculating the horse-power, and I do not see that his remarks have any bearing on this part of the question. Will he state his argument as a definite proposition?

There is internal evidence of the consistency of my report in the fact that, whilst the inflow energy of the current in the exhausting fan was greater than the horse-power delivered to the fan, the outflow energy of the blast fan was less. Obviously, in the latter case there is consistency. Why not also in the former, under precisely the same manipulative treatment? Does not the contrast of results prove that there is an essential distinction between the two cases? As in the exhausting fan, analogously, Péclet's smaller tube is fitted with an expanding adjutage; whilst as in the blast fan, analogously, Péclet's smaller tube discharges direct into the atmosphere. His experiments clearly point to the reason of the distinctiveness of the results.

D. K. CLARK.

8, Buckingham-street, Adelphi, London, April 7th.

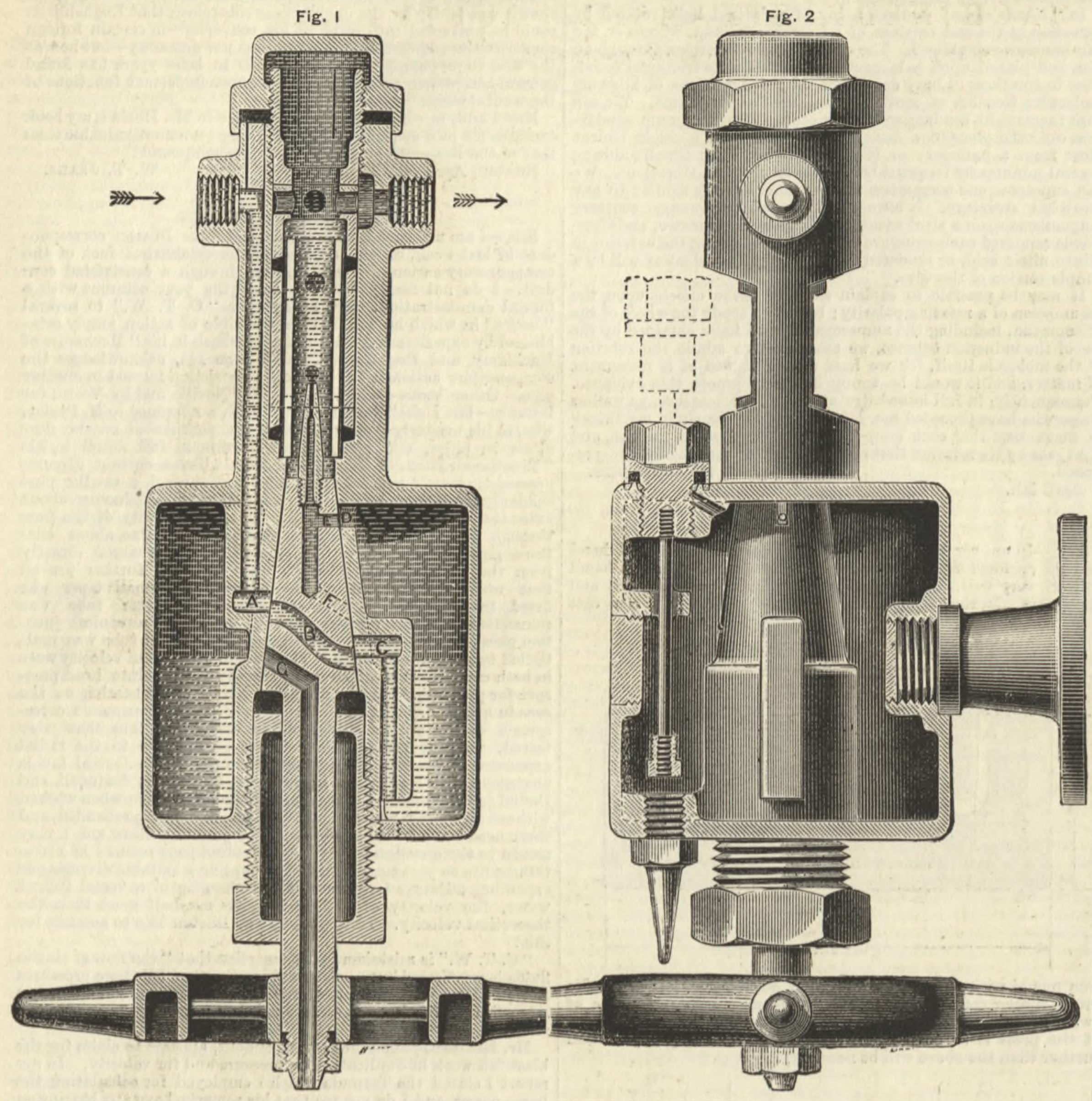
A KNIGHTHOOD FOR MR. J. J. ALLPORT.—The Queen has been pleased to offer to Mr. James Joseph Allport, late general manager of the Midland Railway, the honour of knighthood. That the distinction is worthily bestowed will be recognised by all when it is remembered that Mr. Allport has done more than any other man of his time to make railway travelling in this country cheap, comfortable, and expeditious. He commenced his railway career more than fifty years since on the Birmingham and Derby Railway, and became manager of that system prior to its amalgamation in 1844 with the North Midland and Midland Counties Railways. The management of the whole being conferred upon the manager of the North Midland, Mr. Allport went North to assume the charge of the Newcastle and Darlington Railway, which, during his connection with it, was developed into the York, Newcastle, and Berwick. In 1850 he became manager of the Manchester, Sheffield, and Lincolnshire, and three years later he returned to the Midland as general manager. That responsible position he occupied—with a three years' interval, from 1857 to 1860—until 1880, and it was during that period that he displayed that extraordinary enterprise and judgment which have placed him in the very front rank amongst railway pioneers. Mr. Allport's services in the development of cheap passenger traffic are most conspicuous, and it is doubtless with more particular reference to this part of his labours that her Majesty has decided to confer upon him the honour of knighthood. The consternation caused amongst rival companies, and the delight expressed by the travelling public when, in 1872, he induced the Midland Board to come to the decision to run third-class carriages by all trains, will not easily be forgotten. The change was adopted with startling suddenness, though it had been for some time in contemplation, and the result was an immediate and very large increase in the passenger traffic. Mr. Williams—"The Rise and Progress of the Midland Railway," published in 1875—records a conversation in which Mr. Allport said there was no portion of his public life on which he looked back with more satisfaction than on this. "When a rich man travels," he said, "or if he lies in bed all day, his capital remains undiminished, and perhaps his income flows in all the same; but when a poor man travels, he has not only to pay his fare, but to sink his capital, for his time is his capital." The great increase in the third-class traffic led in the autumn of 1874 to the decision that the second-class should be abolished altogether. Rival companies were again indignant. Threats of retaliation were freely launched at the head of the Midland, who were accused of undertaking, not railway reform, but revolution, whilst Mr. Allport was pointed to as "the Bismarck of railway politics." In 1880 Mr. Allport retired from the general managership of the Midland Railway, when the company presented him with £10,000 and elected him on the directorate. Since then he has lived in comparative retirement at Littleover, near Derby. He is a Justice of the Peace for the county, and has been mentioned in connection with the representation of South Derbyshire in the Liberal interest.—*Leeds Mercury.*

* Traité de la Chaleur, 1860.

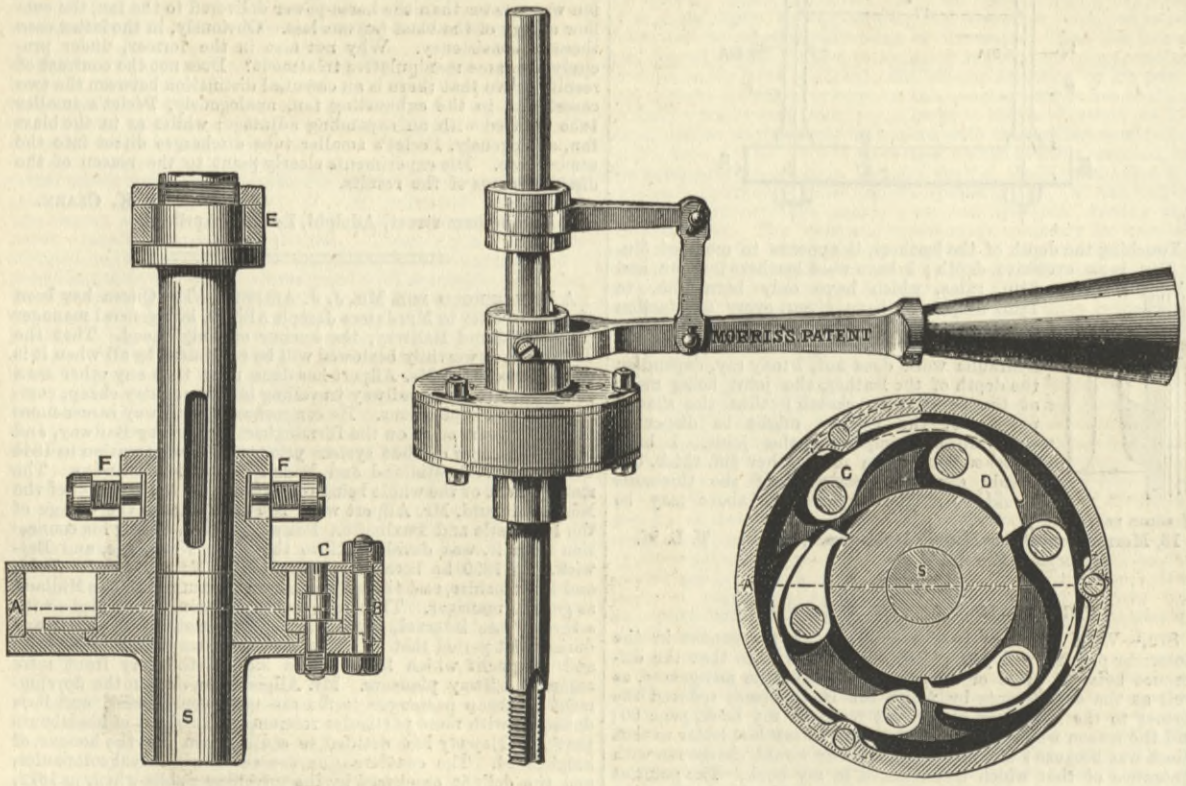
† See "Proceedings" of the Institution of Mechanical Engineers, 1869. 1875

SCHONHEYDER'S VISIBLE AUTOMATIC DROP LUBRICATOR.

Fig. 1 Fig. 2



MORRIS'S DRILLING, TAPPING, AND STUDDING APPARATUS.



In order to avoid the breakage of taps, badly tapped holes, and to economise time, the apparatus we illustrate is now being made by Messrs. Easterbrook, Allcard, and Wild, Sheffield. An apparatus for this purpose must of course work automatically. As soon as the strain becomes too much for the tap or stud, it must of itself be thrown out of gear; it must have a positive and a limited power—the limited power to tap the hole and the positive power to unwind the tap and drill the hole, as it requires more power to drill a hole quickly than to tap it. The tapping machine is composed of two parts—the upper part E F being fixed to the spindle of the ordinary drilling machine by the set screw that generally fixes the drill, consequently has the whole of the power of the main drilling machine given to the tapping machine, but only to the upper part, when the machine is tapping. But when the tap is coming back or when the hole is being drilled both parts of the tapping machine have the full power of the main drilling machine. The top and bottom being connected, the whole is driven by the feather fitted into the upper spindle, the weighted handle being the only means to keep it up; the weight also serves to lift the tap or stud box away from the hole or stud when unscrewing or leaving its work. The power is then transmitted to the lower portion of the tapping machine by three or more pawls which give a positive power to drill or unwind the tap, and a limited power to tap. When the pawls are in gear, and the drilling machine is turning in the direction to unwind the tap, holes are drilled. The right angle points of the pawls become the drivers, and remain in gear, and are capable of giving all the power of the main machine; but as soon as the main drilling machine is reversed, the side of the pawl that has an angle of about 60 deg. becomes the driving power, and as soon as the resistance is above their power the springs allow the pawls to come out of gear or ride up the incline, and the main drilling machine may then revolve freely.

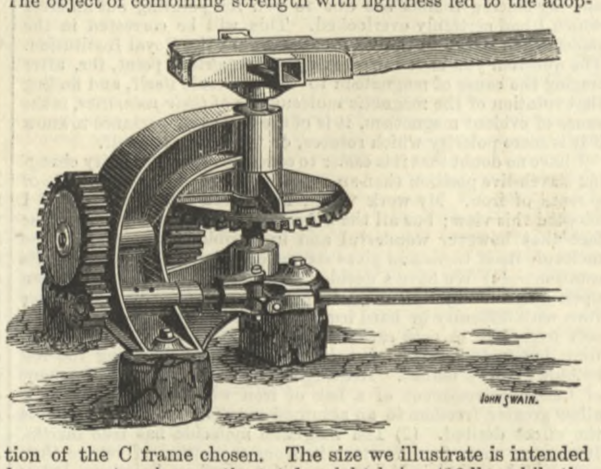
BECK AND CO.'S AUTOMATIC VISIBLE DROP LUBRICATOR.

The "Visible Drop" or "Sight Feed" lubricator, illustrated by the accompanying cuts Figs. 1 and 2, is, like others of its class, intended to supply oil to steam engine cylinders and valve chests in the manner now fully recognised as being the most perfect, viz., by allowing it to enter the steam pipe drop by drop and well clear of the sides of the pipe, so as to become thoroughly mixed with or impermeated in the steam, thus ensuring that all parts such as stop valve, throttle valve, main and expansion valves and piston shall be perfectly lubricated; the number of drops entering the steam pipe being at the same time visible by means of the glass tube through which they rise. The lubricator here illustrated differs, however, materially from others, in that all external pipes, valves, glass, &c., are entirely dispensed with, and in their stead one central tap and a shielded glass are employed, thus rendering it simpler of manipulation, less liable to injury, more compact, and neater in general appearance. The oil is contained in the cylindrical vessel, within which will be noticed a tapered shell containing the tap, which can be adjusted to its various positions by means of the hand wheel, as shown, a pointer secured to the shell and engraved directions on the hand wheel serving as a complete guide to the various manipulations. Various ports and passages are formed within the lubricator body, and the plug, as shown in Fig. 1, for the passage of the water acting as the driving force and for the oil. A glass tube is centrally situated, as shown, immediately over the plug, and is partly exposed by the cutting away of the metal at the two opposite sides, as shown by Fig. 2, the outlet nozzle at the right-hand side being connected with the steam pipe, and the inlet nozzle at the left-hand side also with the steam pipe, but furnished with a condensing box or coil for the purpose of condensing the steam, and thereby supplying water for working the lubricator. The action will be readily understood to be as follows, the plug being in the position shown by Fig. 1 with the pointer immediately over "feed" on the handwheel:—Water entering the left-hand nozzle from the condenser will descend by the vertical passage shown at the left-hand side of the glass tube, will enter the port A, traverse the passage B, port C, and short passage below same, thus entering the container and forcing up the oil which floats on the top of it, through port D and the hole E into the vertical nozzle inside the glass tube, issuing from it drop by drop as shown, each drop being clearly visible as it rises through the body of water contained in the glass. The oil then passes out by the right-hand nozzle into the steam pipe as previously mentioned, and obviously at the same rate as that indicated by the number of drops passing up through the glass in a given time. The rate at which the oil is supplied can be regulated by turning the hand-wheel a little to the right or left, so as to reduce or increase the size of communication between D and E as may be necessary. When the oil is exhausted, which is seen at once by the drops ceasing to appear, the hand-wheel is turned halfway round to "drain," whereby the communication between A and C will be interrupted, and G will be brought opposite C. The screw plug shown in Fig. 2 is next loosened, and air enters; the water with which the reservoir has become filled will then drain off by C and G through passage in the shank of the tap. The plug can then be completely unscrewed, raised up as high as possible, and is, by giving it a few extra turns, secured in the elevated position indicated by dotted lines, the screwed end of the rod attached to the plug entering the tapped lug, as shown in section, Fig. 2, and thereby supporting the plug, as well as securing it from being mislaid or lost. The hand wheel should now be turned to fill, whereby all the ports are closed, and oil can be poured in, the screw plug replaced, and the lubricator set to work as before. It sometimes happens that in lubricators of this class, the water in the glass tube becomes partly exhausted or turbid, and therefore requires replenishing. Instead of having to unscrew the cap over the glass to perform this operation—after, of course, first closing the taps on the inlet and outlet pipes—as is necessary in most lubricators, it is only requisite here to give the wheel a quarter of a turn so as to bring "water" under the pointer. This movement will cause the hole F in the plug, shown dotted in Fig. 1, to come opposite to port A, and water will then flow up through the nozzle as required. The mode of packing the glass tube, &c., is so clearly shown as not to require explanation. Should the glass tube in course of time become dull or obscured by foreign matter from the oil, it can be readily wiped out after simply unscrewing the top cap, and which operation can be done without any fear of loosening the packing of the tube.

It will thus be seen from the above explanation that all the requisite operations are performed by the one central tap, which, of course, is much simpler to manipulate than a number of separate valves or cocks; and being well oiled, always cold, and but little worked, it should remain perfectly tight for a very considerable time. The glass is well protected from injury, but can readily be replaced in case of accident. This lubricator is the invention of and has been patented by Mr. W. Schönheyder, and is being manufactured and sold by Messrs. Beck and Co., of Great Suffolk-street, Southwark, S.E., and Queen Victoria-street, London, E.C., where the lubricators are exhibited in operation.

A SMALL PORTABLE HORSE GEAR.

The neat little horse gear illustrated by the accompanying engraving forms a part of the portable mining machinery to which—the *Engineering and Mining Journal* says—Messrs. Ribon and March, of Jersey city, have given special attention. The object of combining strength with lightness led to the adoption of the C frame chosen. The size we illustrate is intended for one or two horses, the total weight being 419 lb., while the heaviest piece weighs 190 lb. The larger size, for from two to four horses, weighs 1137 lb., the heaviest piece being 324 lb. in weight. The universal coupling is made of steel, and special attention has been given to avoiding the use of bolts and nuts.



The "Pickering" Governor.—In reference to the notice of above in our issue of March 28th, we are requested to state that Messrs. Joseph Evans and Sons, Wolverhampton, are the sole licensees, and not Messrs. Ransome and Marshall, of Liverpool; and that Messrs. Thos. Piggott and Co., of Birmingham, apply it to all the engines manufactured by them. It has also been adopted on several of the Transatlantic steamers.

Messrs. Barford and Perkins' Ploughing Engine.—In our last impression we illustrated and described a traction and ploughing engine of much merit. The engine was exhibited at the Royal Agricultural Society's Show last year by Messrs Barford and Perkins, of Peterborough, the patentees, who are the designers. We regret that we inadvertently attributed the construction of the engine to Mr. Savage, of Kings Lynn, who had nothing to do with it.

HYDRAULIC MACHINERY, STEAMSHIP QUETTA.

MESSRS. A. B. BROWN AND CO., ROSE BANK, GLASGOW, ENGINEERS.

(*For description see page* 274.)

FIG. 1

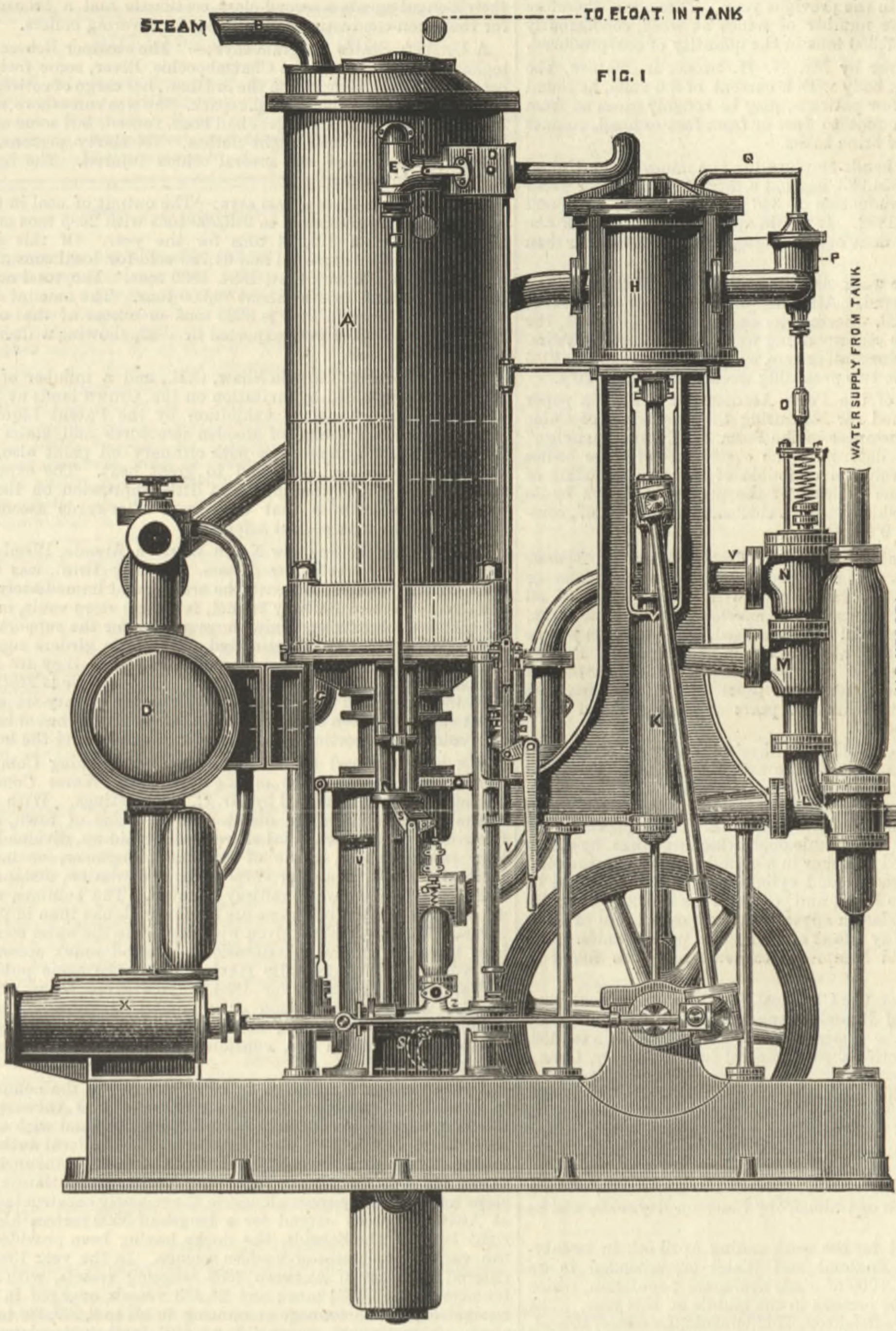


FIG. 19

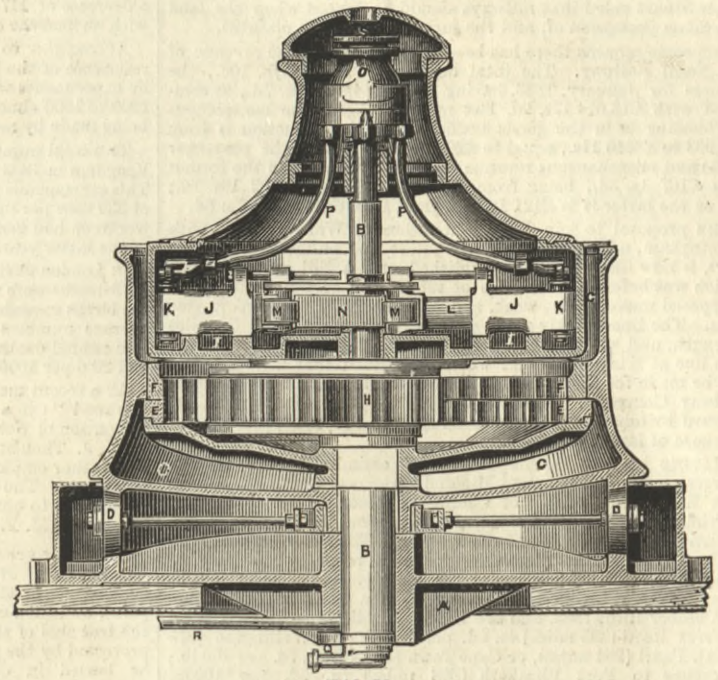


FIG. 20

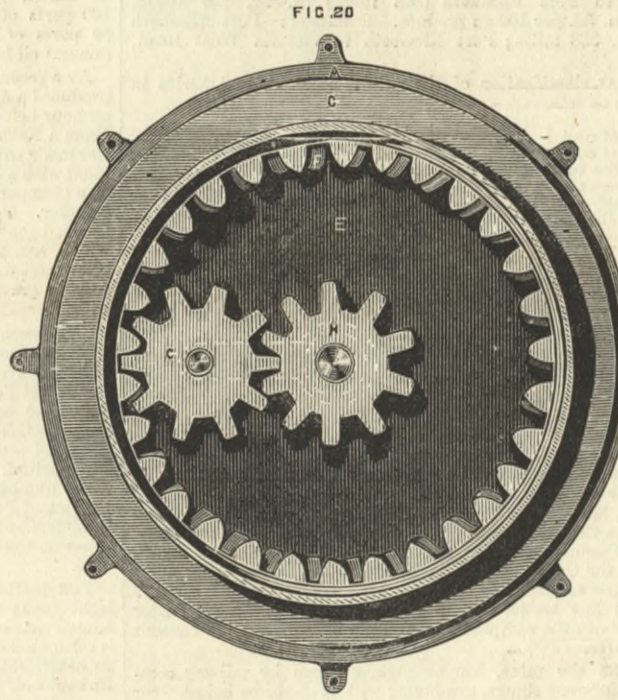


FIG. 2

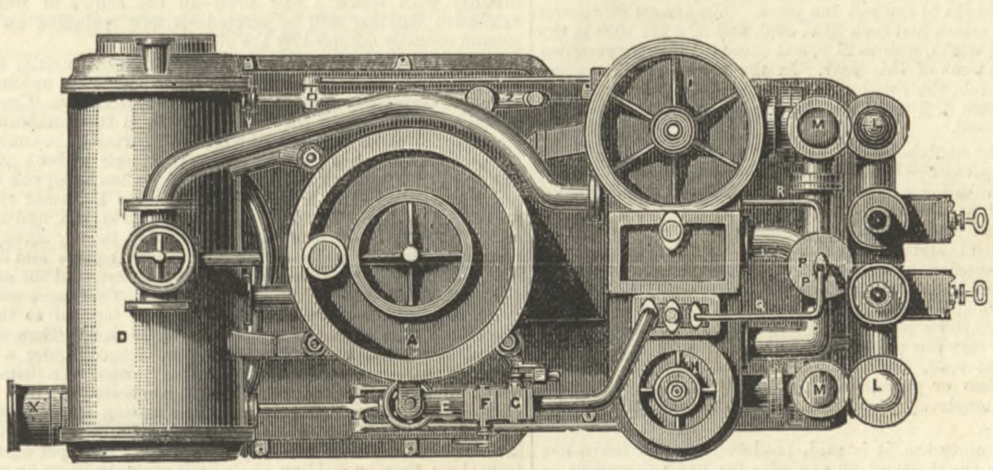


FIG. 2A

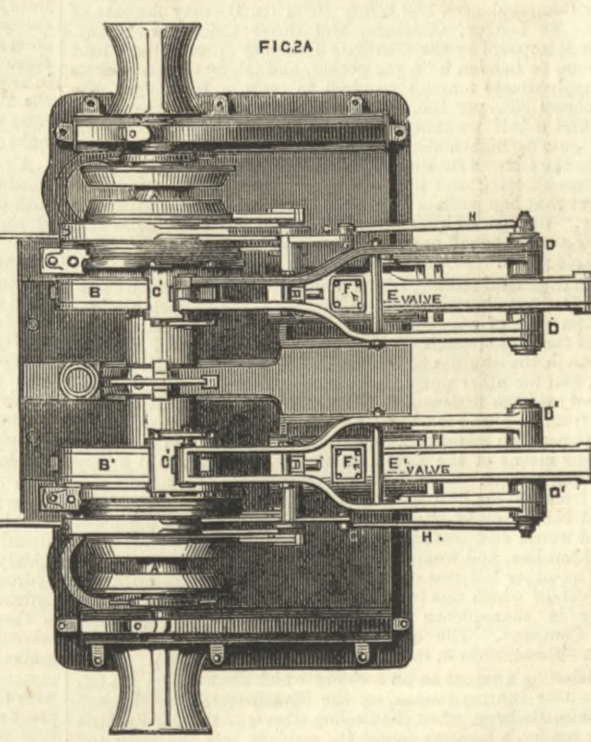


FIG. 26

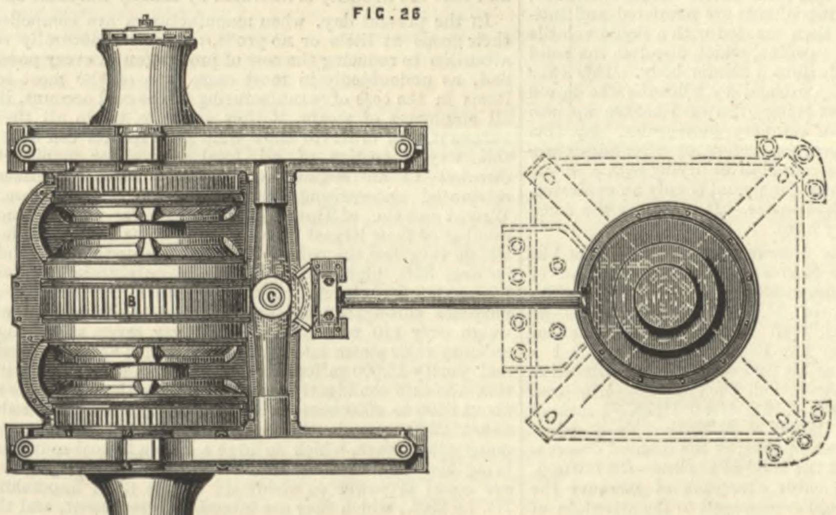
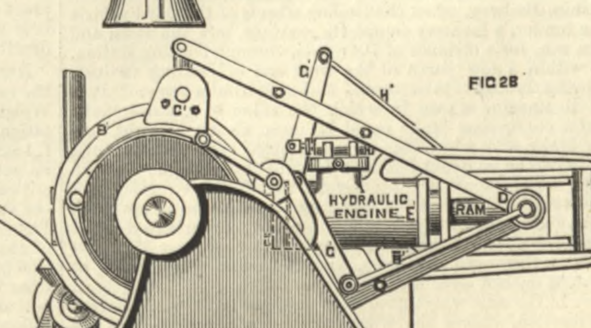


FIG. 28



JOHN SWAINE

RAILWAY MATTERS.

DURING February there were 61 accidents noted as happening in daylight, and 49 at night, on the United States railways.

IN the Adelaide—South Australia—Court, Mr. Edwards, a resident of Ambleside, on the Nairne Railway, sued the Commissioner for Railways for £49, damage sustained through a valuable mare straying on to the line while in course of construction. Commissioner Stuart ruled that railways should be fenced when the land was taken possession of, and the jury found for the plaintiff.

FOR some months there has been a falling off in the revenue of the Natal Railway. The total decrease is £1794 17s. 10d., the receipts for January, 1883, having been £14,809 15s. 7d., as compared with £13,014 17s. 9d. last month. Again the conspicuous shortcoming is in the goods traffic, where the reduction is from £10,693 to £8610 11s., equal to £2083 0s. 9d. Both the passenger traffic and miscellaneous revenue show an advance. On the former it is £167 1s. 3d., being from £3965 17s. 10d. to £4132 19s. 1d.; and on the latter it is £121 1s. 8d., from £150 6s. to £271 7s. 8d.

THE proposal to join Henley-in-Arden, in Warwickshire, with Birmingham, and which has been before the public over twenty years, is now likely to be accomplished, and a Bill promoted this session was before a committee of the House of Commons as an unopposed measure last week, and will shortly be reported in due form. The line—partly made some years since—is about 3½ miles in length, and will join the Great Western London and Birmingham line at Kingswood, and we are informed that arrangements will be made for the traffic to be worked by the Great Western Railway Company. The engineer to the local company is Mr. Edward Pritchard. The estimated cost of the work, inclusive of purchase of land, is £24,680.

HAVING in view the importance of assimilating the railway charges on the Western and Midland systems of South Africa, the Port Elizabeth Chamber of Commerce recently interviewed Mr. Merriman, the chief of the department, upon the subject. Some statistics were produced at the meeting. The following will tend to show the excellent reason for the action taken by the Chamber in bringing this subject under the consideration of the Commissioner. The rates on the Western system came into operation on October 15th, 1883, and are briefly as follows:—Victoria West to Ceres Road (335 miles) 4s. 6d. per 100 lb.; to Wellington (375 miles), Paarl (384 miles), or Cape Town (420 miles), 5s. per 100 lb.; Colesburg to Port Elizabeth (308 miles) 5s. 5d. per 100 lb. Now it is 4s. 3d. per 100 on produce. Distances:—Port Elizabeth to De Aar, 338 miles; Port Elizabeth to Victoria West Road, 419 miles.

A GENERAL classification of the railway accidents in America in February is as follows:—

	Collisions.	Derailments.	Other.	Total.
Defects of road	—	19	—	19
Defects of equipment ..	3	3	8	14
Negligence in operating	27	13	—	40
Unforeseen obstructions	1	19	—	20
Maliciously caused ..	—	2	—	2
Unexplained	—	15	—	15
Total	31	71	8	110

Negligence in operating thus included 36 per cent. of all the accidents, furnishing a larger proportion than any other class. Probably some of the unexplained derailments should be added to those caused by defects of road.

IN order to secure the establishment of ocean termini within the Dominion in connection with the Canadian Pacific Railway, the Canadian Government offer a subsidy of 960,000 dols. for a railway between Montreal and Quebec, together with 1,000,000 dols. for a line between New Glasgow and the Straits of Canso in Nova Scotia, besides 3,500,000 dols., in fifteen annual payments of 231,000 dols. each, as a subsidy or guarantee of the interest on the bonds of the company agreeing to construct a short line of railway connecting Montreal, St. John—New Brunswick—Halifax, and Louisburg in Cape Breton Island. At the sitting of the Dominion House of Commons on the 7th inst. the Minister of Railways stated that the Canadian and Pacific Railway Company was negotiating for the acquisition from the Grand Trunk Company of the north short line between Montreal and Quebec. The Minister added that both the companies concerned had given their consent to the transfer.

WHATEVER the rates, low or high, charged by railway companies for different things, grumbling will no doubt be heard. Sir F. Peel, Mr. W. P. Price, and Mr. A. E. Miller, representing the Railway Commissioners, had before them on Tuesday the case of Berry *v.* the London, Chatham, and Dover Railway Company. The charge imposed by the Chatham Company from Selling, near Faversham, to London is 3s. per pocket, and taking eleven pockets as the approximate amount required to make a ton weight, the rate becomes 33s. per ton. The applicants say that frequently twelve and a-half pockets go to the ton, and consequently the tonnage rate is higher than 33s. Complaint is also made with regard to the charges for cartage, terminals—including loading and unloading—sheeting and unsheeting. But the hop growers must not forget that hop pockets want a lot of truck room and have to be kept dry. Unfounded grumbling may make railway people feel that they are not bound to act as the slaves of every freighter of damageable goods.

A SPECIAL general meeting of the proprietors of the London Chatham and Dover Railway was held on Tuesday at the Victoria station, for the purpose of considering bills authorising the company to construct the "Shortlands and Nunhead Railway," and railways and works in the counties of Surrey and Kent and in the City of London, and for other purposes. Mr. J. S. Forbes occupied the chair, and said the first-named bill was for the construction of a railway from Nunhead to a portion of their line which was known as the Greenwich extension, and which would obtain access to London by means of the East London Railway, over which they had running powers. Works were in progress for the widening of the line from Herne Hill to Bickley, and the greater part of the land had been already purchased. The line would be 5½ miles long, and would cost £411,000. It would effect a junction with the Brighton line, and would give a good alternative route to the City. The other bill was called the "Further Powers Bill," the chief object of which was to get to Folkestone, which had become necessary in consequence of the encroachments of the South Eastern Company. The capital under the second bill would be £385,000. Resolutions in favour of the bills were carried.

IN concluding a report on an accident which occurred on the 6th February near Dinting station, on the Manchester, Sheffield, and Lincolnshire Railway, when the leading wheels of the third vehicle from the tender, a lavatory composite carriage, left the rails, and the train ran, for a distance of 704 yards, through Dinting station, and to within a few yards of the west end of Dinting viaduct, before being brought to a stand, Major Marindin says: "It is difficult to imagine a case in which the value of the automatic action of a continuous brake could be more clearly brought out. Had the brake with which this train was fitted been an automatic one, there can be no doubt but that it would have brought the train to a stand very soon after, if not before, the disabled carriage got on to the viaduct, and that the passengers would have escaped the terrors and discomfort which they must have experienced when being dragged along off the rails for a distance of over 350 yards further than they need have been, with the awful risk of being at any moment dashed over a viaduct more than 100ft. in height. The flaws in the axle which gave way could not have been detected by examination, unless the wheels had been removed from the axle, or at any rate unless the wheels and axle had been taken from under the carriage; and it is most desirable that some rule should be laid down under which all axles should receive a most critical examination after running for some specified number of miles, for the failure of an axle of any vehicle in a train running at high speed is no trifling matter."

NOTES AND MEMORANDA.

AT the Royal Observatory, Greenwich, the mean reading of the barometer during the week ending the 29th ult. was 29·93in. The mean temperature was 41·1 deg., and 1·6 deg. below the average in the corresponding week of twenty years.

THE total number of coal mines of all kinds in operation in 1883 was 3707, against 3814 in the previous year. There was therefore a decrease of 117 in the number of mines at work, concurrently with an increase of 7,237,350 tons in the quantity of coal produced.

ACCORDING to a paper by Mr. N. H. Stone, in *Nature*, the resistance of the human body with a current of 3·6 volts, as found by experiments with a few patients, may be roughly given as from 1200 to 1500 ohms from foot to foot or from foot to hand, contact being made by means of brine baths.

THE total number of hands employed in the mines of the United Kingdom in 1883 was 514,933, against a total of 503,987 for 1882. This corresponds to a production of 346 tons per man in 1883, and of 339 tons per man in 1882. It would appear, therefore, as if the workmen had generally done better average work in the former than in the latter year.

IN London during the week ending the 29th ult., 2732 births and 1573 deaths were registered. Allowing for increase of population, the births exceeded by 23, whereas the deaths were 379 below, the average numbers in the corresponding weeks of the last ten years. The annual death-rate from all causes, which had been equal to 21·6 and 20·6 per 1000 in the two preceding weeks, declined to 20·4.

AT a recent meeting of the Paris Academy of Science a paper was read "On a Method for Measuring the Coefficient of Cubic Expansion of Solid Substances in the Form of Minute Particles," by M. J. Thoulet. To determine the coefficients of these bodies the author employs a solution of iodide of mercury in iodide of potassium. The extreme delicacy of the process is shown by its application to quartz, which yields a coefficient of 0·0000357, compared with M. Fizeau's 0·00003619.

AN anti-corrosion paint for iron is described by the *Neueste Erfindungen*. It states that if 10 per cent. of burnt magnesia—or even baryta or strontia—is mixed cold with ordinary linseed oil paint, and then enough mineral oil to envelope the alkaline earth, the free acid of the paint will be neutralised, while the iron will be protected by the permanent alkaline action of the paint. Iron to be buried in damp earth may be painted with a mixture of 100 parts of resin — colophony, 25 parts of gutta-percha, and 50 parts of paraffin, to which 20 parts of magnesia and some mineral oil have been added.

AT a recent meeting of the Berlin Physical Society, Prof. Landolt produced a cylinder of solid carbonic acid he had prepared about an hour before the sitting, and described the mode of its formation. From a Natterer compressing vessel a stream of liquid carbonic acid was made to penetrate into a conical cloth bag. The bag speedily got filled with a loose snow of carbonic acid, which was then, by means of a stamper, hammered together in a cylindrical vessel into a solid cylinder. Compact carbonic acid cylinders of this kind could be touched gently with the hand, and possessed the hardness of chalk, which, too, they resembled in appearance, and on account of their brittleness did not readily admit of being cut with a knife. The specific gravity of solid hammered carbonic acid was found to be 1·2.

AT a recent meeting of the Chemical Society a paper was read "On the Occurrence of Rhabdophane in the United States," by W. N. Hartley. In the *American Journal of Science*, xxv. 459, Brush and Penfield describe a new mineral from Salisbury, Conn., under the name of Scovillite. This mineral agrees in physical properties, &c., with Rhabdophane—Chem. Soc. Jour. Trans. xli. 210—and seems to be a variety of that mineral, containing erbium and yttrium, associated with lanthanium carbonate. In a subsequent number of the *American Journal of Science*, March, 1884, Brush and Penfield have recognised this identity of Scovillite with Rhabdophane. The society then adjourned to April 17th, when a paper on the "Synthesis of Galena," by Emerson Reynolds, will be read.

THE deaths registered for the week ending April 5th in twenty-eight great towns of England and Wales corresponded to an annual rate of 22·7 per 1000 of their aggregate population, which is estimated at 8,762,354 persons in the middle of this year. The six healthiest places were Brighton, Huddersfield, Leicester, Bristol, Birkenhead, and Hull. In London 2711 births and 1689 deaths were registered. Allowing for increase of population, the births were 130, and the deaths 174, below the average numbers in the corresponding weeks of the last ten years. The annual death-rate from all causes which had been 21·6, 20·6, and 20·4 per 1000 in the three preceding weeks, rose to 21·9, and exceeded the rate recorded in any previous week of this year. In the thirteen weeks ending the 29th of March, the death-rate averaged 20·4 per 1000, against rates ranging from 27·1 to 22·1 in the corresponding periods of the eight years 1876-83.

A DESCRIPTION of Rubennick's process for the metallisation of wood has been given by *Les Mondes*. The wood is steeped in a bath of caustic alkali, for two or three days, according to its degree of permeability, at a temperature between 164 deg. and 197 deg. Fah. It is then placed in a second bath of hydrosulphate of calcium, to which is added, after twenty-four or thirty-six hours, a concentrated solution of sulphur. After forty-eight hours the wood is immersed in a third bath of acetate of lead, at a temperature between 95 deg. and 122 deg. Fah., where it remains from thirty to fifty hours. After a complete drying, the wood thus treated is susceptible of a very fine polish, especially if its surface is rubbed with a piece of lead, tin, or zinc, and finally finished with a burnisher of glass or porcelain. It then looks like a metallic mirror, and is completely protected from all the destructive effects of moisture.

GERMAN ingenuity has, it is said, produced another derivative from coal tar in the shape of an explosive for mining purposes or fire-arms. This resultant is a mixture of saltpetre, chlorate of potash and a solid hydrocarbon, the latter being paraffine, asphaltum or pitch. The solid ingredients are powdered and intimately mixed, and the mass is then treated with a liquid volatile hydrocarbon, such as benzine or gasoline, which dissolves the solid hydrocarbon and forms the whole into a plastic body. This cake is then rolled into sheets and hardened by allowing the liquid solvent to evaporate, the product being afterward broken up into grains of any desired size, like ordinary gunpowder. By this method of dissolving the hydrocarbon before or after admixture with the salts, the grains became coated after drying with a waterproof surface of varnish. The new compound is only an explosive, it is said, when confined in a close space. It possesses the same density as gunpowder and is very hard.

A PAPER on the "Dilatation of Mercury" has been published in the report on the work of the Sevres International Bureau of Weights and Measures. The most exact observations on the dilatation of mercury are those of M. Regnault—*Mémoires de l'Académie des Sciences*, tome xxi. 1847—and to the mathematical reduction of these observations Dr. Broch has now applied a critical examination, employing as his first co-efficient of dilatation the value obtained by M. Wullner—"Lehrbuch der Experimental Physik," t. iii.:—$d_t = 10^{-9} (181161 + 11{\cdot}554t + 0{\cdot}021187t^2)$, instead of that of Regnault—$d_t = 10^{-9} (179007 + 25{\cdot}232t)$. By a reduction by the precise method of least squares, of the original observations to the latitude of 45 deg. at the level of the sea—$B = 760$ mm.—there is now obtained for the cubic expansion of mercury the following formula, which we would recommend to the attention of those engaged in accurate work:—$1 + kt = 1 + 0{\cdot}000181792 \,.\, t + 0{\cdot}000{,}000{,}000175 \,.\, t^2 + 0{\cdot}000{,}000{,}000035116 \,.\, t^3$. *Nature* says that for the current year the president of the Bureau is General Ibanez—Madrid—the secretary being Dr. Hirsch—Neuchâtel. This country is not represented on the committee, our Government having decided not to take part in this international project.

MISCELLANEA.

MR. P. H. MUNTZ, M.P., has been appointed president of the Birmingham Chamber of Commerce for the ensuing year, and Mr. H. L. Müller chairman.

AT the Calcutta International Exhibition, Messrs. F. Leroy and Co., of Gray-street, Commercial-road, E., have obtained through their Bengal agents a second-class certificate and a bronze metal for their non-conducting composition for covering boilers.

A UNITED States telegram says:—"The steamer Rebecca Everingham caught fire on the Chattahoochie River, some forty miles below Columbus, Georgia, on the 3rd inst., her cargo of cotton having been ignited by an electric light spark. She was run ashore within a few minutes. The passengers had been roused, but some of them had to escape in their night-clothes. Of thirty persons, about fourteen were killed and several others injured. The boat and cargo are a total loss."

THE Nanaimo *Free Press* says:—The output of coal in Canada in the year 1883 amounted to 213,299 tons with 2885 tons on hand, making a total of 216,184 tons for the year. Of this amount 149,567 tons were exported and 64,786 sold for local consumption. Stock on hand January 31st, 1884, 1830 tons. The total output is less than that of 1882 by about 66,000 tons. The amount sold for local consumption in 1883 is 8625 tons in excess of that of 1882. 222,411 tons of coal were exported in 1882, showing a decrease of 82,844 tons in 1883.

A FEW days since Captain Shaw, C.B., and a number of others interested, assembled by invitation on the Crown lands at Whitehall-place, to witness an exhibition by the Patent Liquid Fire Proof Cyamite Company, of wooden structures and stairs coated with cyamite, and in one case with ordinary oil paint also, which were set fire to and subjected to great heat. The experiment showed that the flames made so little impression on the stairs treated with cyamite that they were afterwards ascended by several persons with perfect safety.

ON Saturday the fine new North-Western Arcade, Birmingham, which has been erected by Messrs. Horseley Bros., was thrown open to the public. Beneath the arcade, and immediately above the Great-Western Railway tunnel, is a large store vault, in which are massive columns sustaining huge girders for the support of the whole structure. It is estimated that these girders support a weight of 200 tons at any given point, and that they are able to withstand a weight six times as heavy. The arcade is 210ft. long, 45ft. in height, and 17ft. in width. There are twenty-six commodious shops, between each of which there is a light but substantial iron column, supporting a balcony, which runs round the building.

WE have received from the Scientific Publishing Company a copy of the eighth issue of the "Gas and Water Companies' Directory for 1884," edited by Mr. C. W. Hastings. With respect to the gas companies, the directory gives name of town, date of formation, special Act, total share capital paid up, dividends, total loan capital issued, name of chairman, engineer, or manager, secretary, lessee, owner, or corporation, population, distance from London, and upon what railway situated. The columns are not all wholly filled up, but there are far fewer blanks than in previous issues. The information given with respect to the water companies is of the same general classification. A good index accompanies the volume. We have also received from the same publishers, "Waterworks Statistics for 1884." This gives town, source of supply, whether gravitation or pumping, quantity raised per annum, assessment charge, meter charge, price per 1000 gallons, number of waters in use, constant or intermittent service, and dividends.

A UNIVERSAL Exhibition in connection with the commercial, industrial, and maritime interests will be held at Antwerp under the patronage of his Majesty King Leopold II., and with the concurrence of the Belgian Government and of the local authorities, in the spring of the year 1885. In a circular announcing the exhibition it is mentioned that "the largest transatlantic steamships now find quay-room alongside the recently constructed quays at Antwerp, which extend for a length of 3500 metres along the right bank of the Scheldt, the docks having been provided with the various appliances of modern science. In the year 1883 there entered the port of Antwerp 4689 seagoing vessels, with a total tonnage of 3,857,934 tons; and 28,433 vessels engaged in inland navigation, with a tonnage amounting in all to 2,229,588 tons; an aggregate movement susceptible of still further development in the future. Finally Antwerp, aggrandised, opulent, and proud of its monuments and artistic treasures, is itself surprised at the rapidity with which a new town—in the centre of which the exhibition building will be erected—is now springing up on the ground recently occupied by the old citadel."

HERR W. HUPFELD, an engineer of Prevali, Austria, recently published the results of a series of experiments on welding steel in the *Oestreichische Zeitschrift für Berg-und Hütten-Wesen*. He instances the fact that the Austrian navy, in its specifications for steel angles, has a welding test which will certainly be conceded to be severe. One of the sides is cut, the angle is bent at right angles, the flaps are welded together, and, when cold, the angle is again bent straight. This test the Austrian Bessemer steel will stand, the material having from 0·20 to 0·25 carbon, and a tensile strength of from 40 to 50 kilogs. During twenty-seven blows, Herr Hupfeld cast two sample ingots 70 mm. square and 300 mm. long, one of which was used for the welding test, and the other for the corresponding test of metal not welded. One ingot was cut in two, and a butt weld made, each end being tapered so that, put together, they had a bearing surface of 70 mm. Then, after a second low heat, the welded part was forged under a steam hammer to 20 mm. square, and the rod turned to a diameter of about 15 mm., and well polished. When tested the bars yielded results which showed hardly any deterioration through welding. Phosphorus, the *Engineering and Mining Journal* mentions, was in no case above 0·045, and sulphur not over 0·02 per cent. The tests show that by welding the tensile strength is, on an average, diminished by only 1·75 per cent., the maximum being 5 per cent., and that the ductility is increased by exactly the same amount.

IN the present day, when manufacturers are compelled to sell their goods at little or no profit, they not unnaturally turn their attention to reducing the cost of production in every possible way, and, as undoubtedly in most cases, one of the most important items in the cost of manufacturing is the coal account, it behoves all employers of steam, if they are wise, to do all they can to reduce it. In order to show what good results can be effected in this way, attention of all local and other manufacturers is directed to an engineering contract recently placed by a celebrated enterprising Manchester firm with Messrs. Joseph Wright and Co., of Tipton, Staffordshire, for the construction of a number of their largest "Berryman," patent feed-water heaters, of which they are the patentees and sole makers. Each heater will be over 33ft. high, and they are not only to supply boiling hot feed-water for eleven Lancashire boilers, but also for washing purposes throughout the entire works, and when at work will weigh over 110 tons altogether. Sixty seven steam engines will exhaust their steam into the heaters, which are calculated to heat and purify 12,000 gallons of water per hour, and by their application the firm confidently expect to realise the enormous saving of about 6000 to 8000 tons of coal per annum besides a reduction of about £800 a year in their soap account, and further economy in many other ways, which so large a saving in coal must necessarily bring about. These heaters, which will be the largest ever made are equal in power to about six double flued Lancashire boilers 7ft. by 28ft., which they are intended to represent, and the yearly saving of from 6000 to 8000 tons of coal is about the quantity six such boilers would take to drive them. But it should be noticed that whereas the cost of the heaters—which is about the same as the cost of the boilers—has to be paid once for all, the cost of the boilers would have to be repeated every year in payment of coal accounts, &c.

PUBLISHER'S NOTICE.

**** With this week's number is issued as a Supplement a Two-page Engraving of Horizontal Condensing Engines for the Royal Arsenal, Woolwich. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

TO CORRESPONDENTS.

**** In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

**** We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

**** All letters intended for insertion in* THE ENGINEER, *or containing questions, must be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever will be taken of anonymous communications.*

Y. B.—*You cannot manufacture a patented article for your own use.*

D. (Hatcham).—*The idea of using an elastic spoke wheel for bicycles is not new. The Otto wheel with waved spokes is said to solve the problem effectually.*

HARDENING STEEL GAUGES.

(*To the Editor of the Engineer.*)

SIR,—I should feel much obliged if any reader of THE ENGINEER would furnish me with the best method of hardening sheet steel gauges so as to prevent them from casting and splitting at square corners; also ring gauges, to prevent them going oval. I have tried rape oil and boiled oil, with slight improvement over water. CONSTANT READER.

Bow, April 8th.

MEETINGS NEXT WEEK.

ROYAL METEOROLOGICAL SOCIETY.—Wednesday, April 16th, at 7 p.m., the following papers will be read:—"On the Origin and Course of the Squall which Capsized H.M.S. Eurydice, March 24th, 1878," by the Hon. Ralph Abercromby, F.R. Met. Soc. "Waterspouts and their Formation," by Captain J. W. C. Martyr. "The Weather Forecasts for October, November, and December, 1883,' by Cuthbert E. Peek, M.A., F.R. Met. Soc. "On Certain Effects which may have been Produced in the Atmosphere by Floating Particles of Volcanic Matter from the Eruptions of Krakatoa and Mount St. Augustin," by William F. Stanley, F.R. Met. Soc., F.G.S.

THE ENGINEER.

APRIL 11, 1884.

THE RIACHUELO.

IT has been laid down as an axiom that an ironclad ship must be a compromise; and that to obtain anything like a combination of good qualities she must be very large. It has, indeed, been said that it is impossible to produce a satisfactory result with a smaller displacement than 10,000 tons; and the Italian Government build ships with a displacement of 14,000 tons. The conditions to be fulfilled by a modern ironclad are so complex that it has been difficult to dispute the truth of the propositions we have given above. She must have thick armour, heavy guns, great speed, and be capable of steaming long distances. This appears to be an almost impossible combination of good qualities. The more credit, therefore, is due to the Brazilian officers, who, aided by Mr. Samuda, have succeeded in turning out a craft which really appears to embody the impossible. The more carefully indeed the Riachuelo is considered, the more apparent does it become that Brazil has probably obtained the finest man-of-war in the world, although, within certain limitations, not the most powerful. We have nothing whatever to compare her with; and if our Government act wisely, they will repair the omission at once. They could not do better than order from Mr. Samuda a couple of ships the precise counterpart of the Riachuelo.

Let us see what this wonderful ship can do. She carries four 20-ton breech-loading guns. These are small compared with the monsters of the Italian and English navies; but they are able to pierce almost any ship we possess, and any ship in the world save a very few. They can send a projectile clean through 18in. of iron armour, and have some energy to spare. These guns are so arranged that they can fire all round the horizon. Besides, she has six 70 lb. breech-loading rifled guns, and no fewer than fifteen machine guns. This is a wonderfully well designed and powerful armament. Against unarmoured cruisers, for instance, she need not fire one of her big guns; her Nordenfeldts reduce the danger of torpedo attack to a minimum, and she could give a good account of most ironclads. If she were overmatched she could run away faster than any ironclad afloat could follow her, and she could all the while maintain a running fight, for her four great guns can be fired at the same time right astern. Pursuing, no man-of-war could escape by speed; and her guns would as before be available throughout a stern chase. She has two entirely distinct magazines, one for each turret, so that should one-half her armament be rendered useless the other is still serviceable. Her armour is so disposed as to supply sufficient protection with the least possible weight. She has 11in., 10in., and 7in. armour on her sides. Her breast works and turrets are 10in. thick, and she has armoured decks to render her boilers and engines safe. All this is sufficient to cope with any but very heavy guns. The worst point about her is that when she rolls she may leave a portion of her sides below the belt badly protected. Her compound engines, by Messrs. Humphreys and Tennant, appear to be about the best ever made; at all events, they have indicated 4537-horse power for three hours' continuous working, during which the consumption was 1·38 lb. per horse-power per hour. With this power she steamed at the rate of over 15 knots an hour. When working with natural draught she has attained a speed of 16·238 knots, with 6900-horse power, the highest speed by nearly a knot ever attained on the measured mile by an ironclad ship. With only eight of her ten boilers in use, and a very moderate forcing of the draught, she has indicated 7300-horse power, and attained a speed of 16·718 knots, and we have not the least doubt that with all her boilers under steam, and a forced draught, she would run at a velocity of 17·25 knots, at which speed she could steam round and round any other ironclad afloat. Now all this combination of excellent qualities is obtained on a displacement of only 6100 tons, and this, be it observed, when the ship carries 800 tons of coal, or enough for twelve days' consumption, at 15 knots, during which time she could run 4500 miles without re-coaling. No ironclad afloat can compare with her in coal endurance.

These admirable results are due mainly to two factors. The first is the enormous power of Sir William Armstrong's guns, and the second the excellence of her machinery. A very few years ago the 20-ton gun was a comparatively feeble weapon. It is 9in. in diameter, and it was held to be just capable of piercing iron armour at the utmost 10in. thick. The new 20-ton steel gun is really almost three times as powerful as the old gun—a result which is due to its great length and the enormous powder charge which it can carry, thanks to the enlargement of the powder chamber. It is, however, when we turn to the machinery that we find the great factor in the solution of *the* problem of naval construction. The engines are apparently the most economical ever sent to sea; and it is for this reason that the ship can steam so far. That she can steam fast as well is due to the beautiful lines of the hull, which are more like those of an Atlantic racer than those of an ironclad. Mr. Samuda showed a fine model of the ship during the recent meeting of the Institution of Naval Architects, and from this it can be gathered that the ship, like the princess in the fairy tale, is as beautiful as she is good. Indeed, it would seem that we may yet have fleets of handsome ironclads. Some doubt was cast on the economical performance of the engines during the meeting of the Institution of Naval Architects. Nor is this to be wondered at. But the coal was weighed by the Brazilian authorities, and the indicator diagrams were taken by engineers of our own Navy. There is therefore no reason to doubt the perfect trustworthiness of the statement made by Mr. Samuda. The doubt is, of course, that the fires were in precisely the same condition at the beginning and end of the three hours' run; but with care it would be easy to reduce the chance of error arising in this way to a small factor. Even, however, if we make a considerable allowance, and take the coal consumption to be 1·5 lb. per horse per hour, it will detract but little from the marvellous steaming powers of the ship, the great distance which she can traverse being due in one respect to the high rate of speed which she can attain. If we suppose her speed to be reduced to 12 knots—which is nearly the highest speed of many crack ironclads—it will be seen that she could run continuously without re-coaling a distance of no less than 8700 miles. This would take her to Australia from England with once coaling. We do not possess a man-of-war of which this can be said, because we have no engines afloat so economical, no ship with so small a resistance. Too much importance cannot be paid, we think, to giving men-of-war such shapes as will secure the best possible co-efficients; but unfortunately few ironclads are designed for speed, although it is the highest quality such ships can possess, giving them, as it does, the key of any position in which they may be placed, and enabling them to adopt just that style of fighting which suits them best. The high economy of the engines appears to be due in great part to the fact that the boilers are large enough to supply plenty of steam without unduly urging the fires. She has 19,400ft. of heating surface, or 4·3 square feet per horse-power at 15 knots—an unusually large proportion. The grate surface is not given in Mr. Samuda's paper; but, assuming it to be one-twenty-fifth of the heating surface—a very common proportion—we have a total of 776 square feet; and for a total consumption of 6300 lb. per hour, this gives a consumption per square foot of grate per hour of only 8 lb. Under these conditions it is probable that the boilers evaporated not less than 11 lb. of water per pound of coal, so that the steam used per horse per hour was 15·18 lb.—a possible but extremely low consumption.

We cannot take leave of the Riachuelo without commending her to the attention of the United States Government; and we would ask the Naval Advisory Board, or its ex-members, to compare her with the Chicago. This vessel we have fully criticised already, and described and illustrated. It will therefore suffice to say here that the American cruiser is to have a displacement of 4500 tons, or only 1200 tons less than that of the Riachuelo; and in not a single feature does she compare favourably with the latter. The Chicago is to be propelled by twin screws, and she is allowed 18,518 square feet of heating surface, 6000 square feet of superheating surface, and 800 square feet of grate—nominally more boiler power than that of the Brazilian ironclad. Yet she is expected to develope only 4800-horse power, and have a maximum speed of but fifteen and a-quarter knots, while her bottom, which is not to be coppered like that of the Riachuelo, is clean. Her bunkers will stow 800 tons, the same quantity the Riachuelo carries; but she will only be able to keep the sea for six and a-half days, and to steam but 1950 miles. She could not cross the Atlantic. Her armour and her armament cannot bear comparison with those of the Riachuelo; while it is more than probable that she will cost at least as much. The two vessels supply an admirable illustration of the arguments which we have advanced—namely, that to design a good ironclad requires some experience; that no one in the United States possesses this essential; and that much better results could be got by copying the best English practice than can be had from original American design. It is to be hoped that peace may reign between the United States and Brazil; if not, the Riachuelo alone could destroy every ship of war the United States possesses, fighting them half-a-dozen at a time. The doings of the Alabama would be as nothing to her doings; and no Kersearge exists in American waters that could destroy her. If the United States want war ships they cannot do better than buy a few in this country, if only to serve as patterns for use in their own navy yards. We do not know which has most cause to be proud of the Riachuelo—England or Brazil.

RIVETTED JOINTS IN IRON SHIPS.

THAT rivetted joints in iron ships should form matter for discussion at a meeting of the Institution of Naval Architects need cause no surprise. The subject has been often discussed; experiments of various kinds and under different conditions have been made, and to unthinking minds it might seem that the matter had been long since thoroughly thrashed out, and every possible information obtained about it. Mr. West at last week's meeting, however, put rivetting as applied to shipbuilding in a light that took some at least of his hearers by surprise. He practically stated that he found that the ultimate strength of rivetted joints had much less to do with durable work than was usually supposed. He told the meeting that the great point to attain is to prevent joints slipping; for the moment slipping took place, it mattered nothing what the joint was in other respects, it then became bad and untrustworthy. The fact that this statement seemed a new light to men engaged all their lives in dealing with rivetting is one more proof of how prone the mind is to run in a groove, and to take it for granted that an opinion held by everybody must necessarily be right. The general tendency of engineers and ironworkers has been to regard a well rivetted joint as an immovable structure, and to all intents a solid body. The fact is, however, that the durability of rivetted joints depends upon certain conditions of structure, and of subsequent working, and the gentleman who has brought this aspect of the matter before engineers and ironworkers has done good service.

Rivetted joints may be classified into three sections—namely, those where two plates butt, and have a joint cover at each side, the rivets being snapped; those where the joints occur here and there in a number of plates piled one upon another, as in girder flanges, and where the rivets are prevented from canting sideways by the support afforded to them by the large crushing area of iron supplied by the great length of the hole at either side of the point of stress, and where canting is nearly impossible; lastly, rivetted joints such as are found in the skin plating and sheer strakes of iron ships, where two plates are either joined by a lap, or else butted and united by a single cover-piece — which comes to the same thing so far as the rivets are concerned. Now, the conditions of stress in each of these three forms of joint are essentially different. In the first case the rivet has virtually no canting stress put upon it, save such as would result if the rivet were likely to bend; and if we regard the rivet as a girder supported at each end, and having a distributed load on it between these supports, we find that it is a girder so exceedingly deep in proportion to its span that deflection or bending is nearly impossible, and therefore canting is little likely to take place. The rivet is in double shear, and can only give way by shearing. Motion in such a joint can only take place as a result of deformation of the holes. The rivet, again, in the girder flange is, as we have seen, so long and so well supported that no canting can occur. In the last case, where there is merely a lap joint and a short rivet, the rivet will be liable to cant in proportion to the thickness of the plate and consequent length of rivet; in proportion to the strain; and finally, in proportion to the hardness or ability of plates and rivets to resist crushing. Mr. West's statement at the Naval Architects' meeting, that the slipping of joints was *the* evil to contend against in ship rivetting, directs attention forcibly to the fact that the work done by such seams as he dealt with is very different from that done in girders or boilers. The strains put upon rivetted joints in iron ships are much more injurious than those to which other rivetted joints are subjected, and unfortunately the rivets are least able to sustain it. Although, as has been well said of girder or bridge work, that no part of it is ever at absolute rest, owing to expansion and contraction, yet such strains are so slowly applied, and so general in their action, that in well-designed work it is doubtful if any appreciable loosening of rivets or injury to seams ever ensues. Stresses from expansion or contraction, too, have a well-defined limit of play, and once a girder has been exposed to the extreme range of winter and summer temperature, and all the parts have suited themselves to these extremes, no further stress takes place. Rolling loads and their effect upon even continuous girders are so well understood now, and can be so closely calculated and provided for, that rivetted joints in them can be made quite sound and durable.

In ship seams none of these favourable conditions are present. We have comparatively thin plates, ⅝in. thick being a not unusual skin thickness; these are united with single joint covers, and these joints are daily and hourly exposed to strains incessantly changing in direction, and of a magnitude beyond anything like exact determination. In a bridge or a girder, or a boiler, the stresses are almost uniform; they are to a great extent simply statical, and, save in continuous girders, are uniform in direction. The rivets and joints come to a bearing and rest there. The hull of a ship is altogether different. In it the strains constantly alternate between tension and compression; the rivets are pulled and pushed to and fro; the mere frictional resistance, even in the case of a new and unmoved joint is, as experiments of Sir E. J. Reed and others have shown, comparatively small, say equal to three tons on the square inch, and once rubbing has been set up at all, it may be neglected altogether. An impression seems to prevail that countersunk rivets in ship skins are weaker than snapped rivets, and it at first sight would appear that the broad shoulder of the head and snap of a rivet affords more support to prevent canting than a countersunk can. A great deal, however, depends on the size and shape of snap used. A hemispherical snap of insufficient diameter will be weaker than a good countersink, for its overlap will be so narrow and so thin as to be almost useless.

The question of slipping or movement in rivetted joints, and the relative capacities of different systems of rivetting to resist it, as well as the respective strength of countersink as compared with snap rivets; the relative strength and soundness of machine *versus* hand rivetting, and of snap as compared with hammered ends, all these as applied to iron shipbuilding, deserve experimental investigation on the basis, not of strength to resist fracture, but as regards ability to resist slipping. The results of slipping are that the plate next above or below the slipped joint has to take more strain than it ought, tearing sets in, and so a whole structure may be broken up in detail. Mr. West deserves thanks for calling attention to a question the importance of which has hitherto been overlooked.

IMPERIAL DEFENCE.

The audiences attracted by Sir C. Nugent's papers on Imperial Defence are larger than can be accounted for by any supposition except that the subject is one of deep interest. No ability in a paper, no reputation attaching to the lecturer, would bring together the number of distinguished officers and others that filled the theatre of the United Service Institution on Friday last, April 4th. We give a short account of the paper elsewhere. Although a long one, it was followed by so keen a discussion that at ten minutes past five the meeting was adjourned to the following Tuesday. Admiral Fanshaw, Captain Colomb, Admiral Phillimore, and Mr. Labilliere took part in the discussion. The speaker, however, who naturally excited the strongest interest was Colonel Drury, of the Queensland Artillery, who, while he gave expression to loyal Imperial sentiments, which would doubtless win applause from the audience he addressed, spoke very much to the point, and with so much ability that it was encouraging to listen to him, and to think that he represented even a section in Australia.

The question discussed—namely, the defence of our colonies and commerce—cannot really be separated from the maintenance of our existence as a nation; for England might be as surely blockaded and starved as Paris was, if her supplies were cut off. That this would only be a matter of months is, we think, made obvious; and the consideration impressed us with the weakness of England in one way, and the need to provide against the gravest danger. On the other hand, it is quite conceivable that the subdivision of the world into English naval stations, with coaling and repairing places in each, and all the necessary communications and arrangements for securing our safety in all seas, might convey to some minds the impression that England aimed at a species of naval supremacy everywhere. The long lists of fortified and unfortified ports certainly surprise any one who has not studied the question. Nevertheless, we think it will be obvious to any one who does study it that with the bulk of the carrying trade of the world in our hands we are so open to attack that the safety of our ships and colonies can only be secured by what appears to be rather an ambitious programme. To put it shortly, safety is only to be secured by supremacy. Nor is it unreasonable that it should be so. If the relation of our war to our merchant ships bore any approach to that of other nations, the question would be at an end; but this no one contends for. Indeed, this would be to advocate that our Navy is to be superior to the combined fleets of the world; instead of which it is only urged that we should be equal to any two of them, or that we should have, at all events, once and half the strength of France. Of course, however, ports and coaling stations require to be in suitable proportion to our ships and length of communications. The dangers spoken of by Sir Charles Nugent may be classed under two heads—(1) Present danger as a liability; (2) future danger which may be regarded almost as a certainty.

Present danger would arise from a combination of powers against us. Political changes are rapid, and so we might be over-matched with very little warning, and certainly without time to make up for our past negligence. For many years past the relations of Germany and France have been such that they might almost be regarded as in the position of members of Parliament who had paired off against each other, and their influence in Europe on that account might be almost disregarded. Yet it is evident that Germany has formed alliances which counterbalance this, and enable her to speak with the greatest weight. If this can be done, who can limit the power of combination? What would be our position in the face of a combination of Italy and France, whose combined fleets would be far more powerful than anything we could hope to have, and whose position on the Mediterranean cuts our Empire in two.

Future danger, however, threatens with certain steps. France and Germany have now populations of 37,000,000 and 45,000,000, respectively, at densities of 183 and 213 per square mile. England, with 35,000,000 at present, bears a fair proportion to these Powers, but it is with a density of 445 per square mile. How far can this density be increased? Is it not probable that while our population is greatly kept down by emigration, those of France and Germany will steadily increase until approaching our own in density? Each of them will then be far more than double our strength. Is it likely that Holland, Belgium, and Denmark can then hold their own? If absorbed, they will still further increase the strength of Germany and France. The only obvious means by which England may hope to hold her own is the strong federal union of England and her Colonies, who must otherwise become separated and weak. Germany, America, and Canada have each in their way given us lessons as to what may be done by this means. Our interests ought to enable England to do as much, but it is the mother country that must exert herself to effect an object which is so much for her own interest. Colonists are for a long time engaged in a struggle to overcome the natural obstacles in their individual paths, and are necessarily scattered and occupied with local matters. Yet to our humiliation it must be said that our Colonies have been more ready to move than ourselves in this matter. It is a shameful spectacle when a colony has to borrow money in the market at 4½ per cent. to carry out the completion of fortified ports for Imperial purposes which England might have procured at 3 per cent. The rulers of a country, in the position of England, at all events, ought to have a sense of imperial responsibility which is not to be drowned by party or popular cry; and we venture to think that when men have spoken out in this spirit, whatever their political party, they have commanded respect, and a more lasting, though perhaps less noisy, popularity than is to be attained by party successes. However, we do not desire to let this theme draw us into politics, and we would close by enumerating the heads of the defensive preparations advocated by Sir Charles Nugent, with estimates of the costs:—(1) Defence of London, £5,000,000; (2) central arsenal, £1,000,000; (3) commercial ports of defence, £2,000,000; (4) harbour defence depôts, (5) gun and torpedo boats, (6) strategic harbours of refuge, £1,600,000; (7) militia, land, 80,000 men; (8) militia, sea, 20,000 men; (9) army additional, (10) coaling station defences, £2,500,000; (11) submarine cable communication, £2,500,000; total, £14,600,000.

THE COLLAPSE OF SHIPBUILDING.

After attaining last year to the highest point that it has reached in the history of the industry, shipbuilding at the North-Eastern ports has in the first three months of 1884 collapsed. It has been definitely stated that there are now about 7000 shipbuilders unemployed on the rivers Wear and Tyne. If this statement be even exaggerated, it must be confessed that there is an enormous falling off in the number and the tonnage of vessels in course of construction. On the Tyne and the Wear the number of the vessels on the stocks is only about one-half of those on the stocks at the same date last year; and at the other shipbuilding ports there is also a falling off, though not quite so marked. Again, out of the vessels on the stocks there are some, the progress of which is stopped; and as others are launched their places are not taken up. It is thus clear that there will be an enormous falling off in the tonnage of the vessels built at the North-Eastern ports during the current year, and it is probable that the completeness of the collapse will be one of the reasons that lead to the conclusion that the recovery, if not very rapid, will be not so long deferred. The loss of vessels still goes on, and as the work of the steamers had been restricted by the enormous stocks that had accumulated, and as these stocks are now falling off, it may be fairly concluded that the demand for tonnage will recover with more speed than had been thought likely. So complete a collapse as has been witnessed and is being witnessed may lead to a revival in the trade at no very distant date.

LITERATURE.

Northern Transcontinental Survey. First Annual Report of Raphael Pumpelly, Director of the Survey. With some Experimental (Divisional) Maps. New York: E. Wells, Sackett, and Rankin, William-street. 1882.

The first report of the director of this very important Transcontinental Survey is addressed to Mr. H. Villard, president Northern Pacific Railroad Company, Oregon Railway and Navigation Company, and Oregon and Transcontinental Company, by Professor R. Pumpelley. He tells us that the territory, which is exclusively tributary to the lines of the Northern Pacific and associated roads, covers about one-fifth of the area of the United States. A large portion of this region is almost unexplored geographically, and is still less known as regards those resources which are to contribute to the business of his corporation. To obtain a comprehensive and authoritative knowledge of the resources of this region, an economic survey was established in the interest of the associated roads, and called "The Northern Transcontinental Survey." This organisation is divided into the following divisions: (1) Division of mineral resources; (2) division of climate, rivers, and irrigation; (3) division of soils; (4) division of forests; (5) division of economic botany; (6) laboratory; (7) division of topography.

The division of mineral resources will trace out the rock formation and study the mineral resources, especially of coal and iron ore. It will also pay attention to subterranean water supply and the question of artesian wells. It has charge of the work of finding and testing coal for the use of the roads, and is equipped with a diamond drill for testing in depth.

The division of climate, rivers, and irrigation is established to study the local climate—that is, of the great valleys and of the climate zones of elevation. It is establishing stations at points representing the local climates, at which there will be observed temperature and rain-fall, and certain other important facts. This division will also have charge of the work of gauging the streams, and determining the relation between the prospective demand and supply of water for irrigation in the different valleys.

The division of soils will determine the areas of the various soils, and represent them on the map, according to a classification based on observation in the field of the conditions of the soil, the native vegetation, and on chemical and mechanical analysis.

The division of forests will determine the distribution of the various trees, and will have the different forests examined by men well known for their experience in regard to timber and the manufacture of lumber. This will give such a general knowledge of the economic character of the forests as will be needed in order to settle many questions of general policy. Where it may be necessary, closer estimates of the amount of timber on each quarter section may be made independently. This division will also pay attention to general questions of tree planting and acclimatisation and to questions relating to the forest policy of the roads.

The division of economic botany relates especially to the forage plants which form the basis of the whole grazing industry, and of other questions relating to that business. This division will also be charged with the duty of ascertaining, for the experience of other countries, the useful plants either entirely new or of hardier varieties, which are adapted to cultivation in the different climatic areas.

In the laboratory will be analysed the large amount of samples collected in the field; and there will also be carried on such experiments as may be necessary to determine the commercial value of such useful materials as may be discovered by the survey.

The division of topography has charge of the mapping of the more important portion of the region covered by the survey. It also has the duty of determining and representing the areas of land adapted to irrigation; and from an inspection of the maps it will be practicable to determine in a broad way the possibility of large irrigation enterprises.

The object of the survey is essentially by gathering systematically all the facts concerning the resources of the region, to obtain the data necessary to guide the companies in regard to building feeders, in regard to matters of policy in encouraging the starting of different industries, and in directing immigration to the proper points. It is also intended to furnish to the world such comprehensive information concerning the great North-West and its resources as will forward a sound development of the country, and thus increase the prosperity of the companies under whose auspices the enterprise is conducted. To insure the gathering of these facts in such a manner as to make them of service, the divisions have been put under the direction of men whose names vouch for their value. The staff consists of a number of chemists, geologists, and topographers, numbering twenty-two in all.

To execute the survey in the manner planned requires the organised effort of a force working at a considerable expense. The result of this effort will be the collection of an enormous number of facts, which will be almost useless unless properly digested and correlated, and represented in a graphic manner. The information obtained concerning this great area can be expressed only in very general terms, unless we have at least approximately accurate maps on which the facts obtained in each division of the work may be represented, and on which the final generalisation and correlation of all the facts described may be clear to everybody. As such maps do not exist, the survey is obliged to make them, which it can do at a rate of 6000 to 10,000 square miles per season for each party.

The region with which the survey has to do presents itself to the economist in two aspects:—First, as a producer of raw materials. It has immense forests on the Western coast, and in the interior mountains, valleys, forests, on which the whole United States may before long become dependent. The railroads of this corporation are destined to become the most important lumber-carrying roads in the world. It is evidently therefore important that the commercial character of these forests should be determined and the data gathered for the framing of a forest policy. The mineral wealth of this region is known to be both varied and extensive, and there is little doubt that a properly conducted study of mineral resources will lead to the encouragement of mining industries, which might lie dormant in the absence of information that may be furnished by the survey. Nearly all of the region, excepting the forests and the rugged mountains, is adapted to grazing; vast areas to grazing only, others in part to grazing and in part to agriculture. It is important to have the data for determining upon what areas the small amount of possible agriculture shall be discouraged in order to protect the naturally predominant grazing interest, and for what areas the opposite policy shall be adopted. These facts will be readily obtained by the survey.

The second aspect in which the region presents itself is as to its capacity under cultivation. While there are large areas of land which are always sufficiently watered in the right season by rains and dew, there are larger areas in which droughts occur more or less frequently, and in which the possibility of irrigation would ensure its agricultural value; and there is a far larger area in which the soils are of the higher and highest grades on which the cereals cannot, under existing climatic conditions, be cultivated without irrigation. Now this region is traversed by many rivers with many tributaries, some of them fed by spring and autumn rains, and others by the summer melting of the snow on the mountains. There is no physical question that is more intimately connected with the future and immediate prosperity of this great region than that of irrigation. The determining of the maximum and minimum amounts of water in the streams; the periods of flood; the areas where the climate renders irrigation necessary and where unnecessary; the areas in each valley of bottom and bench-land adapted to irrigation, and the relation existing in each valley between the area needing irrigation and the water supply, and the times of different stages of water—these are the chief factors of the problem. And it seems to the author that there is no direction in which the survey can be of greater service both to the roads and to the country than in that of determining the fundamental facts relating to the possibility of irrigation and artesian wells in this region.

The intention is to make the record of the results of the survey essentially cartographic; to show upon the maps in a general form all the physical facts that have an important bearing on the prosperity of that region.

Having this object in view from the beginning, the topographical survey will represent the form of the surface by contour lines of 200ft. vertical distance. The maps will show the form of the surface, the grades of the streams, the extent of the bottom and bench-lands, and the extent and conformation of the uplands.

On one of these maps will be shown the minimum known volume of water, at high and low water, in the principal streams, and the seasons at which these stages occur; and the classified distribution of the soils and subsoils. This set will exhibit the data needed to determine the practicability of irrigation and under-drainage.

On another set will be shown the present climatic conditions, according to natural or local sub-climate areas. These will show the rainfall and temperature by months, and the phenomena which condition the success or failure of different crops will be mapped by areas and crop seasons. These maps will not necessarily be based, as regards their conditioning phenomena, wholly on a short range of observation, for the reason that there are facts of general information, and traders, military officers, ranchmen, and Indians, all observe and remember for years the time of injurious frosts, of droughts, and the years of failure of the few local crops.

Another set of maps will show the distribution and relative abundance of the various and numerous forage plants, and the climatic facts conditioning success in stock grazing.

A fourth set will show the mineral resources. On these will be represented the geological formations of the region, the outcroppings of coal and the areas underlaid by it; and, as the survey will test by drill and otherwise the character and thickness of the coal in the different fields, these facts will appear on the maps in a generalised form.

Of the topographical maps, showing contour lines, some are agricultural maps, some belong to divisions of forests. Some do not match along the edges, but, as they are provisional, this will doubtless be seen to before the finished plans are issued. They are all very clear, and are excellent specimens of printing.

PRIVATE BILLS IN PARLIAMENT.

GROUP No. 7.—The Midland Railway—Additional Powers—Bill was before the Committee on this group. There was but little opposition to the various proposals embodied in the scheme. The first part of the case which occupied the attention of the Committee was as to certain unusual powers which are sought by the promoters with regard to the Bristol Port Railway and Pier Company. Clause 20 of the Bill provides that the Midland or Great Western Railway Companies, or either of them, may enter upon so much of the railway and works of the Bristol Port Railway and Pier Company as lies between Sneyd Park Junction and Avonmouth, and may alter and restrict the signals thereon in such a way as to enable the said portion of railway to be worked on the block system, all costs—not exceeding £600—incident to such alteration to be defrayed by the Bristol Company. The debenture holders of the Bristol Company appeared in opposition to this proposal, contending that it was contrary to principle and precedent that Parliament should give its consent to a scheme by which the user of property was to be allowed to expend money and to charge it against the mortgagees in possession against the will of the latter. At the conclusion of the arguments the Committee passed the Bill as far as regarded this point, stipulating, however, that the Midland Company should provide the money at a rent charge of 2 per cent. per annum.

Group 9.—The Manchester, Sheffield, and Lincolnshire Railway (Chester to Connah's Quay) Bill was again before the Committee, presided over by Admiral Egerton. This is a scheme which presents engineering matters of a specially interesting character. At present the south-westerly limit of the Manchester, Sheffield, and Lincolnshire system is Chester, to which place it obtains access as one of the members of the Cheshire Lines Confederation. It is now the intention of Sir Edward Watkin to project the railways of his company further to the west; and by the present Bill Parliament is asked to sanction an extension from Chester across the river Dee by means of a swing bridge to Connah's Quay. Running powers are taken over the lines of the Wrexham, Mold, and Connah's Quay Railway, a combination of lines promoted by North Wales colliery owners for the accommodation of their traffic, and sanctioned by Parliament after several contests with the Great Western. The capital which is raised for the purposes of carrying out the works contemplated under the Bill is £200,000 to be obtained by the issue of shares, and the usual one-third borrowing powers are taken. Out of these amounts, the Sheffield Company undertake to expend £50,000 on the improvement of Connah's Quay, a promising port in the estuary of the Dee. The main feature in the scheme is undoubtedly the swing bridge to be thrown across the river for the purposes of the railway. This bridge, in common with the rest of the scheme, is designed by Mr. Davies, C.E., the resident engineer of the Wrexham Company, under the approval of Mr. Sacré, C.E., of the Manchester, Sheffield, and Lincolnshire Company, and Mr. Abernethy. It is intended that the bridge shall have three piers—the usual centre pier on which the structure is to swing, and one pier at each bank. Though it is proposed to give a clear 100ft. of navigable channel on each side of the centre pier, the scheme met with the most vigorous opposition from those engaged in the river traffic, the objection being the usual one taken in these cases, viz., that the impediment thus created will be a fruitful source of accidents. Starting with the general proposition that bridges over waterways are attended with inconvenience to navigation, the petitioners alleged various matters which rendered this proposal particularly objectionable. Against this evidence, Admiral Bedford and other authorities were called, and proved that in this case danger would be reduced to a minimum, as the bridge would be in sight for four and a-half miles on one of its sides and a mile and a-half on the other. As it was provided that river traffic should have the preference over railway traffic, and as arrangements would be made by which the swinging could be carried out in somewhat under a minute, it was impossible, said these gentlemen, to conceive how the incidents of the present case were such as specially to increase the difficulty of conducting vessels up or down the channel. The Corporation of Chester, representing the above bridge interests, presented formidable opposition to the scheme. Besides alleging the danger of collision which has already been dealt with, they expressed great alarm as to the possible consequences of such an interference with the channel as is proposed. At present the traffic to Chester is not large, averaging, as was shown during the hearing of the case, about one vessel and a-half per day, and the tonnage even of this craft must, owing to the nature of things, be small. But the Corporation have in contemplation the improvement of the river so as to admit of its navigation by vessels of large size, and they naturally consider that the presence of a low-level bridge in the lower part of the river, would in itself seriously operate against their town as a destination for water traffic. But its consequences in other respects would, they represented, be even more serious; and this part of the case may best be summed up in the words of Mr. John Fowler, who with his partner, Mr. Baker, was called in opposition to the Bill. Mr. Fowler says, "Such bridges are a bar to navigation, they disturb the currents, create eddies round the piers, and scour holes; they are accompanied by shoals above and below in the tidal channel." Thus it appears that the objection taken in the present case is somewhat similar to that urged by the Liverpool interest against the Manchester Ship Canal—that the works proposed—in this case the bridge; in that of the ship canal, the training walls—will, by diminishing the scour, cause silt and the formation of shoals, and the consequent diversion of the channel. Against this contention the promoters say that as their bridge is to be at right angles to the set of the tide, the deflection by the bridge as a consequence of the works became a physical impossibility. They pointed to the successful working of both railway and water traffic in connection with the Headley Bridge of the Manchester, Sheffield, and Lincolnshire, and the bridges of the Hull and Barnsley and North-Eastern Companies over the Ouse. The petitioners admit these instances, but they draw attention to the fact that Parliament had been most careful to guard the interests of the upper portion of the Dee by rejecting several schemes for crossing the river and sanctioning only one, on the express understanding that the viaduct should be of an extraordinary height. (This scheme, it may be mentioned, was abandoned, after having received the approval of the Legislature.) The promoters' retort to this allegation was that in this case a high-level bridge would be impracticable, owing to the low nature of the ground on both sides of the river. The estimated cost of the bridge is £60,000. As a railway project, the Bill is strenuously opposed by the North-Western and the Great Western, the two companies whose "monopoly" the promoters seek to break up by affording an outlet for the North Wales coal at Connah's Quay. The petitioning companies, however, refuse to take the view that this scheme is one for throwing open Connahs' Quay to the coal and salt trade, there being no such traffic from these sources as would justify the large expenditure of £227,000 necessitated under the Bill. Their belief is that this is merely the first instalment of a competitive route across the peninsula to Birkenhead, and thence by the Mersey tunnel to Liverpool. They also think it likely that Sir Edward Watkin will carry his company further into the North Wales coal-field. The suggestion of an ulterior motive was emphatically denied by Sir Edward Watkin and by Mr. Robertson, M.P., the well-known civil engineer, and an active promoter of the scheme. They submitted that their object was *bonâ fide* to cheapen the cost of transit to the colliery owners—of whom Mr. Robertson is one—by introducing the element of competition, and on this ground they asked the Committee to find the preamble proved. On Tuesday, the twentieth day on which the case had been before them, the Committee expressed their opinion that the preamble of the Bill was proved, and accordingly the scheme will be allowed to proceed.

At a recent meeting of the Committee of Selection, Sir John Mowbray presiding, Select Committees were appointed for the consideration of the six groups, which with the Bills constituting them, are given below. This list nearly exhausts the opposed Bills commencing in the Commons, most of the other groups having been disposed of.

Group 1.—London Central Electric Railway, East London Railway, London, Tilbury and Southend Railway; Metropolitan District Railway; Metropolitan Railway (various powers); Metropolitan Outer Circle Railway. Chairman, Sir Joseph Bailey. Date of meeting, April 29th.

Group 3.—Croydon and Kingston Junction Railway; Croydon Central Station and Railways; Croydon Direct Railway; Croydon, Norwood, Dulwich, and London Railway. Chairman, Viscount Emlyn. Date of meeting, Thursday, May 1st.

Group 4.—Aldershot, Farnham, and Petersfield Railway; London, Brighton, and South Coast Railway; London and South-Western and Metropolitan District Railway Companies; Basingstoke, Alton, and Petersfield Railway; London and South-Western Railway; Easton and Church Hope Railway. Chairman, Sir John Ramsden. Date of meeting, Tuesday, April 29th.

Group 6. — Blackpool Railway, West Lancashire Railway (Extensions); Manchester, Sheffield, and Lincolnshire Railway (Additional Powers); Lancashire and Yorkshire Railway; Liverpool, Southport, and Preston Junction Railway; Lancashire and Yorkshire and London and North-Western Railway Companies (Preston to Wyre Railways). Chairman, Sir H. Selwin-Ibbetson. Date of meeting, Tuesday, April 29th.

Group 8.—Wisbech Dock and Railways, Swansea Harbour, London and North-Western Railway, Sutton Bridge Dock, Wirral Railway, Mersey Railway, Eastern and Midlands Railway. Chairman, Mr. Blennerhasset. Date of meeting, Tuesday, April 29th.

Group 11.—Barry Docks and Railways, Cardiff and Monmouthshire Valleys Railways, Great Western Railway (No. 1), Taff Vale Railway, Treferig Valley Railway. Chairman, Mr. Foljambe. Date of meeting, Wednesday, April 30th.

On Monday Sir Arthur Otway, Chairman of Ways and Means, sat to consider two adjourned cases. The first of these—the Scarborough and East Riding Bill—was further adjourned until after Easter, in order to give an opportunity to certain dissenting parties to petition to be heard against the scheme. The Bill, as originally deposited, contained powers of an important and extensive character involving the construction of about fifty miles of lines; but the project has since been very considerably modified. The question now is whether the Bill shall be withdrawn, as is desired by nine of the twelve first promoters, or whether it shall be prosecuted in accordance with the wishes of the three remaining gentlemen. The adjournment of the case will enable those gentlemen who are in favour of the abandonment to present a petition in the usual form, praying to be heard before Committee on the Bill. Whether the Court of Referees will allow the *locus standi* is another matter. The point is an interesting and important one, and has not, so far as we are aware, arisen in connection with any previous case. After a lengthened examination of the financial position of the Scarborough and Whitby Railway Company, the Chairman determined to pass the Bill for the creation of £180,000 of preference stock. The promoters brought up a statement that they had received assents from shareholders representing £131,114; dissents, £46,086; and no answers, £44,340. It appeared from the evidence of Mr. Fox, C.E., that the railway had cost considerably more than was anticipated when the company had first obtained parliamentary powers. The condition in which the company now stood was that, unless they got the required amount for the completion of their scheme, the large expenditure which has already been incurred would be utterly wasted, and the proprietors could not hope for any return for their money. Taking this view of the case, the Chairman allowed the Bill to pass.

FOREIGN NOTES.

M. BOUTIGNY has shown that water ceases to wet metallic surfaces raised to a temperature considerably exceeding the boiling point, the water assuming the spheroidal state. Evaporation then goes on very slowly, but it is resumed suddenly and with great violence, as soon as the bottom of the boiler returns to a temperature near upon the boiling point. A long time ago M. Dumas, in his course of lectures upon physics, made a very conclusive experiment in this direction. He heated a wrought iron bottle almost to redness, nearly filled it with water, and corked it up tightly. Not immediately, but after a few minutes, when the bottle became cooled down, the cork was driven out with a loud report by the pressure of steam generated.

This question was lately brought up at the Société d'Encouragement, Paris, by M. Félix Le Blanc, who called upon M. Melsens, of Brussels, to explain his method for preventing boiler explosions from this cause. While M. Trève has been experimenting in the direction of restoring to the water the air abstracted in ebullition, M. Melsens has been labouring to prevent the water from assuming the spheroidal state; and this he proposes to effect by providing the inside surface of the water space of the boiler with a number of small sharp points. He conducted an experiment with a model boiler — open—made of copper, with a division in the middle, the bottom of one-half being left plain, while the other is provided with small conical points attached by hard solder. The boiler was placed over a gas stove of many burners; and the same volume of water was poured simultaneously into the two compartments, in sufficient quantity to cover the points in one of them. In this compartment the water boiled violently as soon as it came into contact with the heated metal; but in the other the water only gave off a very small quantity of steam, thus leading to the supposition that it had passed into the spheroidal condition. Exactly the same results were obtained when the water was previously freed from air. M. Melsens submitted a piece of boiler plate studded with rivets, the conical heads of which are drawn to a sharper point than usual. Without being yet satisfied that water does assume the spheroidal state, M. Melsens simply contends that if it does so, this is a method for preventing it, and calls upon a practical boiler maker to repeat the experiment on the scale of actual working. It may be observed on all this, first, that there is no proof that any boiler ever exploded because the water assumed the spheroidal state; and secondly, that the remedy proposed is impracticable, because scale would be deposited and could not be removed. The experiment is interesting, however, as showing the influence of points on ebullition.

The works of Cail and Co., of Paris, have been partially lighted by electricity since 1876; but now a total area of 23,407 square metres, including the fitting and erecting shops, the drawing-office, the general offices and stores, are electrically illuminated. The work has been entrusted to MM. Sautter et Lemonnier, who have adopted the system of machines of low tension and great quantity, by arranging the lamps in subsidiary circuits. The four I D Gramme dynamos, making 700 revolutions a minute, have an electro-motive force of 70 volts and a quantity of 280 ampères. Three of them supply respectively 22, 24, and 26 arc lamps, and the fourth 22 arc and 83 incandescent lamps. The engines give out 140-horse power, of which the arc lamps absorb 1·38-horse power, and the incandescent lamps 10 kilogram-metres, or 72¼ foot-pounds each. The whole plant cost 72,673f. = £2907, while the expense per hour is 0·107f. for each arc lamp and 0·01f. each incandescence lamp, without reckoning the motive power. Apparently the arc lamps are worked in multiple arc, the electro-motive force being too low to work more than two or three in series.

THE MANCHESTER SHIP CANAL.

THE Select House of Lords' Committee, to which has been entrusted the task of deciding whether or not there shall be a ship canal constructed between Manchester and Liverpool, have now had nineteen sittings of five hours each, and still the promoters' case is certainly not finished; but no serious consequences will ensue from this slow progress, for even if their lordships pass the Bill, there will be ample time for the other House to deal with the project. Last year the Bill left the Lower House so late that the Lords had barely time to take it up, but they managed nevertheless to reject it. By the method adopted last session all the costs of two inquiries were incurred to no purpose; therefore on economical grounds it was wise to introduce the Bill this time in the House least favourable to it; for while if the Lords reject it there will be no further expense, on the other hand, if they sanction the scheme the other House is most likely to take the same course. The Duke of Richmond and Gordon and his noble colleagues go steadily and contentedly along, apparently heedless of the length of the inquiry, although it must be admitted that the chairman is very prompt to suppress irrelevant matter. Out of an investigation of this kind one can hardly expect to get much that is lively and amusing. For the most part the proceedings are dull and dry and technical; but to some men it is given to enliven the dreariest of matters, and so even in this case there have been some witnesses who have caused great amusement by quaint expressions, intense earnestness in the cause, astounding bursts of eloquence where only simple answers to questions were required, and eager desire to settle the case at once upon their own authority. These rare gleams of brightness have been both welcome and useful, but the whole business is solid, and essentially practical, as indeed it need be when more than ten millions are involved.

Having at last concluded their commercial evidence, the promoters once more produced the designer of their gigantic scheme, Mr. Leader Williams, to explain the engineering points. Dealing first with the old part of the scheme, viz., the canal proper, from Runcorn to Manchester, he explained the changes for the worse that had taken place in the beds of the Mersey and the Irwell in the last half-century through the deposit of solid matter, and the floods produced by more rapid falls of upland waters. These evils, of course, he hoped and intended to remedy by means of the canal, which would be deeper and broader than the present rivers; while a highway right up to Manchester would be created capable of taking the largest ocean-going vessels, mainly, of course, steamers, seeing that sailing vessels would have to be towed, and that would minimise the relief anticipated from the heavy dues at Liverpool and railway charges to Manchester. The length of the canal, he explained would be twenty-one miles, with a rise on level of 50ft. 6in., the whole length to be split up into sections by a series of locks. The minimum width at the bottom would be 120ft., 50ft. more than the Suez Canal, while the width below Runcorn locks would be increased to 200ft., which would afford a sort of tidal basin, in which vessels could ride while waiting for a suitable tide down the river. The minimum depth of the canal was intended to be the same as that of the Suez Canal, viz., 26ft., or 3ft. more than the depth of the Amsterdam Canal. The banks of the canal, where of a friable nature, were to be lined with stone, to be won from the red sandstone, through which a portion of the canal would be cut. After dealing with the railway deviations which would be involved by the canal, and on matters relating to the canal proper, and which, therefore, were, in the main, not new, Mr. Williams turned to the proposed low-water channel in the estuary of the Mersey, which, having been excluded from consideration last year upon a technicality as to the depositing of plans, is really the new part of the scheme. Having described the legislation for many years past respecting the estuary, the constitution and rights of the Mersey authorities, viz., a Conservancy Board, composed of the First Lord of the Admiralty, the President of the Board of Trade, the Chancellor of the Duchy of Lancaster, and an acting conservator, at present Admiral Spratt, he explained that the first section of the proposed estuary was a mass of channels through sandbanks, which shifted from year to year; the second section comprised what were called the "narrows" between Liverpool and Birkenhead; the third, leading up to Runcorn, was like the first, consisting of sandbanks overlying beds of gravel, clay, and rock, and having a maximum width of three miles; while the fourth, from Runcorn to Woolton Weir, included the tidal portion of the canal. Describing the varying depths of the water and the impossibility of navigation at certain times, he stated that the intention under this Bill was to form a regular channel in the estuary by means of training walls, which would not rise above the surface, so that there should be no reclamation of land; but which, in addition to defining the channel, would concentrate the scour of the channel and so create a constant and regular depth. By dredging the channel would ultimately be increased to a depth of 12ft. at low-water average spring tides, 20ft. at low water average neap tides, 32½ft. at high water average neap tides, and 48ft. at high water average spring tides. The greatest width of the channel was intended to be 960ft., and the lowest width 300ft.; and in this connection he mentioned that the Thames was 800ft. wide at Westminster Bridge, with an available width of navigation of 740ft. at high water. An important effect of this channel would be to increase the velocity of the current, to prevent silting up by carrying off any deposits, and so to increase the depth of water over the bar of the river. The amount of water in the estuary would also be increased, and generally the condition and the navigability of the river would be improved, while a clear way would be provided into the intended canal, so that the largest steamers would be able to pass by Liverpool and up to Manchester. This in brief outline was the scheme put forward by Mr. Leader Williams, and although he was, of course, severely cross-examined by various opposing counsel, he equally, of course, adhered to the practicability and beneficial results of the project.

Following upon the engineering part of the scheme came Mr. James Abernethy, C.E., the consulting and advising engineer to the Canal Committee. He supported Mr. Leader Williams as to the practicability of his scheme, and his evidence derived greater weight from the fact that he had himself had executed, or taken part in executing, and successfully, works similar to those now proposed in the Severn, the Ribble, the Tyne, the Tees, and some foreign rivers, and, moreover, he had constructed docks on the Mersey itself. He was therefore familiar with that river, and he described the state of that waterway as discreditable to the authorities. Mr. J. Deas, engineer to the Clyde Navigation, Mr. John Fowler, engineer to the Tees Conservancy, Mr. Messent, engineer to the Tyne Conservancy, and Mr. Brunlees, C.E., were the next witnesses on this branch of the inquiry. They described the extensive works which they had carried out on the Clyde, the Tees, the Tyne, and Morecambe Bay, and gave so satisfactory an account of the results to the navigation in general and the shipping in particular, and spoke so confidently as to like benefits ensuing from the Mersey scheme, that opposing counsel were unable to gain a single point from them to weaken their testimony. Having in this way settled, so far as it rested with them, the question of whether or not the proposed estuary works were possible, the promoters proceeded to call evidence in the interests of shipowners. Two points sought to be made by the opposition were that large vessels would have difficulty in passing under Runcorn Bridge and other bridges by reason of their masts; and next that steamers were not very likely to go up the canal, and if only sailing vessels used the canal they would have to be towed up, and that would cost as much as the charges complained of at Liverpool. To dispel these contentions several shipbuilders, sea captains, and shipowners were examined, who showed that it would be easy enough for most vessels afloat to get under Runcorn Bridge merely by striking their topmasts, that it would be worth while in other cases to alter pole masts to telescopic masts, and that the strong tendency in shipping was in the direction of steamships in place of sailing vessels. Evidence was also produced to show that freights and insurance to Manchester would be no heavier than they now were to Liverpool, and that many large shipowners who now did not send to Liverpool would be ready to send their largest ships up to Manchester for the valuable cargoes they could there obtain without railway transit and breaking of bulk.

A singular incident in the enquiry was the interposition, during the promoters' evidence, and the examination of a witness against the Bill, in order that he might be able to leave this country. This witness was Mr. Eades, C.E., of America, who stated that he had been familiar with the river Mississippi for forty years past, and he had laid before Congress a scheme for improving that river with a view to preventing floods. That plan had been approved by the House of Representatives, but had not been sanctioned by the Senate. He had constructed several steam and other vessels, and also the steel bridge at St. Louis, which was the largest bridge of the kind in the world, and which cost 3½ millions sterling. The bar of the Mississippi had been for thirty or forty years a great obstruction to navigation and to commerce, and it had in 1875 so far risen that the depth over it was only 8ft. He then designed improvement works which had increased the depth to 30ft., and he was personally responsible for maintaining that depth for the next fifteen years. To prevent the deposit of silt he had designed a number of submarine dykes, which were constructed parallel to each other, and were carried out to a distance of two and a-half miles to deep water. The result was to so direct the force of the current that the channel was now maintained by the force of the current, and the silt was thus swept further out to sea than it previously was, and the water of the river could be detected twenty-five miles out to sea instead of only two and a-half miles. Mr. Eades next stated that he had been engaged by the Mersey Docks and Harbour Board in February last to examine the report upon the estuary of the Mersey with special reference to this scheme. His conclusion was that the effect of the low-water channel as proposed by the present scheme would undoubtedly be to discharge the energetic part of the ebb tide and would stop the fretting process over the rest of the estuary. The sandbanks would consequently inevitably grow, and that portion of the estuary would gradually silt up. The fretting process due to the action of the tide was absolutely necessary to the maintenance of the estuary. The only remedial agent which kept the estuary open was the fretting process which caused the channel to wander backwards and forwards in the estuary, because it was impossible for the deposit to be removed from the surface of the sandbanks except by a current equal in velocity to the current which brought it in, and the only way in which the sand could be brought within the influence of such a current was by the undermining caused by the flow of the stream and the consequent "tumbling-in" of the sandbanks from time to time. He was satisfied that this process would be interfered with by the proposed works, which would cause a deposit below the mouth of the low-water channel at Garston, thus interfering with the entrances to the docks at Garston and Liverpool.

The last witnesses examined on behalf of the Bill before the adjournment for the Easter recess were Mr. Jacob Bright and Mr. Slagg, the members for Manchester, and Mr. Arnold and Mr. F. Salford, all of whom spoke strongly as to the universal desire in Lancashire for the scheme, and as to the commercial advantages the canal would confer. As an indication of the confidence of the wealthy classes in the success and value of the scheme, it was stated on authority that Mr. John Rylands, of Manchester, was prepared to take up £50,000 worth of shares in the projected company, and it was further shown that many other gentlemen had expressed their intention to invest to the extent of thousands.

The Committee have now adjourned until the 24th of this month, when the case for the opposition may be, but not certainly, opened.

It is perhaps interesting to note that the promoters' case in the House of Commons last year occupied twenty-one sittings of four hours each; but before the Lords' Committee this year their case has absorbed nineteen sittings of five hours each; while nearly 100 witnesses have now been examined as against sixty-nine last year, and 15,000 questions have been asked, as against only 8000 odd last year in the Commons' inquiry.

THE ELECTRIC LIGHT ON BOARD THE IRONCLAD RIACHUELO AND S.S. MASSILIA.

In our impression of the 4th inst. we published some account of the Riachuelo, which is an ironclad belonging to the Brazilian Navy. This vessel has been fitted with an electric lighting installation by Messrs. Siemens Bros. and Co. She is lighted internally with 270 Swan incandescent lamps of 20-candle power each, in addition to which there are two yard-arm lights, each consisting of a group of eight 40-candle power Swan lamps and two arc lights of 25,000-candle power each for search purposes. The current is furnished to the lamps by three Siemens S D0 dynamo machines, each driven by one of Brotherhood's three-cylinder engines. Any two of the dynamos will maintain either the incandescent lighting or the search lights. The incandescent lamps are fed from two independent circuits, the lamps on one circuit being maintained throughout the whole night for purposes of police, locomotion, &c. The double wire system is used throughout, the hull of the ship not being used as return. The whole of the wires are enclosed in solid teak casings covered with teak strips screwed on and French polished. The fittings carrying the Swan lamps in the officers' quarters, ward room, &c., consist of electro-silvered pendants of simple design, similar pendants finished in bronze being used in the passages. In the working parts of the ship the lamps are enclosed in special lanterns protected by strong wire guards. Special provision is made in the lampholders to neutralise the effect of concussion upon the lamps when the guns are fired. The end of the lamp rests against a piece of india-rubber, and is held there by three springs, by which the lamp may freely move in any direction. The engine-room and stokehole are supplied with portable lamps, joined to the circuit by flexible wires, thus enabling the lights to be carried into a coal bunker or inside a cylinder. The water-gauge glasses are lighted by specially strong waterproof lanterns, which may be cleaned from coal dust and spray by being drenched from a hose. The lighting throughout is very complete, and embraces that of the magazines, stores, sail rooms, crew's quarters, turrets, and loading pockets, conning tower, and every part where work is carried on at night. In the dynamo-room is a switchboard provided with means of readily connecting any main circuit to any machine, and of putting the arc lamps in circuit. This switchboard is an example of the solid form of work of which more is now to be seen than a few months ago, when contacts were mostly made by means, the simplicity of which could scarcely lay claim to any accompanying virtue. A complete system of safety fuses is provided. The yardarm lights, have white enamelled concave reflectors provided with rings at their outer edge for guy wires to steady them.

The Massilia (s.), which is sister ship to the Valetta (s.), is lighted with 250 Swan incandescent lamps of 20-candles power each. These are maintained by two Siemens S D0 dynamo machines each driven by a 10-horse power Tangye vertical engine by means of the frictional gearing introduced by Messrs. Siemens Brothers about twelve months ago, and exhibited at the Southport meeting of the British Association. The engine fly-wheel runs in contact with a paper pulley on the generator spindle. The lamps are placed upon two distinct circuits, one of which is kept in operation all night. The single wire system is employed, the hull of the ship being made use of as return. This, of course, greatly simplifies the wiring, and the objections made against the use of the hull for this purpose are said to be groundless. The lights in the saloon, music-room, and smoke-room are carried in electro gas-fittings, consisting partly of two-arm pendants and partly of single brackets, while for lighting the state-rooms the lamps are enclosed in the ordinary pillar lanterns, which also carry candle sockets. In the officers' cabins bronze fittings are used, each having a separate switch, and the engine-room is lighted by fittings like those in the Riachuelo.

CONDENSING ENGINES FOR WOOLWICH ARSENAL.

We publish as a supplement this week engravings of a fine pair of horizontal engines, made by Messrs. Simpson and Co., Pimlico. The engines are high-pressure condensing, with cylinders 28in. diameter coupled together with cranks at right angles, and having a stroke of 3ft. 6in. They are specially designed for running at a high speed and for driving the first motion shaft of a mill or factory direct without the intervention of the usual heavy and cumbrous gear. The crank shaft is arranged in line with the main shaft either in the centre of its length or at one end of the same, and is secured with solid flange couplings, so as practically to form one and the same shaft. The main bearings being of extra length for the high speed have been specially designed so as to ensure the whole of the surface in each bearing being in contact with the journals of the shaft; and arrangements have been made so that each can be adjusted in every direction with the greatest exactness. The correct setting of the main bearings as regards being fair, level, and in line, does not depend therefore on the accurate fixing of the engine, as ample adjustment is provided for errors in erection, settling of the foundations or straining of the holding-down bolts, while all wear can be taken up when the engines are running. The cylinders are steam jacketted with inserted liners, the joints being so arranged as to prevent the slightest chance of leakage of steam either from the cylinder or jacket. The steam distribution is effected by separate steam and inlet exhaust valves. The former consist of two main and expansion slide valves, and the latter of two circular rotating valves arranged one at the bottom of each end of the cylinder, thereby providing efficient means of draining. All the valves are designed to work in almost perfect balance, with just sufficient pressure to keep them up to the faces of the cylinder, and therefore take little power to drive them; while the strain on all the working bearings is so reduced as to obviate that excessive wear of the valve faces and gear which militates against the adoption of ordinary hollow slides for high-pressure quick running engines. The valves are actuated direct by two excentrics, one driving the main steam inlet and exhaust valves and the other the expansion plates, which are adjustable by hand while the engines are at work. The valve gear is therefore of simple design, with few working parts. The main engine frames are substantial castings of ornamental appearance, having the lower guide bars cast on, and arranged with movable upper bars, so that all wear can be easily adjusted and the crossheads readily removed. The air pumps are single-acting plunger pumps with water pistons. They are worked direct from the piston-rods. The valves and valve chambers are arranged so as to ensure the discharge of the whole of the air at each stroke. This is a most important point, and one that, unfortunately, does not always get the attention it ought. These engines will soon be running, and we hope then to be able to give the details of their performance. Messrs. Simpson and Co. have given great attention to the designing and manufacture of high-class economical engines, and have with their compound engines frequently obtained, they inform us, an indicated horse-power for less than 14 lb. of feed water.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

This has been the week of the quarterly meetings. The Wolverhampton gathering was held to-day — Wednesday — and the Birmingham gathering comes off to-morrow. Less importance than usual attaches to the latter meeting, since the market to-day has been taken as pretty conclusive of the course of the Birmingham market.

Business to-day opened with the announcement by the all-mine pig makers of Staffordshire and Shropshire alike that there was to be no declared reduction upon the quarter. Cold blast all-mine pigs therefore stood at 82s. 6d. to 80s., and hot blast at 62s. 6d. to 60s. These prices, however, were too high to permit of much business. Indeed the orders which were given out for this class of iron were very small. Makers were unable to report much decrease in stocks at the furnaces. The competition of hematites imported from other districts, and of part-mine pigs made in other parts of the kingdom and sold in Staffordshire, had very much to do with this quietude.

Sellers of second and third-class pigs, alike native and foreign, did more business than the vendors of best iron. Some of these who offered outside brands reported that, during the last fortnight or so, they had made some fair transactions for the supply of consumers' needs over the ensuing quarter. Yet these transactions had not been so numerous as sometimes happens. Staffordshire part-mine pigs were 47s. 6d. to 42s. 6d. per ton, and cinder pigs, though generally quoted 40s., might have been freely had at 37s. 6d., and in exceptional instances at even 35s. Lincolnshire pigs were easy at about 47s. 6d., Derbyshires at 45s. to 44s., and Northamptons at 42s. 6d. This was a fall upon the quarter of about 2s. a ton on Derbyshires, and 1s. 6d. to 2s. upon Northamptons. Good hematites, made by the Tredegar Company, South Wales, and by the Barrow Company, were quoted at about 58s., but buyers were unprepared to give the full price, notwithstanding that it was a drop upon the price quoted in January of from 2s. to 2s. 6d. per ton.

The marked bar firms, such as the Earl of Dudley, W. Barrows and Sons, the New British Iron Co., Noah Hingley and Sons, John Bradley and Co., Phillip Williams and Sons, William Millington and Co., and John Bagnall and Sons redeclared, as I anticipated last week, the January price of £8 2s. 6d. for his lordship's iron, and £7 10s. for the bars of the other firms named. These are the prices which were fixed as far back as February last year.

But the market to-day very generally assumed that with the exception of one or two firms the £7 10s. quotation has now become little more than a nominal figure, and that for an order of anything like size a lower price would be accepted without much demur. Indeed these makers have gone a long way towards meeting the expectations of customers by selling what they are pleased to term a brand of somewhat lower quality than their old marked description at £7 per ton; and other less valuable brands again at £6 15s. and £6 10s.

The Earl of Dudley's "list" for the new quarter stands as here: —Rounds, from ⅜in. up to 3in.; ordinary quality, £8 2s. 6d.; single best, £9 10s.; double best, £11; treble best, £13. Rivet and T-iron —single best, £10 10s.; double best, £12; treble best, £14. T-iron of ordinary quality is £9 2s. 6d. Angles and strips and hoops of from 14 to 19 b.g. were—ordinary quality, £8 12s. 6d.; single best, £10; double best, £11 10s.; and treble best, £13 10s. Strips and hoops of ⅝in. and 20 b.g. were—ordinary, £9 12s. 6d.; single best, £11; double best, £12 10s.; and treble best, £14 10s. Strips and hoops, ⅝in. and 20 b.g., were £10s. 12s. 6d., £12, £13 10s., and £15 10s. respectively.

Messrs. William Barrows and Sons' list stands at £7 10s. for rounds and squares and flats; £9 for best crown, scrap, and chain bars; £10 for double best bars, marked "B. B. H.," and for double best scrap and chain bars; £8 for plating bars; £9 10s. for plating angle, T and rivet iron; £10 10s. for best angles and double best swarf iron; and £16 for double best charcoal iron.

The "list" of Messrs. Noah Hingley and Son is £7 10s. for "Netherton" best crown bars and for Netherton best crown horseshoe bars; £8 for best rivet iron; £8 10s. for double best crown bars; £9 for double best plating bars; and £9 10s. for treble best crown bars. Ordinary angle iron is £8, and T-iron £8 10s. per ton.

The reports which the marked iron makers gave of current business varied, but as a whole they cannot be considered as by any means satisfactory. The demand as regards best qualities is limited. Australia and other of the Colonies are buying pretty well of some of the best makers. Chain and cable iron is also selling fairly.

Common Staffordshire bars were to be had this afternoon at from £6 5s. to £6, and for hurdle purposes even as low as £5 17s. 6d. Other merchant iron was also low in price. Indeed, some consumers stated that at the present time they could buy as cheaply as ever in the history of the trade. This remark applied not only to merchant sections, but likewise to sheets of nearly every description other than the best sorts.

Sheets were the description of iron that saw most business. Yet the orders placed were not, in other than cases where export merchants were the buyers, of large dimensions. Makers still reported that they were curtailing the output. It does not seem likely that the new business will necessitate much increased activity. I speak now of ordinary merchant, and galvanising, and common working-up sheets—not of best stamping or best working-up sheets. For these latter the demand was good, and makers reported a large export business.

Mild steel sheets are rapidly displacing the old-fashioned charcoal sheets, and the steel sorts are being rolled in large quantities.

Prices of ordinary sheets—singles—were £7; double, £7 10s.; and lattens, £8 10s., which was a drop of 5s. per ton in singles on the quarter, and of 2s. 6d. to 5s. on doubles. From £10 to £11 was quoted for best working-up sheets of 20 b.g., and from £13 to £13 10s. for stamping sheets of 24 b.g.

Messrs. E. P. and W. Baldwin quoted their "list" prices to merchants as:—Severn singles, £11; Baldwin Wildes B., £12; B.B., £13; B.B.B., £14; charcoal, £16 10s.; burnt charcoal, £19 10s.; and E. burnt charcoal, £21 10s.

The "list" of the marked iron houses, such as William Barrows and Sons, John Bagnall and Sons, Limited, W. Millington and Co., and others, for sheets stood at:—20 b.g., £9; 21 to 24 b.g., £10 10s.; 25 to 27 b.g., £12; best, sheets, £1 10s. per ton extra; double best, £2 10s. per ton extra; and best charcoal ditto, £10 5s. per ton extra. But these quotations, like those for marked bars, were largely nominal.

Hoops for export were £6 7s. 6d. to £6 10s., and best marked hoops £8. Common nail hoops were under £6. Gas tube strip was £6 2s. 6d.

The plate trade showed but little improvement. Proprietors had to report their mills only partially engaged. For boiler qualities E. T. Wright and Son quoted "Monmoor" plates:—Best, to 5 cwt. each, £9; double best, £10; treble best, to 4 cwt. each, £12; special for flanging, &c., to 3 cwt., £15 10s. charcoal, to 3 cwt., £17 10s. The "Wright" qualities were 10s. per ton less than the above.

W. Millington and Co. quoted:—Boiler plates, 4ft. wide and 15ft. long, marked "S. H.," £9; best ditto, £9 10s.; double worked, £10 10s.; treble best for flanging outwardly, £12 10s.; and treble best for flanging inwardly, marked "L. M.," £15 10s. The New British Iron Company's plates were £9.

On many hands to-day the prospects of the steel trade afforded food for interesting discussion, and will doubtless do so in Birmingham to-morrow. In this district, as well as in others, the steel age is advancing. Much satisfaction is occasioned by the knowledge that by the laying down of new plants upon the Basic, Basic-Bessemer, Siemens-Martin, and Clapp and Griffiths' processes respectively, ironmasters here are preparing to enter with vigour into the new condition of things.

More business would have been done this afternoon if it had not been for the disturbing influence of the wages questions in alike the finished iron and coal trade. When these arbitrations—if they come to arbitrations—are over buyers will be readier to order.

The Iron Trade Wages Board has been summoned for a meeting in Wolverhampton next Tuesday, to consider the wages question. In all probability a resolution will be passed by the united masters and men to submit the question of a drop which the masters claim to arbitration.

The large engine sheds just opened at Cathays, Cardiff, by the Taff Vale Railway Company, were manufactured and erected by Messrs. Morewood and Co. The sheds are in two spans, and have an aggregate length of 600ft. by 108ft. wide. The Welsh national Eisteddfod was held in the building in August last, but the sheds have only just been applied to the purpose for which they were originally intended. The walls are of brickwork, there being two main outside walls and one centre wall of the same length, which forms the partition dividing the building into two sheds.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Business throughout the iron trade of this district, though not in an absolutely depressed condition, continues without animation, and no one seems able to look forward with confidence to any legitimate source from which improvement can be expected. Generally, there is no actual scarcity of work. Pig iron makers and forge proprietors are able to keep going, but orders are only got with difficulty at low prices. In the large consuming branches of industry, engineers as a rule are also kept fairly employed—machinists, in fact, being unquestionably busier than they were a month or so back, and makers of locomotives and special machine tools are kept well supplied with work; but there is an absence of any hopeful feeling with regard to the future. The result is that business is only entered into very cautiously; users of iron have to cut down prices to the lowest possible point to secure orders, and although the raw material is at present to be bought at very low figures, this does not seem to offer much inducement to buy beyond present requrements.

At the Manchester iron market on Tuesday, considering that it was the commencement of the quarter, there was only a small business doing, and in some cases there was a little giving way in prices. Lancashire makers of pig iron were open to book orders at about 1s. per ton under the full rates which were being quoted last week, and for delivery equal to Manchester the average price for local brands of forge and foundry is now about 43s. 6d. to 44s., less 2½ per cent. At the lower prices a few orders have been booked; but so far as buyers generally are concerned, the reduction does not seem to have had any very material effect in bringing forward new business. For district brands the average prices remain at about 43s. 10d. to 44s. 4d. for Lincolnshire, and 45s. to 46s. for Derbyshire forge and foundry, less 2½ delivered into this district. Only a few sales, however, are reported, and at the above figures makers are open to book orders for long forward delivery, whilst for prompt sales more disposition is being shown to entertain orders. In outside brands, notwithstanding the recent blowing out of furnaces in the Cleveland district and the reduction from various causes of the make elsewhere, supplies continue so fully equal to requirements that no real hardening in prices has been possible, and Scotch iron has recently been sold in this market for delivery over the year at slightly under the prices quoted by makers for prompt sales.

In the hematite trade there has, if anything, been a slightly better feeling. Although buyers are not disposed to come up to the full prices asked by makers, there is more inclination to entertain business on the basis of the minimum rates of 55s. 6d. to 56s., less 2½ for good foundry qualities delivered into the Manchester district.

Business in the finished iron trade has during the past week been practically held in abeyance pending the settlement of prices at the quarterly meeting. Nominally makers quoted rates have been without alteration, but merchants have been underselling in anticipation of prices having to give way. For delivery equal to Manchester the average price for good ordinary bars is about £5 15s. to £5 17s. 6d. per ton.

In the metal market the most noticeable feature has been the extremely low price at which ingot copper is now being offered, and fairly large sales have been made during the past week in this district at from £59 10s. to £62 10s. per ton according to brand.

Brass founders in this district are in some cases being kept briskly employed on foreign orders for steam and general engineers' fittings, and there is also still a good deal of work giving out by the large locomotive building firms for locomotive fittings. Generally, however, the home trade is very quiet, and orders only come forward in small quantities, with prices being continually cut down by the small makers to secure work to keep them going.

Ironfounders still report trade as extremely quiet. For engineers' castings there is a moderate demand, but in heavy builders' work there is very little being given out, and this is competed for at excessively low prices. For columns the average quoted prices are about £5 5s. to £5 10s., but this class of work has been delivered into the Manchester district and fixed at as low as £4 17s. 6d. per ton. Pipe castings are also extremely low in price, the ordinary sizes, bored, turned, and lined, being delivered into this district at from £4 11s. to £4 12s. 6d. per ton.

Messrs. W. and J. Galloway and Sons, of Manchester, are supplying two of their patent Galloway boilers 26ft. long by 6ft. 6in. in diameter, and one of their compound engines with 14in. and 24in. cylinders and 2ft. 6in. stroke, to drive the machinery at the International Health Exhibition to be opened in London next month, and they are fixing the gearing for the same. Messrs. Galloway have also in hand a pair of blowing engines for Spain similar to those made a short time back for Bolckow, Vaughan, and Co., which were fully described and illustrated in The Engineer.

The reports sent in for the past month by the various branches connected with the engineering trade union societies show no very material change in the general condition of trade. Most branches of industry in the important engineering centres throughout the district seem to be fairly well employed, and the percentage of members in receipt of out-of-work support on the books of the Steam Engine Makers' Society remains at not more than about 1½ per cent. Locomotive builders and tool makers are generally well supplied with work, and the leading cotton machine making firms are tolerably busy. Small stationary engine builders are, however, but indifferently employed, and in the boiler making trade work is falling off rapidly, the number of men out of employment in this branch of industry being now very considerable. With regard to wages matters no further movement is reported beyond what were referred to in my "notes" a month back, but with regard to the hours question, the secretary of the Steam Engine Makers' Society reports that in one district where the men had been working in excess of the standard hours they had been successful in bringing them on to the fifty-four hours' scale.

Generally throughout the coal trade of this immediate district a fairly steady tone is reported, with, if anything, a rather better demand having set in since the commencement of the month, and the pits in the neighbourhood of Manchester are being kept going about four to five days a week, with little or nothing being put into stock except a small quantity of the common quality of round coal. Prices at the Manchester pits are steady at last month's rates, and although there is some competition from outside districts, this has not as yet had any material effect upon the local collieries In the West Lancashire district business continues only quiet, with pits as a rule not working more than three to four days a week. The better classes of round coal move off moderately well, but common round coals are very bad to sell. Engine classes of fuel continue in good demand at full rates. At the pit mouth quoted rates average about 9s. to 9s. 6d. for best coals, 7s. to 7s. 6d. for seconds, 5s. 6d. to 6s. for common, 4s. 6d. to 5s. for burgy, and 3s. 6d. to 4s. for good ordinary qualities of slack; but for anything like quantities the minimum figures above given represent more nearly the average prices which are being taken.

For shipment there is moderate business being done, but only at very low prices, 7s. 3d. being about the average figure for steam coal, and 8s. 3d. for seconds house coals, delivered at the high level, Liverpool, or the Garston Docks.

For coke there is only a dull demand, but prices are without alteration, best qualities averaging 10s. to 12s., and common cokes about 8s. per ton at the ovens.

I had a conversation this week with one or two of the promoters of the Manchester Ship Canal, and it is expected that another fortnight will see the close of the inquiry before the House of Lords' Committee. Very sanguine expectations are entertained that the Bill will be passed, and certainly a very strong feeling would be raised in this district if the project were again to be thrown out.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The Easter holidays this year will not be the cause of much inconvenience, and in only a few instances will work be resumed early next week. In the colliery districts no great difficulty would be experienced in "setting down" for a considerable time were it not for the expense of keeping the ventilation perfect and the "ways" safe during the pause in coal-getting. The miners will have very little money with which to make holiday. In few instances is half-time being worked, though in one or two high-class seams much in favour in the London market, four days a-week are being worked. Derbyshire is, perhaps, suffering more severely than Yorkshire, the coal from the southern part of the latter county being preferred by metropolitan consumers, though one or two of the Derbyshire pits produce equally good fuel for house purposes.

Dronfield, which has been familiar with disaster for the last eighteen months, is now threatened with another—the stoppage of collieries. The proprietors of the new Dronfield Silkstone Colliery, finding their pits unprofitable, required the men to concede a reduction of 10 per cent. in wages. This they declined to do, and on Monday Mr. Hague, the manager, gave orders to take the timber and rails out of the workings, as the directors, in consequence of the loss sustained, had resolved to close the colliery. A singular, not to say serious, incident connected with the abandonment of this colliery is a fear of flooding lower down the valley. Mr. Hague believes that, in the event of the New Dronfield Colliery being closed, the great volume of water previously pumped there would flow into the pits in the Unstone Valley, with the probable result of their having to be closed also. In a few weeks the pumping engine will be stopped, and it will then be seen what ground there is for the alarming apprehensions entertained regarding the collieries in the Unstone Valley. If there is the least probability of any sudden or stealthy rush of water into these collieries lower down the valley, no doubt the managers there will take due precautions for the safety, not only of the men in the pits, but of the property under their charge.

Messrs. John Brown and Company, Atlas Steel and Ironworks, have made all the steel blades for the large Cunard s.s. Gallia; but the one which broke the other day at sea was not of their manufacture, but one of phosphor bronze. This kind of blade is made in Glasgow. Messrs. Brown and Co. state that, up to the present, they have not heard of one of their steel blades breaking, though they have made a very considerable number.

The Board of Trade returns for March show that in the gross the downward tendency of business appears to have been checked at last. It is rather sorry comfort to have to congratulate ourselves that our trade is not still declining. The exports of the month show an increase of £3301, and the imports an increase of £1,362,807 as compared in the corresponding month last year. If one could only reverse these figures! In hardware and cutlery the contraction of the volume of business still continues. For the month of March the exports of the last three years were respectively £377,637, £338,803, and £282,099. France, the United States, Spain and Canaries, Foreign West Indies, Brazil, Argentine Republic, British North America, British Possessions in South Africa, British East Indies, and Australasia. There is a slight increase in the value exported to Russia and Germany, and Holland; all other markets show a decline. The falling off in South Africa is something extraordinary. For March in the three years 1882-3-4 the values have been £19,762, £10,492, and £6393! Taking the three months of the year, the only increasing market is Holland, and that to less than £5000. In the first quarter of 1882 we shipped to foreign and colonial ports hardware and cutlery to the value of £1,005,381; last year, £975,418; and this year, £796,635. Steel is still worse. In the first quarter of 1882 the steel exports amounted to £579,840; in the first quarter of 1883 there was a sudden drop to £353,130, and for the last quarter £281,974! In steel rails the values have fallen from £1,123,946 in 1882 to £664,175 in 1884!

The exports of machinery, millwork, and steam engines are again in an unsatisfactory state. In March, 1882, the value was £280,779; in March, 1883, it rose to £365,497, and in March of this year it has fallen to £263,899. Taking the entire quarter, however, it shows an increase, the values for the first quarters of 1883 and 1884 being £883,069 and £964,273 respectively.

In connection with the British returns, it is significant to notice that the German ironmasters and manufacturers are extending their businesses outside their own empire, particularly in merchant iron, special quality iron, section iron, bridge iron, plates and sheets, and work. In steel alone Germany produced last year 1,074,806 tons, or 177,447 tons over the preceding year. Steel wire increased no less than 100 per cent. during the year, and there was also an improvement in blooms, wheels, tires, sleepers, merchant steel, ingots and billets, &c.

In the House of Commons, on Monday night, Mr. Wortley, the junior Member for Sheffield, asked the Surveyor-General of Ordnance whether there was any truth in the report that the Government intend to supersede, by an extension of the Government factories at Woolwich or otherwise, the private firms now engaged in supplying the Government with heavy steel forgings for guns. It is an open secret that for some time such an extension has been advocated, and on Monday night Mr. Brand, the Surveyor-General of Ordnance, was able to assure Mr. Wortley that the Government had decided some weeks ago not to manufacture steel guns. This will be welcome news at Sheffield, where a large and important trade is done in this kind of work.

The members of the Steel Institute will not meet at Sheffield this year, as has been repeatedly stated locally. How this has come about is not definitely known. A local paper suggests that our manufacturers are getting shy of showing their establishments, and gave the Institute to understand as much. It would be something new to find the Sheffield firms in this frame of mind. If they had been more careful in the past they might have guarded many "a good thing" which was seen and noted by rivals who operated in it to Sheffield's disadvantage.

There is, I believe, no foundation for the statement that Sir John Brown, of Sheffield, intends to resign the chairmanship of Earle's Shipbuilding Company, Limited, Hull.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow pig iron market has again been dull this week. On Tuesday the quotations of warrants were down to within a half-penny of 42s. cash, and although there has since been some little improvement, the market still lacks animation. The disappointing nature first of the Cleveland returns, and subsequently of the Board of Trade returns, have certainly not tended to improve the feeling in business circles. The current shipments of Scotch pig iron are fair as to amount, but they are fully 10,000 tons behind what they were at this time last year, and it may be doubted whether the requirements of April will nearly atone for the deficiency of the first quarter of the year. There are 93 furnaces in blast, as compared with 110 at the same date twelve months ago. Stocks in the Glasgow warrant stores have been slightly decreasing; but they still aggregate 594,600 tons, as compared with 583,500 tons at the same time in 1883.

Business was done in the warrant market on Friday forenoon at 42s. 1½d. cash, and 42s. 3d. one month. On Monday the cash quotations receded to 42s. 0½d., whilst on Tuesday there was a slight improvement to 42s. 3d.

The market quotations of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 52s. 9d.; No. 3, 51s.; Coltness, 58s. and 51s.; Langloan, 54s. and 51s.; Summerlee, 52s. and 48s.; Calder, 53s. 6d. and 47s. 6d.; Carnbroe, 52s. and 48s.; Clyde, 48s. and 45s. 6d.; Monkland, 44s. 3d. and 41s. 3d.; Quarter, 44s. and 41s.; Govan, at Broomielaw, 44s. and 41s. 3d.; Shotts, at Leith, 53s. and 52s.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s.) and 47s. 6d.; Kinneil, at Bo'ness, 46s. and 45s. 6d.; Glengarnock, at Ardrossan, 52s. and 45s. 6d.; Eglinton, 46s. and 42s. 6d.; Dalmellington, 48s. 6d. and 44s. 6d.

There is no change for the better in the condition of the Scotch malleable iron trade. Fresh orders are very difficult to obtain, and prices are low. The shipments of iron manufactures from Glasgow in the past week included £23,693 worth of machinery, £3400 sewing machines, £6900 steel manufactures, and £1700 iron manufactures, exclusive of pig iron. The locomotive and bridge-building departments of the iron trade are brisk, but most other branches are feeling the pinch of dull times.

In the coal trade of Lanarkshire there is rather more animation than of late, but the shipping department has not yet attained the state of business anticipated, and which may possibly still be realised a few weeks hence. Among the cargoes shipped from Glasgow in the past week was 1310 tons for Lisbon, 1066 for Demerara, 1047 for Fiume, 1011 for Malaga, 900 for Gothenburg, 484 for Stockholm, 800 for France, and smaller quantities elsewhere. At Grangemouth the week's export of coals was 6472 tons. There have also been fair quantities sent away from the other ports on the east and west coasts. The total coal shipments at Burntisland during March was 43,400 tons, being a decrease of 5044 tons as compared with the quantity shipped in the corresponding month of last year.

A conference of miners' delegates was held a few days ago, when progress was reported with reference to the curtailment of output. It appeared that at all the collieries in the Glasgow district, with two exceptions, the men were working on the short darg. In the Hamilton district short time had also been adopted at many of the pits, the same being true with regard to Falkirk, while at Motherwell and in the Slamannan district the men were working the old hours. The delegates were exhorted to promote the union of the miners everywhere. There is little chance of the agitation producing any good results for the men, more particularly as the more limited character in both the iron and coal trades has rendered the supply of workmen more plentiful than it was some months ago.

The Clyde shipping trade is very quiet at present. Taking the amount of tonnage merely, there is an increase in the arrivals of 23,347 tons over the inward tonnage of the first quarter of last year, and 81,567 tons over that of 1880. There has been a slight falling-off in the exports from the Clyde in the three months; but these figures as to quantities do not clearly represent the true state of matters in the trade, which has been greatly injured by the extreme competition that has lately prevailed.

The cotton manufacturers of the entire South met at Augusta, Georgia, and have determined upon a policy of reduced production, intended to meet the depressed condition of trade. They have also formed a permanent organisation of their body.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office Officials, by giving the number of the page of* The Engineer *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* The Engineer *Index, and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

*** When patents have been "communicated," the name and address of the communicating party are printed in italics.

1st April, 1884.

5749. Steering Gear, J. S. Nicholson, North Shields.
5750. Covering Ships with Anti-fouling Metal Sheeting, G. M. Borns, London.
5751. Roller Drawers for Furniture, W. H. Blackwell, Manchester.
5752. Shuttle Pegs, W. Turner, Bradford.
5753. Drying-machine Cylinders, J. Whittaker, Accrington.
5754. Looms for Weaving Wire Cloth, C. H. Johnson, Manchester.
5755. Pump for Supplying Soft and Hard Water, R. H. Perks, Birmingham.
5756. Trouser Suspender, J. A. Hawkins, London.
5757. Insulating Supports for Electric Wires, B. Pitts, Bristol.
5758. Gas Pressure Gauges, T. G. Marsh, Oldham.
5759. Spinning and Doubling Textile Materials, R. Riley, Habergam, near Burnley.
5760. Measuring the Pitch of Screw Propellers, W. C. Martyn, Cornwall, and W. Kinley, Liverpool.
5761. Revolving Lamp, &c., J. Roots, London.
5762. Sanitary Apparatus, W. Baird, Dublin.
5763. Ventilating, &c., Gas Stove, R. Cox, Bristol.
5764. Double-bolted Top-extension for Drop-down Guns, &c., J. W. Smallman, Nuneaton.
5765. Sewing Machines, H. Gamwell, Liverpool.
5766. Hot-air Ovens, W. Varley, Carleton.
5767. Recording the Revolutions of Wheels, J. W. Brown, Seacombe.
5768. Hydraulic Properties of Lime, &c., W. Mills, Bedford.
5769. Breech-loading Cannon, R. H. Brandon.—(*B. B. Hotchkiss, Paris.*)
5770. Boxes for Receiving Fares, &c., J. G. Grimsley, Leicester.
5771. Mouth-pieces, L. P. Jacobs, London.
5772. Furnaces, T. L. Ellis, Coatbridge.
5773. Cutting Carbon, &c., T. J. Howell, London.
5774. Marine Steam Engines, G. Rodger, Barrow-in-Furness.
5775. Miners' Safety Lamps, J. Cope, Sheffield.
5776. Ball Castors, J. E. Tate and W. H. Shaw, Milnsbridge.
5777. Chemical Motive Powers, P. M. Justice.—(*W. L. Lowrey, Boston.*)
5778. Patent Churn or Washing Machines, J. Stenner, Tiverton.
5779. Fitting Horseshoes, A. Martyn, London.
5780. Air-tight, &c., Covering, J. W. M. Miller, Southsea.
5781. Electro-magnetic Machines, N. Rolland, London, and S. Vyle, Walthamstow.
5782. Screw-keys, B. Hargreaves, Burnley.
5783. Self-closing Cocks and Valves, J. N. Sperryn, Croydon.
5784. Preventing Robbery from Letter-boxes, W. E. Cadman, Picardy.
5785. Chimney-top, &c., J. Kell, Durham.
5786. Button Fasteners, H. Andrews, Birmingham.
5787. Actuating the Catches of Door Locks, J. Kaye, Kirkstall.
5788. Crane Locomotives, W. Cross, Newcastle-on-Tyne.
5789. Finishing Cotton Goods, J. H. Gartside, Manchester.
5790. Cocoon Silk Winding and Twisting, J. Lavenaz, Lyons.
5791. Loading Cartridges, H. J. Haddan.—(*F. L. Chamberlain, Ohio, U.S.*)
5792. Paper Cutter, J. Wetter.—(*F. Müller and E. M. Fasch, Leipzig.*)
5793. Magazine Rifles, G. E. Vaughan.—(*O. Schoanauer, Austria.*)
5794. Generating Gas from Hydrocarbons, A. J. Boult.—(*G. Jones, Washington, U.S.*)
5795. Type Casting Machines, O. Titchener, London.
5796. Closing Tin Vessels for Packing Biscuits, &c., E. Carr, London.
5797. Gas Engines, C. T. Linford, Lozells, and H. J. T. Piercy, Birmingham.
5798. Cribbage Boards, &c., W. S. and W. A. Dackus, Birmingham.
5799. Couplings for Railway Vehicles, W. R. Lake.—(*The Union Car Coupler Company, Boston, U.S.*)
5800. Rotary Web Printing Machines, G. Toulmin and W. Bond, Preston.
5801. Fixing Lawn Tennis Poles in the Ground, F. Cooke, London.
5802. India-rubber, &c., Coated Fabrics, W. R. Lake.—(*N. S. White, Canton, U.S.*)
5803. Ellipsograph, W. R. Lake.—(*L. Abbott, Cambridge, U.S.*)
5804. Backing-up Electro-type Shells, &c., W. R. Lake.—(*C. B. Cottrell, Stonington, U.S.*)
5805. Fire-escape, W. R. Lake.—(*V. Albert, France.*)
5806. Governors for Steam Engine, &c., G. Revet, France.
5807. Railway Signalling, C. D. Tisdale, London.
5808. Hose Coupling, E. Nunan, London.
5809. Envelopes, W. Guise, Redditch.

2nd April, 1884.

5810. Attaching Buttons to Boots, &c., F. Griffin, Stourbridge.
5811. Double Syphons, W. Devoll, Erdington.
5812. Expanding Finishing Tool for Lathes, H. Horner and W. Adcock, Loughborough.
5813. Drying and Roasting Coffee Berries, &c., H. M. Thorne, Leeds.
5814. Stopping Bottles, &c., G. T. Phillips, Northampton.
5815. Turnscrews, T. M. Frost, Sheffield.
5816. Tumblers for Supporting the Shafts of Travelling Cranes, &c., M. Easthope, Sheffield.
5817. Photographic Studio Background, J. S. Tulley, London.
5818. Drying and Airing Bedclothes, &c., J. W. B. Hawkesworth, Stokeford.
5819. Marking Tickets, H. T. Davis, North Brixton.
5820. Rotary Water Meter, W. N. Cox, Horfield.
5821. Combined Inkstand and Pen-rest, H. de la Spée, jun., Wandsworth.
5822. Pleating and Kilting, H. Trotman, London.
5823. Needle-cases, &c., F. H. Peace, Sheffield.
5824. Fasteners for Curtain Cornices, E. de Pass.—(*W. Zunz, Germany.*)
5825. Primary Electric Batteries, E. P. Chaimsonovitz, Leytonstone, and G. Binswanger, London.
5826. Stoppers for Bottles, H. Barrett, London.
5827. Portable Clipping Device, &c., J. M. C. Grove, Donegal.
5828. Connecting Links, E. Badois, Paris.
5829. Clarification of Liquids, S. Pitt.—(*W. Oldham, Paris.*)
5830. Lubricating Apparatus, E. L. H. Bauermeister, Hamburg.
5831. Sounding Boards of Pianofortes, E. W. Brinsmead, London.
5832. Brushes for Dynamo-electric Machines, C. G. Beechey, Liverpool.
5833. Ensilage, A. Chambers, London, and W. H. Champion, Lynsted.
5834. Extracting Gold from Its Ore, &c., E. Fischer, London.
5835. Gas Retorts, G. K. Harrison, Stourbridge.
5836. Preventing the Escape of Volatile Fluids from the Stuffing-Boxes of Compression Pumps, C. D. Abel.—(*A. Osenbrück, Germany.*)
5837. Reduction of Grain, A. W. L. Reddie.—(*La Société Anonyme pour les procédés Brevetés de Fariniere Saint Requier, Paris.*)
5838. Treating Vegetable Fibrous Materials, A. Prinz and E. Quellmalz, Saxony.
5839. Wood, &c., Articles, G. W. Ley, South Norwood.
5840. Portable Frame Tent and Easel Apparatus Combined, S. R. Cadogan and T. Wilkins, London.
5841. Extracting Fat from Bones, G. W. von Nawrocki.—(*J. Wellstein, Bavaria.*)
5842. Amalgamating Machines, H. Moon, Leicester.
5843. Combined Washstand and Step Ladder, W. R. Lake.—(*J. Nelson, Ohio.*)
5844. Conduction, &c., of Electric Currents, W. R. Lake.—(*L. Bollman, Vienna.*)
5845. Chimney Pots, E. S. Romilly, London.
5846. Electric Telephones, A. F. St. George, Redhill.
5847. Sewing Machines, J. Kayser, Bavaria.
5848. Speed Gauges, &c., W. R. Lake.—(*E. R. E. Cowell, Detroit.*)
5849. Secondary Batteries, F. G. Howard and T. J. Jones, London.

3rd April, 1884.

5850. Boots and Shoes, J. Parr, Earlestown.
5851. Seats of Chairs, &c., F. G. Rogers, Bristol.
5852. Rendering Apparent the Discharge of Oil from a Lubricator, J. Dewrance and G. H. Wall, London.
5853. Attaching Harness to the Hooked Wires and Shafts in Jacquard Machinery, T. Sutcliffe.—(*H. Rigby and Lindsay, Paterson, U.S.*)
5854. Brushes, A. W. Abraham, Georgia.
5855. Cistern Pumps, W. Devoll, Erdington, and Messrs. Lee, Howl, Ward, and Howl, Tipton.
5856. Hardening and Tempering Steel Wire, G. and E. Ashworth, Manchester.
5857. Carding Engines, G. and E. Ashworth, Manchester.
5858. Hand and Steam Steering Gear, J. H. Smiles, Stockton-on-Tees.
5859. Supplying Air to Furnaces, E. Padley, Tipton, and W. T. Holt, Willenhall.
5860. Tent Pegs, C. A. Jones, Hatherley Court.
5861. Preserving Perishable Substances, J. Barnett, London.
5862. Reservoir and Self-feeding Penholder. W. T. and C. Smith, Birmingham.
5863. Lifting and Carrying Rails, P. U. Askham, Sheffield.
5864. Moulding Composition for Casting Steel, &c., W. Birchenough, Sheffield.
5865. Breaking Down Coal, E. Mould, White Barn.
5866. Securing Buttons, &c., C. J. Brooksbank, Matlock Bank.
5867. Force Meat and Puree Pressing, S. Arnaud, Bangor.
5868. Leg Suspension Compound Fracture Apparatus, I. N. Davies, Ystrad Rhoudda.
5869. Drawing Compasses, G. F. Thompson, Chester.
5870. Disinfecting Water-closets, J. R. Meihe.—(*T. S. de Dienheim-Brochocki.*)
5871. Steam Generators, G. Rodger, Lancashire.
5872. Packing for Stuffing Boxes of Steam Engines, G. Rodger, Barrow-in-Furness.
5873. Damp-proof Material for Lining Walls, J. Barnes, Manchester.
5874. Gas Liquor, F. C. Hills, Deptford.
5875. Lamps for Bicycles, C. Phillips, Birmingham.
5876. Jacks, B. T. Newnham, Bath, S. F. Hamper, Cirencester, and C. Shepherd, Bath.
5877. Governors, W. Murdoch, Glasgow.
5878. Armatures for Dynamo-electric Machines, W. Fairweather and W. Ross, Glasgow.
5879. Hutches, &c., J. Johnston, Bathgate.
5880. Water-closet Basins, W., J. and W. Moyes, Pollockshields.
5881. Tiles for Paving, T. Robb, Glasgow.
5882. Steam Winches, A. Jackson, Yorkshire.
5883. Refrigerator Tubes, S. Briggs, Burton-on-Trent.
5884. Producing, &c., Electric Currents, L. A. V. Pellegrin.—(*G. Carette, Paris.*)
5885. Electric Lamp, L. A. V. Pellegrin.—(*G. Carette, Paris.*)
5886. Lawn Tennis Bats, R. S. Moss, London.
5887. Antimonial Compounds, J. Wetter.—(*M. B. Vogel, Leipzig.*)
5888. Sash Windows, R. A. Lowe, Chislehurst.
5889. Window Sashes, W. Meakin, London.
5890. Boilers, J. Miller and G. Tupp, Hammersmith.
5891. New Cake, H. Harris and G. Beavis, London.
5892. Doors, J. Thompson, London, and J. Hatfield, Kew, Surrey.
5893. Operating Tramway Points, F. A. Abeleven, Amsterdam.
5894. Boots and Shoes, W. H. Stevens.—(*W. James, Chicago, U.S.*)
5895 Metal Hinges, C. J. Harcourt, Birmingham, and D. Drysdale, Worcestershire.
5896. Extracting Metals from Carbons, &c., A. E. Scott, London.
5897. Lathes for Cutting Screws, F. Wirth.—(*H. Voigt and W. Braun, Germany.*)
5898. Ammonia, W. R. Lake.—(*La Société Anonyme Lorraine Industrielle, France.*)
5899. Cleaning Knives, J. A. McKean, London.
5900. Opening Cans, J. A. McKean, London.
5901. Lubricating Compounds, A. M. Clark.—(*D. D. Wass, New York, U.S.*)
5902. Aquatic Velocipede, A. M. Clark.—(*D. T. Simon, Paris.*)
5903. Mashing Apparatus, T. Starkey and G. Clapp, North Petherton.
5904. Producing Air Blast, W. Baxter, jun., and C. H. Peck, Wisbeach.
5905. Fountain Pen, W. B. Wicken, London.
5906. Supporting the Seats of Velocipedes, E. R. Settle, London.

4th April, 1884.

5907. Doors and Gates, F. Grazebrook, Netherton.
5908. Mining Machines, J. T. King.—(*Van H. Lechner, Columbus, U.S.*)
5909. Electrical Incandescent Lamp Safety Holder, A. Wright and G. F. Philpot, Brighton.
5910. Cages for Bobbins or Pirns, J. Gamble, Belfast.
5911. Photographic Cameras, W. Middlemiss, Bradford.
5912. Steam Boilers, J. T. Bintley, Colchester.
5913. Hand Pump, C. Bailey, Wolverhampton.
5914. Bearings for Axles and Shafts, J. Barkby, Sheffield.
5915. Traps for Rats, &c., R. P. Cato, Liverpool.
5916. Making Bread, W. Jones, Liverpool.
5917. Branding Machines, F. W. Blood, Liverpool.
5918. Head and Neck Protectors, L. Cobe, Manchester.
5919. Folding Beds, &c., A. Forbes, Govan.
5920. Water Gauges, S. Morley, Stockton-on-Tees.
5921. Nautical Instrument, W. C. Keith, Dundee.
5922. Galvanic Batteries, J. Rapieff, Barnet.
5923. Utilising Waste Heat, W. H. Radford, Nottingham.
5924. Frame for Velocipedes, E. R. Settle, Coventry.
5925. Ironing, Mangling, Wringing, &c., Machine, E. Moore, Liverpool.
5926. Converting Continuous Rotary Motion into Rectilinear Reciprocal Motion, E. A. Brydges.—(*W. Bügler, Germany.*)
5927. Expansile Glove, F. Hawley.—(*J. R. Crauford, New York.*)
5928. Ladder Machine, J. E. Doughty, and P. Kranich, London.
5929. Down Quilts, &c., A. Fox, Manchester.
5930. Destructive Distillation of Sulphate of Iron, &c., T. Terrell, London.
5931. Domes, &c., R. M. Ormerod, Carlisle.
5932. Distillation of Coal, R. Irvine, near Edinburgh.
5933. Distillation of Shale, Coal, &c., R. Irvine, near Edinburgh.
5934. Steam, &c., Engines, C. Lee, Bilston.
5935. Utilisation of Tidal Forces, W. Whieldon, London, and C. H. Romanes, Beckenham.
5936. Using, &c., Gas, E. Davies, London.
5937. Boat Lowering, &c., Gear, E. J. P. Brown and G. W. M. Paine, Dover.
5938. Connector for Piping, J. Cadett and J. Acworth, London.
5939. Securing Rubber Tires on Wheels, E. Hutchison, London.
5940. Draining Roofs, A. B. Merrick, Exeter.
5941. Safety Saddle bar, F. and G. Lavender, Staffordshire.
5942. Artificial Timber, O. Kosztovitz, Russia.
5943. Steam Boiler, A. Pifre, Paris.
5944. Twisting Machinery, G. A. Craven, J. Crabtree, and W. Clayton, Yorkshire.
5945. Beverages, W. H. and H. H. Bliss, Anerley.
5946. Hopples for Horses, R. Wright, Yorkshire.
5947. Silos, E. L. Pease, Durham.
5948. Chromates, &c., W. J. A. Donald, Glasgow.
5949. Cutting the Edges of Grass Lawns, J. E. Ransome, and G. Ling, Ipswich.
5950. Reservoir Pen-holders, T. A. Hearson, Blackheath.
5951. Pipe Couplings, W. W. Fyfe, Aberdeen.
5952. Consuming Smoke, W. Vogel, Chicago.
5953. Gas, &c., Burners, G. W. von Nawrocki.—(*J. Schülke, Berlin.*)
5954. Metal Magazines for Ships' Distress Rockets, &c., J. Pain, London.
5955. Taps or Dies, W. R. Lake.—(*J. Patten, U.S.*)
5956. Diggers for Cultivating Land, M. R. Pryor, Hertfordshire.
5957. Ornamenting Potteryware, R. Kelsall, Staffordshire.
5958. Printing, &c., Tickets, W. R. Lake.—(*W. R. Bacon, London.*)
5959. Telephone Transmitters, G. L. Anders, London.
5960. Cleaning Pipes, &c., W. A. Hurst, London.
5961. Propelling Ships, A. McCulloch, Dundee.
5962. Flower-pot Window Guard, H. R. Hughes, London.
5963. Fireproofing Ceilings, J. C. Hudson, London.
5964. Electrical Contact Apparatus, E. Tyer, London.
5965. Coupling for Rotary Shafts, R. Munro, London.

5th April, 1884.

5966. Shedding Motion for Looms for Weaving, D. Bailey, Yorkshire.
5967. Sorting Coins, &c., H. G. Forbes, Bitton, Gloucestershire.
5968. Clutch Union for Hose, &c., Joints, A. Godman, Hertfordshire.
5969. Downcast Ventilators, A. W. Kershaw, Lancaster.
5970. Weaving Looped Fabrics, A. Lister, Low Moor, near Bradford.
5971. Flush Handles for Drawers, &c., C. Collins, Birmingham.
5972. Pigments, H Knight, Liverpool.
5973. Sawing Wood, &c., R. Lansdale, Liverpool.
5974. Burning, &c., Oils, J. Lyle, Scotland.
5975. Chlorate of Potash, J. Wilson, Berwick-on-Tweed.
5976. Washing Plates, &c., T. Read, Yorkshire.
5977. Securing the Laths of Metallic Bedsteads, G. H. and E. B. Hovey and G. H. Hovey, jun., Sheffield.
5978. Automatic Vents for Barrels, &c., C. Wingfield, Sheffield.
5979. Cleaning Chimneys, J. Jarman, Birmingham.
5980. Pneumatic Bells, M. Pitts, Stanningley.
5981. Hygienic Lighting Apparatus, A. Hill, Manchester.
5982. Writing Pens, F. Iles, Birmingham.
5983. Window Fastening, R. T. Bells, Birkenhead, and T. B. Stott, Rockferry.
5984. Superphosphates, E. de Pass.—(*E. Dreyfus, Paris.*)
5985. Safety-bars for Saddles, H. Rees-Philipps, Birmingham.
5986. Indicator for Electric Bells, C. W. Stewart and G. H. Harrison, London.
5987. Electric Watch Alarm, C. W. Stewart and G. H. Harrison, London.
5988. Vertical Steam Boilers, C. Beechey, Liverpool.
5989. Alarm Bells, J. Butcher, Boston, U.S.
5990. Self-acting Head-lift for Landaus, &c., J. Offord, London.
5991. Railway Signalling, J. Enright, London.
5992. Jacquard Looms, J. Escorbia and J. C. Merley, France.
5993. Driving Gear for Velocipedes, J. Nichols, Great Malvern, and C. Santler, Malvern Link.
5994. Door, &c., Mats, W. H. Bates, G. Bidlake, and H. Faulkner, Leicester.
5995. Chairs for Surgical Purposes, A. E. Kennard, St. Leonard's-on-Sea.
5996. Paints or Compositions, G. J. Andrews and J. E. Sutton, London.
5997. Machine Guns, C. F. Wood, Enfield Lock.
5998. Substitute for Sponges, J. S. Gamgee, Birmingham, and H. S. Wellcome, London.
5999. Cutting Metal Strips or Pieces, C. G. Biggs and T. Wilde, Newport.
6000. Weft-forks for Looms, J. Ashworth, Bury.
6001. Food, &c., for Medicinal Purposes, G. Jaeger, Stuttgart.
6002. Cutting Apparatus, P. Aggio, Colchester.
6003. Glasses, F. H. Wenham, London.
6004. Composition for Covering Boilers, &c., D. Burns, Carlisle.
6005. Horticultural Frames, &c., C. E. Shea, Foots Cray.
6006. Blinds, J. C. W. Rolfe, London.
6007. Bucket Mechanism for Raising Liquids, J. Wetter.—(*J. B. Estublier, France.*)
6008. Silos, J. B. A. McKinnel, Dumfries.
6009. Attaching Loose Pulleys, &c., to Axles, &c., T. Walker, Tewkesbury.
6010. Punching, &c., Machines, W. F. Gilmer, Gosforth.
6011. Air-warming Apparatus, G. Connell, Newcastle-upon-Tyne.
6012. Calendering Machines, O. Imray.—(*L. Piette, Pilsen, Bohemia.*)
6013. Call Signals, C. D. Abel.—(*La Société Générale des Téléphones, Paris.*)
6014. Ventilator, W. Cowell, Blackburn.
6015. Thrashing Machines, E. Capitaine.—(*G. T. Yull, Vienna.*)
6016. Corn Mills, E. Capitaine.—(*T. M. Simon, Strassburg.*)
6017. Gas Engines, E. Capitaine.—(*M. Hecking, Dortmund.*)
6018. Lamps, G. S. Galt, Reading.
6019. Pavements, J. Kerr, London.
6020. Cutting Fustian, G. Baddeley, Cheshire.
6021. Speed Indicators, J. M. Napier, London.
6022. Oxide and Carbonate of Strontium, of Barium, &c., E. F. Trachsel, London.
6023. Terminals, &c., of Electrical Apparatus, A. M. Clark.—(*L. de Combettes, Paris.*)
6024. Loading Steamers, J. V. Thomas, Cardiff.
6025. Boots and Shoes, F. Laycock, Northampton.
6026. Shelling Peas, H. A. Dufrené. (*P. M. Faure, Paris.*)
6027. Drying Washed Grain, J. Walworth, Bradford.

7th April, 1884.

6028. Circular Slate Planing, &c., Machine, W. Lewis, Tanygrisian Blaenau, Festiniog.
6029. Spring Cutlery, A. Pilley, Sheffield.
6030. Steam Engines, W. Bagshaw and A. Brearley, Batley.
6031. Luminous Advertising, A. Nield, Edgbaston.
6032. Necks and Stoppers of Bottles, R. Bateman, Birmingham.
6033. Steam, &c., Packing, H. Montgomerie, East Boldon.
6034. Tanks, J. Rea, Liverpool.
6035. Mechanical Motion, J. F. Moore, Liverpool.
6036. Sheep-rack and Shelter, T. Loveridge, Leominster.
6037. Lock-wing Roofing Tiles, T. and H. Grimbleby, Barrow-upon-Humber.
6038. Handle Bars for Velocipedes, T. Ballard, London, P. Jolin, Redland, and C. Miles, Bristol.
6039. Entrenching Spade, E. B. Boyle, Cornwall.
6040. Heating Water by Gas, T. Fletcher, Warrington.
6041. Preventing Doors Slamming, H. Y. Dickinson, Newbury.
6042. Rollers for Wringing, &c., Machines, Hoyle, near Halifax.
6043. Bleaching, &c., Machinery, P. Thomas, Manchester.
6044. Violin Cases, V. A. Lorne, London.
6045. Ventilator, Z. Levy, London.
6046. Cock or Tap, R. Cole, Bristol.
6047. Coppers for Boiling Wort, &c., Liquids, H. Aplin, Bishopston.
6048. Warp Lace Machines, H. Scattergood, Nottingham.
6049. Regulating, &c., Currents, H. J. Allison.—(*W. Hochhausen, New York.*)
6050. Medicinal Gargle, L. Siegenberg, London.
6051. Compounds containing Nitro-cellulose, W. V. Wilson, London, and J. Storey, Lancaster.
6052. Bracelets, &c., E. Jones, London.
6053. Compressing Ensilage, T. Pearson, Glasgow.
6054. Signalling, W. Fox, Leeds, and A. Gledhill, Batley.
6055. Fog Signalling, W. Fox, Leeds, and A. Gledhill Batley.
6056. Railway Chairs, F. J. Talbot, Sheffield.
6057. Sight-feed Lubricator, W. Brierley, Rochdale.
6058. Beverages, J. McEwen, Manchester.
6059. Gas Motor Engine, H. P. Holt, Manchester.
6060. Nut Blanks, J. C. Mewburn.—(*La Société Pièrret-Bosquet et Fils, Paris.*)
6061. Window-sash Fastener, F. Mann, London.
6062. Rotary Engine, J. E. and C. G. Jordan and G. H. Rogers, Monmouth.
6063. Lamps, F. Besnard, Paris.
6064. Measuring Electricity, L. B. Miller, London.
6065. Couplings, I. B. Harris, Edinburgh.
6066. India-rubber Hose, I. B. Harris, Edinburgh.
6067. Steam Tricycle, A. Pifre, Paris.
6068. Secondary Batteries, E. Jones, Leeds.
6069. Stocking Suspenders, H. H. Lake.—(*F. Armstrong, Bridgeport, U.S.*)
6070. Lathes, S. Wilding.—(*H. Wohlenberg, Germany*
6071. Stoppers for Bottles, &c., H. Barrett, London.
6072. Stoppers for Bottles, &c., H. Barrett, London.

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for The Engineer *at the office of Her Majesty's Commissioners of Patents.*

3018. Means and Apparatus for Securing Corks in Bottles by Wire, *F. G. Riley, London.—18th June*, 1883. 6*d*.

The object is to mechanically wire corks in bottles, and to automatically twist and sever said wire in such a manner that the ends are left in position for the next bottle, and securing of its cork, and so on in succession.

3730. Production of Certain Substances for Use in Obtaining Colouring Matters, &c., *R. Holliday, Huddersfield, and W. R. Hodgkinson, London.—31st July*, 1883. 4*d*.

Consists, First, in the production of fluorol from fluorene or acenapthene by converting the fluorene into mono-sulphonate and then into a phenole by fusion; Secondly, the production of fluory lamines by treating fluorenes or acenapthene by means of nitric acid or a mixture of nitric acid and sulphuric acid, or in other suitable manner, to produce nitro compounds therefrom, and the reduction of those nitro compounds into their corresponding amido compounds for use in obtaining colouring matters for dyeing and printing.

3870. Manufacture of Paving Blocks from Furnace Slag, &c., *C. J. Dobbs, Middlesbrough.—9th August*, 1883. 6*d*.

Relates partly to the method of annealing the blocks exclusively by means of their own initial heat by enclosing them, immediately after they have solidified, in kilns or chambers of moderate dimensions that are only heated by the heat radiated from the blocks.

3873. Process and Apparatus for Separating and Treating Metals, and Extracting them from Ores, Matts, &c., *H. R. Cassel, New York, U.S.—9th August*, 1883. 6*d*.

The process is more especially applicable for the separation of gold, and consists in using any salt or acid in solution, which will yield, under electrolytic decomposition, nascent chlorine. The apparatus may be so constructed as to permit of the metal being dissolved and held in solution, or so as to deposit the metal at the negative electrode.

3888. Screw-cutting Tools, *A. Selim, London.—10th August*, 1883.—(*A communication from P. C. J. Lemaire, Paris.—(Not proceeded with.)* 2*d*.

Relates partly to the arrangement of dies.

3906. Reproduction of Writings, Drawings, &c., *J. H. Johnson, London.—11th August*, 1883.—(*A communication from I. Marquis de Camarasa, Madrid.*) 10*d*.

Relates to reproducing writings, drawings, &c., with mechanical needle pins supported and operated by an elastic cord above a suitable work table.

3917. Galvanic Batteries, *H. J. Allison, London.—13th August*, 1883.—(*A communication from A. Haid, New Jersey, U.S.*)—(*Not proceeded with.*) 2*d*.

The negative electrode, contained in a porous jar, consists of a carbon conductor, embedded in a mixture of carbon, and a depolarising substance insoluble in the liquid of the battery. The jar is sealed.

3926. Portable Folding Fishing and Shooting Punts, &c., *A. Samels, Red Hill.—13th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the general construction of the punts, so that they may be folded.

3936. Book-binding, &c., *E. de Pass, London.—14th August*, 1883.—(*A communication from F. W. Schwarz, Offenbach on-the-Main.*)—(*Not proceeded with.*) 2*d*.

Consists in binding the articles by means of bands or tapes of suitable material without employing the usual means of stitching the leaves with thread or wire.

3937. Sizing Woollen Warps, *F. Millo, Manchester.—14th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists principally in the use of a solution of potato flour or starch in boiling water.

3947. Brushing Apparatus, chiefly for Cleaning the Walls, Ceilings, &c., of Buildings, *H. Sutton, London.—14th August*, 1883.—(*Not proceeded with.*) 2*d*.

A circular or cylindrical brush is arranged upon the end of a rod, and means are provided for rotating the brush.

3949. Machinery for Cutting or Quarrying Slate, &c., *F. W. Turner, London.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists of a movable frame carried on wheels, on which is mounted one or more saw spindles, supported on suitable bearings, and each carrying one or more circular saws adjustable in their position by set screws or otherwise.

3951. Traps for Sanitary and other Purposes, *T. S. Truss, London.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to means for preventing the foul air and fluids in the drains entering into the buildings.

3952. RECOVERY AND USE OF TIN FROM TIN-PLATE SCRAP AND WASTE TIN-PLATE ARTICLES, *R. S. Laird, Corstorphine, Midlothian.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

The tin is dissolved and separated from the iron by means of a solution of caustic soda or potash and electrolytic action.

3954. PROCESS OF AND APPARATUS FOR OBTAINING EXTRACT FROM HOPS TO BE USED FOR BREWING, *E. Edwards, London.—15th August*, 1883.—(*A communication from G. Heller, Prague.*)—(*Not proceeded with.*) 2*d*.

Relates to the construction of a boiler, and also to a process of treating the hops.

3955. POSTAL AND OTHER WEIGHING MACHINES, *E. and A. Stillwell, London.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the general arrangement of the parts.

3957. CHECKING, COUNTING, OR INDICATING APPARATUS, *R. W. Vining, Liverpool.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to a construction of turnstile in which the arms are made adjustable.

3959. PAINT OR PRESERVATIVE COMPOUND FOR WOOD OR IRON, *R. Johnson, Boyton, Woodbridge.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists of a compound, the essential ingredients of which are Stockholm or wood tar, benzoline or like spirit (by which the tar is thinned to a suitable degree), and ochre or other pigment, by which body is given to the compound, as well as an agreeable colour imparted to it.

3963. APPLIANCES FOR WORKING TELEPHONES, *F. Morris, London.—15th August*, 1883.—(*Not proceeded with.*) 2*d*.

To increase the intensity of the sound, two telephones, enclosed in a case containing air under pressure, are placed in the circuit of the transmitter and receiver.

3964. KITCHEN STOVE PLATES, *P. Jensen, London.—15th August*, 1883.—(*A communication from F. Kohl, Vienna.*)—(*Not proceeded with.*) 2*d*.

The stove plates are formed of four separate pieces connected with each other by means of groove and tongue joints.

3970. CONSTRUCTION OF LEAD PLATES FOR THE STORAGE OF ELECTRO-CHEMICAL FORCE IN ACCUMULATORS, *A. C. Henderson, London.—16th August*, 1883.—(*A communication from G. Philippart, Paris.*)—(*Not proceeded with.*) 2*d*.

The electrodes are made from a number of refined soft lead sheets mechanically combined into blocks, and then sawn down to the size required.

3977. MANUFACTURE OF WOVEN BELTING, *F. Reddaway, Pendleton.—16th August*, 1883.—(*Not proceeded with.*) 2*d*.

The inventor uses camel hair yarn and cotton yarn, and weaves the belt complete, the lifting of the warps being so arranged as to bring the camel hair to the outer surfaces, so as to obtain durable wearing surfaces on the belting.

3979. CIGARETTES AND CIGARS, *I. A. Anderssohn, Breslau.—16th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to a wrapper of thin tin foil.

3980. PACKINGS FOR PISTONS, *T. H. Taylor, Southampton.—16th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the construction of split ring packings.

3981. APPARATUS TO BE WORN BY INVALIDS, &c., *J. Sainty, East Dereham.—16th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the construction of a portable urinal.

3984. RUNNING GEAR FOR VEHICLES, *A. J. Boult, London.—18th August*, 1883.—(*A communication from G. Kelly, Chicago.*)—(*Not proceeded with.*) 2*d*.

Relates to a means for preventing the springing or breakage of vehicle axles.

3985. FURNACES OR APPARATUS FOR BURNING, CALCINING, OR ROASTING SULPHUR ORES, SPENT OXIDE OF IRON, &c., *I. S. McDougall, Manchester.—16th August*, 1883. 6*d*.

Consists partly of a furnace or apparatus for burning, calcining, or wasting sulphur ores, spent oxides of iron, and other materials, or for use in the purification of coal gas or for stirring or agitating materials to expose them to heat or the action of air, gases, or vapours, or to expose gases or vapours to the action of the materials so heated; the said furnace or apparatus consisting of a number of superposed chambers provided with revolving rakes or agitators and feeders, and provided with openings or passages from chamber to chamber, the said openings being situated alternately at the centre and the side.

3992. GAS OR LAMP SHADES, &c., *H. E. A. Wallis, London.—17th August*, 1883. 4*d*.

Consists in using sheets of millboard or cardboard composed wholly or in part of asbestos, rolled and enamelled, or glazed as an incombustible material for the manufacture of shades. It also consists of the mode of supporting the shades.

3993. THRASHING MACHINERY, *H. Savill, London.—17th August*, 1883.—(*A communication from H. Honour, New Zealand.*—(*Not proceeded with.*) 4*d*

Consists in the combination with the thrashing box of any ordinary thrashing machine of a twine binder.

3994. EQUIPMENT FOR FOOT SOLDIERS AND OTHERS, &c., *A. E. Wardroper, Chichester.—17th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists in utilising the present uniform great coat worn by the soldier to carry the kit by means of pockets.

3995. MEANS FOR LESSENING THE EFFECTS OF SHOCKS OR CONCUSSIONS, APPLICABLE TO LIFTS, RAILWAY BUFFERS, &c., *H. E. Newton, London.—17th August*, 1883.—(*A communication from F. Pelzer, Dortmund.*)—(*Not proceeded with.*) 2*d*.

Relates to an arrangement of apparatus in which hydraulic cylinders are employed.

4004. FASTENER BUTTONS FOR ARTICLES OF CLOTHING, &c., *E. G. Colton, London.—17th August*, 1883.—(*A communication from E. Wuerfel, Brooklyn.*)—(*Not proceeded with.*) 2*d*.

Relates to the construction of a spring button fastener.

4012. CRADLES, ROCKING-HORSES, &c., *O. J. Haddock, Selley Oak.—18th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists in the employment of a coiled spring or equivalent means for imparting motion.

4015. SCREWING APPARATUS, *W. Heap, Ashton-under-Lyne.—18th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists in the means for setting-up and withdrawing the dies.

4016. SCRIBBLING AND CARDING ENGINES, *H. Marsden, Huddersfield.—18th August*, 1883.—(*Not proceeded with.*) 2*d*.

The inventor employs between the two fans a sheet forming a partition, so as to enable the fans to act at greater advantage upon the fibre in forwarding the latter to the delivery rollers, and he dispenses with two vertical endless sheets and employs a horizontal sheet.

4023. GAS ENGINES, *E. Quack, Cologne.—20th August*, 1883.—(*Not proceeded with.*) 2*d*.

The inventor provides a cylinder entirely covered internally with bad conducting material, in which cylinder the explosions take place.

4024. APPLIANCE FOR SECURING SCARF PINS IN SCARVES, *A. E. King, London.—20th August*, 1883. (*Not proceeded with.*) 2*d*.

Relates to the construction of a spring clip fastener.

4031. MANUFACTURE OF SERRATED WEDGES, *W. and J. Pollard, Burnley.—20th August*, 1883.—(*Not proceeded with.*) 2*d*.

The wedge is cast in metal, with one or both sides serrated in such a manner that the same may be easily driven forward but not readily withdrawn. Two wedges thus constructed may be driven one over the other and act as a folding wedge.

4030. MANUFACTURE OF WATERPROOF AND VERMIN-PROOF TEXTILE FABRICS, &c., *H. H. Lake, London.—20th August*, 1883.—(*A communication from D. M. Lamb, New York.*)—(*Not proceeded with.*) 2*d*

Consists partly in combining with textile fabrics or other materials, either before, during the time of, or subsequent to the manufacture of textile fabrics, a compound which will render the fabric water-proof, vermin-repellent, and non-oxidisable.

4034. ARTICLES AND ARRANGEMENTS FOR HOLDING AND PREVENTING POTS, CHINA, AND GLASSWARE, AND OTHER ARTICLES FROM SLIPPING WHEN THE SURFACE CARRYING THEM IS SUBJECTED TO MOTION, *H. Walley, Manchester.—21st August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists in the use of mats of india-rubber or other suitable material.

4038. CELLS OF VOLTAIC BATTERIES, *R. H. Courtenay, London.—21st August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to so constructing the elements as to obtain large surfaces; to a supply tube to feed the cell while in use, and to the excitants.

4040. PROCESSES FOR SOLIDIFYING LIQUID OR SEMI-LIQUID FATTY ACIDS, &c., *E. A. Brydges, Berlin.—21st August*, 1883.—(*A communication from A. Marix, Paris.*)—(*Not proceeded with.*) 4*d*.

Consists partly in the transformation of oleine into a solid fatty acid with high melting point, so that the same can be employed to like purposes as stearic acid of first quality.

4048. CONSTRUCTION OF TRAMWAYS WITH ROLLING STOCK FOR THE SAME, *J. Hayes, London.—21st August*, 1883.—(*A communication from T. Sanders, Amsterdam.*)—(*Not proceeded with.*) 2*d*.

Consists in the employment of a single line of rails in the construction of tramways, the rail adopted being a double-grooved or channelled section, in order to admit the two flanges with which the wheels are furnished, so as to prevent the car from leaving the rail on either side.

4049. SAFETY APPLIANCES FOR ELEVATORS, *A. W. L. Reddie, London.—21st August*, 1883.—(*A communication from R. A. Cheesbrough, New York.*) 6*d*.

Consists in the combination with an elevator shaft, and a car or platform working therein, of a cylinder and plunger, one fixed at the bottom of the shaft and the other attached to the car or platform, in such manner that the rise and fall of the car or platform will cause a reciprocating movement between said cylinder and plunger without the plunger leaving the cylinder, and a vent aperture or passage through which air or other elastic fluid may enter and leave the cylinder, the whole being independent of the mechanism for raising and lowering the car or platform, and forming a safety appliance which always extends from the bottom of the car or platform for retarding the fall of the car.

4051. MANUFACTURE OF TESSERÆ FOR USE IN MOSAIC WORK, APPLICABLE ALSO TO SLABS, &c., *J. P. Rickman and A. B. Wood, London.—21st August*, 1883.—(*Not proceeded with.*) 2*d*.

The tesseræ, blocks, slabs, tiles or other pieces are made with fangs, studs, projections, or protuberances.

4052. APPARATUS FOR MARINE NIGHT SIGNALS, *H. J. Allison, London.—21st August*, 1883.—(*A communication rom R. J. Baker and J. P. Roberts, Providence, U.S.*) 6*d*.

Consists partly in a marine night-signalling apparatus, of the combination with a white light or lantern, of three movable, concentric, cylindrical shades or screens, one opaque, and two of coloured glass, fitted below the support for the light, and adapted to be moved upward, each independently of the other, to cover and uncover the light.

4053. REGULATING, MAINTAINING, OR STOPPING FERMENTATION IN WORT, BEER, WINE, &c., *W. P. Thompson, London.—21st August*, 1883.—(*A communication from H. G. Pommer and Dr. P. Ebell, Germany.*) 4*d*.

This consists in the use of peroxide of hydrogen or of peroxide or hydrated peroxides of barium, strontium, calcium, magnesium, potassium, sodium and ammonium to regulate or stop fermentation.

4057. COMPOUND METAL OR ALLOY CHIEFLY DESIGNED FOR DEOXIDISING AND COATING METAL PLATES, *H. H. Lake, London.—21st August*, 1883.—(*A communication from J. B. Jones, Brooklyn, U.S.*)—(*Not proceeded with.*) 2*d*.

This compound metal or alloy is composed of metallic sodium, lead, tin, and zinc to be used as a metal bath into which iron plates are immersed and deoxidised, and thereby coated so as to prevent future oxidation.

4059. GALVANIC BATTERIES, *G. C. V. Holmes and S. H. Emmens, London.—21st August*, 1883. 6*d*.

Relates to the construction and to methods of charging and discharging the battery cells so as to admit of the fumes being utilised.

4060. TRACTION ENGINE BRAKES, *W. Wilkinson, Wigan.—21st August*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to brake the wheels of traction engines upon any cessation of steam pressure, as when a boiler tube bursts, and it consists in causing the steam pressure to keep the brake blocks from the wheels against the action of springs, which when the pressure is reduced cause such blocks to be applied to the wheels.

4064. CONSTRUCTION OF SPRING PUNCHES, *G. Sykes, Ashton-under-Lyne.—22nd August*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to punches for making holes in leather and other materials, and it consists in fitting a pin to one jaw and causing it to enter the interior of the hollow cutting punch attached to the other jaw.

4068. APPARATUS FOR CONVEYING FLOUR OR OTHER PULVERULENT OR GRANULAR MATERIALS, *W. E. Dell, London.—22nd August*, 1883. 4*d*.

This relates to improvements on patent No. 3617, A.D. 1882, in which a series of slides or drawers were employed for directing flour into one or two worms or conveyors placed side by side, and it consists in substituting for such slides or drawers a series of tumbling spouts of triangular shape turning on pivots either at the top or apex or in the middle of the bottom, and by canting which in opposite directions the flour is directed to one or the other conveyor.

4070. LAWN TENNIS AND RATCHET BATS, *W. B. Chalmers, London.—22nd August*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in the use of a weight which can be adjusted to suit the player.

4073. MANUFACTURE OF BOXES MADE MAINLY OF PAPER, *T. Bishop, Birmingham.—22nd August*, 1883. 6*d*.

The edges of the boxes are connected by means of strips of metal cut and stamped to the required size.

4074. MOTORS APPLICABLE ALSO AS PUMPS, &c., *A. J. Boult, London.—22nd August*, 1883.—(*A communication from P. E. G. Jacomy, France.*)—(*Not proceeded with.*) 2*d*.

The machine consists of two parts, each forming a distinct engine, which parts are symmetrically placed and act on the crank shaft, the crank pins of which are diametrically opposite to one another. The operation of these engines resembles that of the so-called "Root" engines, from which, however, they differ insomuch that the steam is supplied in a different manner, and that a double crank shaft is used instead of a solid excentric.

4077. PAPER-MAKING APPARATUS, *A. M. Clark, London.—22nd August*, 1883.—(*A communication from M. Sembritzki, Switzerland.*) 8*d*.

This consists in apparatus for mechanically carrying on the process of hand-made paper, and comprises, First, a special paper-maker's mould, having a peculiar series of motions; Secondly, the application of pneumatic exhaustion to the under surface of the mould, to facilitate the draining of the pulp and couching of the sheet; Thirdly, a distribution of the pulp, whereby a given quantity may be spread over the mould; and Fourthly, the arrangement of the whole apparatus for mechanically making hand-made paper.

4081. MANUFACTURE OF FELTED CARPETS, *W. Mitchell, Waterfoot, Lancs.—23rd August*, 1883.—(*Not proceeded with.*) 2*d*.

A pile or plush is raised on one side of a stout woven fabric of jute, hemp, or flax, by means of teazles or cards, and upon it a "batt" of unfelted wool is laid, and the two passed through the ordinary felting operation. A design for a carpet is printed on the felted surface.

4082. VALVES OR STOPPERS FOR THE TAP OR BUNG-HOLES OF CASKS, &c., *H. Forman, Derby.—23rd August*, 1883.—(*Not proceeded with.*) 2*d*.

A plate has a rim arranged to come over the bung-hole, and to one end arms are attached, and to them a flat valve is pivotted and pressed against the rim by a spring. The valve can be pushed aside to insert the tap, which the spring then tends to keep in place.

4083. MANUFACTURING EXTRACTS OF ORCHAL, *B. J. B. Mills, London.—23rd August*, 1883.—(*A communication from J. B. Peter, France.*) 4*d*.

This consists in substituting for the liquid ammonia hitherto employed in the manufacture of extracts of orchal, a continuous current of air charged with gaseous ammonia traversing the solution in closed vessels, thereby preventing all waste of gas and permitting the employment of heat.

4085. MACHINERY FOR CUTTING WHEEL RACK TEETH, OR PERFORMING SIMILAR WORK UPON THE SURFACES OF TUBES, &c., *J. H. Stone, Birmingham.—23rd August*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to cut the teeth or grooves of a double-sized rack simultaneously and with great rapidity. A sliding piece or a bed-plate carries the tube, upon which is a frame carrying two revolving cutters carried by adjustable spindle and driven by suitable gearing, a vertical reciprocating motion being also imparted to the cutters. An intermittent motion is imparted to the sliding piece carrying the tube.

4086. FUSIBLE PLUGS, *J. W. Kenyon, Manchester.—23rd August*, 1883. 6*d*.

The alloy is contained in a conical piece, which is screwed into position in the outer shell of the plug, a narrow shoulder fitting a seating on the inside of the said shell, so as to make a tight joint. The alloy is contained in a space between a hollow conical piece and an inner cone, the base of the latter touching or almost touching the interior of the hollow cone.

4087. SLIDE VALVES FOR STEAM ENGINES, *J. Thom, Barrow-in-Furness.—23rd August*, 1883. 6*d*.

Consists essentially in constructing a slide valve with all the exhaust ports (which may be of any desired number so as to reduce the travel) separated from the steam inlets by the back of the valve—that is to say, so that the steam enters only from the outside of the valve, whilst the inside of the valve is entirely devoted to the exhaust.

4088. STEAM GENERATORS AND THEIR FURNACES, *H. C. Bull, Liverpool.—23rd August*, 1883. 1*s*. 4*d*.

This relates to improvements in boilers for generating steam and in furnaces therefor, which furnaces are so constructed and fitted with apparatus as to form combined gas producers and combustion chambers, and are worked on what is known as the "gas firing" principle. A boiler and furnace of the vertical type consists of three vessels arranged side by side, all cylindrical and the side ones joining on to the central one for affording communication for circulation. The side vessels are tube filled, having top and bottom tube plates. An intermediate diaphragm is arranged near the top of each vessel, so as to isolate the upper part and form superheaters. The vessels have dome tops, which form uptakes to the chimney. The side vessels are mounted over combustion chambers, and an arrangement of gas-producing furnaces with hopper charging doors, removable fire-bars, and closed ash-pits.

4089. HORSESHOES, &c., *E. E. Hewitt, Sheffield.—23rd August*, 1883.—(*A communication from C. F. A. Zincke, Hamburg.*)—(*Not proceeded with.*) 2*d*.

Consists essentially in constructing the stem or shank of the calk and toe-piece with a longitudinal rib or projection or longitudinal ribs or projections, and the holes in the shoe with a corresponding longitudinal groove or recess or grooves or recesses. The longitudinal projections or ribs on the stems or shanks of the calks and toe-pieces fit into the recesses or grooves in the holes of the shoes, by which a firmer hold of the calks and toe-pieces in the shoe is secured, and the said calks and toe-pieces cannot turn round.

4090. VELOCIPEDES, *H. H. Lake, London.—23rd August*, 1883.—(*A communication from J. J. A. Larroque, Paris.*) 8*d*.

Relates partly to the mode of converting the alternate movement of the pedals into a continuous rotary motion which is imparted to an axle by means of a connecting rod of peculiar construction. Relates also to other improvements in the general construction of the velocipede.

4091. HORSESHOES, *J. J. O. Wilms and J. H. G. Schaper, Hamburg.—23rd August*, 1883. 4*d*.

This consists in securing detachable calks to horseshoes by forming spherical or polygonal heads on the calks, and causing them to enter corresponding recesses in the shoes.

4092. SAFETY BICYCLE, &c., *J. Orme, London.—23rd August*, 1883. 1*s*. 2*d*.

Consists in the employment of friction clutches which can be immediately disengaged, and simultaneously with the movement thereof, to actuate the brake on the wheel from which the friction clutch has been disengaged, and thus effecting the steerage of the machine. The brake is free to be actuated independently of the friction clutches.

4093. SURFACE CONDENSERS, *S. G. Browne, London.—24th August*, 1883. 6*d*.

Relates principally to the use of condenser tubes made with one or more spirals running the whole or a part of the entire length of the tube.

4094. WALLS FOR FENCES, BUILDINGS, &c., *W. Thompson, Wexford.—24th August*, 1883. 6*d*.

This consists in making walls of concrete with vertical corrugations.

4095. RAISING SUNKEN VESSELS, &c., *R. W. Doherty, Liverpool.—24th August*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to raising vessels by means of inflatable bags.

4096. VARNISH IMPERVIOUS TO LIQUIDS AND RESISTING ACIDS, *E. T. Hughes, London.—24th August*, 1883.—(*A communication from J. Wojacrek, Vienna.*)—(*Not proceeded with.*) 2*d*.

The varnish is composed of a solution of shellac, to which some Venetian turpentine and some soot are added.

4097. BILLIARD REGISTERS OR COUNTERS, *T. W. Harding, Leeds.—24th August*, 1883.—(*Not proceeded with.*) 2*d*.

Consists mainly of three counters, on the general principle of those known as "Harding's counters."

4098. ROPES OR BANDS FOR DRIVING, *W. White, Bingley.—24th August*, 1883. 4*d*.

The object is to build up a belt so that it will freely leave the grooves in grooved pulleys, and it consists in building the belt of triangular form with layers of leather which are cemented, sewn, or rivetted together.

4099. RAILWAY CHAIRS AND JOINT FASTENINGS, &c., *J. Revell, Dukinfield.—24th August*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to improvements on patent No. 3507, A.D. 1882, and consists in securing the key which keeps a plate having studs which enter holes in the web of the rail in position by substituting screws or conical headed bolts for the studs. The spike holes and spikes for securing the chair to the sleeper are of polygonal form, so that the spikes cannot turn.

4101. THRASHING MACHINES, *J. Thomas, jun., near Nantwich.—24th August*, 1883.—(*Not proceeded with.*) 2*d*.

This consists, First, in feeding the machine by an opening at the top above the main drum and fitted with an adjustable inclined flap, a movable slide being also placed above the opening; Secondly, in employing in connection with the main driving drum a curved bed in two parts fitted with transverse bars which can be reversed. An endless band is placed under the shakers to convey the corn over the riddle box.

4103. "CATCHES" FOR SKIPS AND GIGS AS USED FOR MINING PURPOSES, *J. Prisk, Redruth.—24th August*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to check the descent of skips and gigs in case they should descend too rapidly, and it consists essentially in the use of an india-rubber spring or pad which acts upon a bar, so as to bring a catch against the rails on which the carriage runs.

4104. APPLIANCES FOR HANGING ELECTRICAL LAMPS, *T. T. Smith, London.—24th August*, 1883. 6*d*.

An incandescent lamp is suspended by a flexible cord containing the leads suitably insulated and balanced by a weight. The weight is provided with a guide piece and stop.

4107. SUBSTITUTE FOR SPONGES, APPLICABLE ESPECIALLY FOR USE BY PHYSICIANS AND SURGEONS AND GENERALLY IN CASES OF ILLNESS AND AS SURGICAL TISSUES, *S. Gamgee, Birmingham.—24th August*, 1883. 2*d*.

An absorbent elastic ball is formed of alternate concentric layers of cotton wool and elastic fibres enclosed in a bag of woven gauze or similar openwork fabric.

4112. CARTS, CARRIAGES, &c., *T. Briggs, Darwen.—25th August*, 1883. 6*d*.

This relates principally to brakes applicable to two-horse vehicles, the object being to throw the weight off the horse when going down hill, and at the same time to apply the brake to the naves of the wheels. The brake is brought into action by a hand wheel and screw rod, which at the same time causes the body of the cart to move back on the frame and so relieve the horse from the weight.

4113. METHOD OF FORMING A GROUND IN THE MESHES OF NET AND OPENWORKED FABRICS, AND THE COATING OF SUCH GROUND ON BOTH SIDES BY METAL OR OTHER POWDER TO PRODUCE AN ORNAMENTAL EFFECT IN SOLID PATTERN AND FLAT WITH THE SURFACES OF THE FABRIC, *E. J. Cox, Nottingham.—25th August*, 1883. 4*d*.

The meshes are filled with a viscid body or solution, such as india-rubber in solution, which is then ornamented with metal or other material in powder.

4115. SEWING MACHINES, *A. J. Hurtu, Paris.—25th August*, 1883. 6*d*.

This relates to machines in which a rotating hook draws the loop of the needle thread over a fixed bobbin, and it consists in means for accelerating the speed of the hook during one part of its rotation, and diminishing the speed at another part. The driving shaft and hook shaft are placed either in the same axial line or parallel to one another, and a third shaft is placed parallel to the other two, the three shafts being connected by cranks and connecting links.

4121. BRUSHES, *J. Thompson, London.—25th August*, 1883. 6*d*.

This relates principally to tooth brushes, the object being to prevent the outer bristles from being bent outwards, and it consists in substituting for the outer bristles tongues of vulcanised india-rubber, which are secured in holes and grooves formed in the back of the brush.

4122. MACHINERY FOR DYEING OR STAINING WOOLLEN, COTTON, SILK, AND OTHER FIBROUS MATERIALS, EITHER IN THE FORM OF YARNS OR WOVEN OR FELTED FABRICS, *L. Glover, near Wakefield.—25th August*, 1883. 6*d*.

A tank is fixed in a frame and filled with the dye, and above it are two rollers, and near the bottom two other rollers. The material to be dyed is caused to pass from one top roller under both bottom rollers and up to the other top roller, the two top rollers being actuated so as to cause the material to pass backwards and forwards through the dye in the tank, their motion being reversed automatically. Friction brakes are arranged so as to automatically retard the motion of the top rollers when required.

4123. MACHINERY FOR CRUSHING COAL, CLAY, LIME, &c., *C. Sheppard, Bridgend, Glamorgan.—25th August*, 1883.—(*Complete.*) 4*d*.

Three rolls are arranged and actuated so that the material passes first between two of them and is reduced to a certain extent, and then between one of the first two rollers and a third roller, whereby it is still further reduced. Two of the rolls are driven by a pulley and suitable gear, and the third roll by contact with one of the other two rolls, this third roll being supported by a pair of arms pivotted to the frame.

4125. MANUFACTURING MATERIAL FOR MAKING TRUNKS, PORTMANTEAUS, &c., *O. Jacobi, Dresden.—27th August*, 1883.—(*Not proceeded with.*) 2*d*.

Strong sail cloth is immersed in a solution of glue and india-rubber, and used as a substitute for leather.

4126. DEVICE FOR THE BEATING OR MIXING OF EGGS, BATTER, &c., *H. J. Newport, London.—27th August*, 1883. 4*d*.

Consists in the combination in a beater of a chamber having a coned or domed bottom, with a perforated plunger piston barely clearing its walls, and domed or coned to correspond.

4127. CONSTRUCTION OF METAL LATHS FOR USE IN THE FORMATION OF CEILINGS AND PARTITIONS, &c., *G. M. Edwards, London.—27th August*, 1883. 8*d*.

Thin strips of sheet iron or other metal are used, along each edge of which pieces are cut out at intervals, so as to present serrated edges. A groove is then indented along the centre of the entire length, and the edges of the groove are brought so close together as to cause the groove to assume a form of which the open end is sufficiently narrow in relation to the rest of the groove as to permit of materials, inserted therein in a plastic condition, being mechanically repaired there when they shall have become set or hardened.

4128. ARTIFICIAL PALATES OR BASES, *J. J. Wedgwood, London.—27th August*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to generate a continuous current of electricity in the mouth.

4133. CASE OR BOX FOR HOLDING POSTAGE AND RECEIPT STAMPS, *S. R. Edwards, London.—27th August*, 1883. 6*d*.

Relates to the combination of a spring clip, roughened surface and transverse bar or projection in boxes or cases to hold postage and receipt stamps, so that one stamp may easily be withdrawn without disturbing the rest.

4139. TREATMENT OF IRON AND STEEL FOR PROTECTING AND IMPROVING THE QUALITY OF THE SAME, &c., *W. Arthur, Cowes.—28th August*, 1883.—(*A communication from J. P. Gill, New York.*) 8*d*.

Relates to the treatment of iron and steel, and has for its principal object the incorporation of the rustless principle into their surfaces, producing a non-corrosive surface capable of resisting the action of the elements, acids, and salt water, and which withstands rough usage and the hammer stroke.

4140. TREATMENT OR REDUCTION OF IRON ORES FOR OBTAINING IRON OR STEEL THEREFROM, *W. Arthur, Cowes.—28th August*, 1883.—(*A communication from J. P. Gill, New York.*) 6*d*.

Consists essentially in the application in measured and automatically regulated quantities of hydrogen, nitrogen, carbonic oxide, and carbonic acid gases, and air with hydro-carbon vapours and gases, and either with or without steam; to iron ores of any kind or description, in closed muffles, retorts, or chambers, from which the outside air and the products of combustion are excluded; and also in the treatment of such ores in open hearths, in cupolas, and in reverberatory furnaces for the steps required in the treatment of the respective ores and metals.

4141. MACHINERY FOR PRINTING PAPER OR OTHER MATERIAL, SPECIALLY APPLICABLE TO PRINTING PAPER HANGINGS, *C. P. Huntingdon, Darwen.—28th August*, 1883. 6d.

Refers to machinery for printing paper or other material in a number of colours at one process by means of a number of rollers, each furnished with colour and set around a central cylinder, around which the paper passes, receiving the various imprints in its progress.

4144. MANUFACTURE OF PLASTIC COMPOUNDS CONTAINING BONE OR SIMILAR MATERIAL, &c., *H. H. Lake, London.—28th August*, 1883.—*(A communication from the Bonsilate Company, Limited, Albany, U.S.)* 4d.

Relates to a composition consisting essentially of phosphate of ammonia or its elements or comminuted bone.

4146. TREATMENT OF STARCH YIELDING MATERIALS AND APPARATUS THEREFOR, *J. H. S. Wildsmith, London.—28th August*, 1883. 6d.

Relates to improvements in the whole process.

4147. WINDING AND REELING MACHINES, *A. C. Henderson, London.—28th August*, 1883.—*(A communication from E. Essers, Viersen.)—(Not proceeded with.)* 2d.

Relates, First, to mechanism for holding the ends of skein threads whilst winding; Secondly, to mechanism for tying the hanks in a manner to avoid inequalities by regulating the length of the tying yarns or threads.

4149. APPARATUS FOR HEATING WATER, *M. Steel, Gosforth.—28th August*, 1883.—*(Not proceeded with.)* 2d.

Relates to the arrangement of the water tubes.

4150. WINDOW VENTILATORS, *G. Connell, Newcastle-upon-Tyne.—28th August*, 1883. 6d.

The object is the admission of fresh air with the absence of draught, and when required at an increased temperature.

4151. TREATMENT OF HOPS FOR THE PURPOSE OF OBTAINING AN EXTRACT THEREFROM, *J. H. Johnson, London.—28th August*, 1883.—*(A communication from L. Boulé, Paris.)* 4d.

Relates to the treatment of hops for obtaining therefrom an extract consisting of the fixed extractive matter of the bracts or leaflets combined with the lupuline or valuable principle of the hop plant.

4152. PRODUCING PRINTS OR TRANSFERS OF PHOTOGRAPHIC PICTURES, *E. de Zuccato, London.—28th August*, 1883. 4d.

Consists in the production of a picture or transfer by pressing paper or analogous material between a "Woodbury type relief," and a slab or plate lined, grained, or stippled with ink.

4153. PRODUCING PRINTS OR TRANSFERS OF PHOTOGRAPHIC PICTURES, *E. Zuccato, London. — 28th August*, 1883. 4d.

Consists, First, in the production of a picture or transfer by pressing an inked textile fabric or the like against paper or other suitable material by means of a wood-type relief; Secondly, the production of a print or transfer on paper, or analogous material, which is pressed between a textile fabric or the like and an inked "Woodbury-type relief."

4154. PRODUCING PRINTS OR TRANSFERS OF PHOTOGRAPHIC PICTURES, *E de Zuccato, London.—28th August*, 1883. 4d.

Consists in the production of a picture or transfer by pressing paper or other suitable material against an inked roughened plate, or the like, by means of a "Woodbury-type relief."

4155. TRICYCLES, *G. Singer, Coventry.—28th August*, 1883. 10d.

Relates to improvements in tricycles intended to carry luggage.

4157. VELOCIPEDES, TRICYCLES, AND OTHER MANUMOTORS, *J. F. Smith, Leicester.—28th August*, 1883. —*(Not proceeded with.)* 2d.

Relates to the employment of fly-wheels to give impetus to the machine.

4158. CHECKING THE TIME OF ENTRY OF WORKMEN INTO AN ESTABLISHMENT, AND APPARATUS THEREFOR, *N. C. Firth, Chester.—28th August*, 1883. 6d.

Relates to a timepiece, or mechanism that will automatically indicate at what time the workmen respectively deposited their checks.

4159. SEWING MACHINES, *H. Grellier, London.—28th August*, 1883. 6d.

Relates to the construction and arrangement of those parts of a sewing machine which deal with the thread below the table, so as to make lock-stitch, employing an ordinary reel for the under thread, or to make chain-stitch without an under thread, or to make several kinds of compound lock and chain stitches, at the will of the operator.

4160. SOLITAIRES, STUDS, OR DRESS FASTENERS, *E. E. Ashing, London.—28th August*, 1883. 6d.

Relates to the construction of solitaires, studs, or dress fasteners, in which a separate head is secured to the tubular shank of the stud by a spring catch, which is released by means of "pushers" projecting from the sides of the head.

4161. INJECTORS AND LIKE APPARATUS FOR EJECTING AND FOR THE NOISELESS DISPOSAL OF WASTE STEAM, &c., *P. Zotoff and B. Afonasieff, Cronstadt. —28th August*, 1883. 1s. 4d.

Relates to the general construction of silent blow-off ejectors.

4162. APPARATUS FOR CATTING AND FISHING SHIPS' ANCHORS, *A. M. Clark, London.—28th August*, 1883.—*(A communication from J. N. Purdy, St. John's, Canada.)* 6d.

Consists in combined mechanism comprising a windlass barrel with suitable operating gear mounted in a frame pivotted upon the cat-head of the ship so as to be adjustable in position, to enable it to wind up either the cat-fall or the fish pennant, in order that the anchor when raised can be easily moved on board.

4163. SIGNALLING, MAINLY APPLICABLE TO RAILWAYS, AND APPARATUS THEREFOR, *J. Enright, London.—28th August*, 1883. 6d.

Relates to a means of signalling a train at the station which it is approaching, and also at a station in its rear.

4165. UTILISING GAS ENGINES FOR LOCOMOTION, &c., *T. F. McNay and F. J. Harrison, London.—29th August*, 1883. 6d.

Relates partly to the employment of a suitable arrangement of pulleys or gearing whereby the strain resulting from starting the tramcar, train, or other vehicle or boat or vessel is (although the engine may be running at a high rate of speed at the moment of starting) applied gradually, and thus all jerk or strain is obviated.

4175. METHOD AND APPARATUS FOR CONNECTING THE PIPES USED ON RAILWAY TRAINS FOR COMMUNICATING FLUID PRESSURE TO WORK BRAKES OR SIGNALS, *J. Imray, London.—29th August*, 1883.—*(A communication from G. Westinghouse, jun., Pittsburg, U.S.)* 6d.

The object is to provide flexibility of the pipes to allow for the relative movements of the coupled carriages without the use of flexible tubing, and it consists in the use of a double-jointed metallic pipe between the pipe of each carriage and the half coupling connecting it to that of the next carriage, the joints of the lengths of pipe being formed in two similar halves held together by setting screws.

4173. APPARATUS FOR MARKING AND MEASURING LENGTHS, CHIEFLY APPLICABLE TO TEXTILE FABRICS, &c., *C. H. Weckbecker and L. Schwabe, Manchester. —29th August*, 1883. 6d.

The object is to impress a mark or sign at any required point upon a length of cloth or other goods, in order to indicate the exact length of such piece of cloth or goods.

4179. LAMPS FOR LIGHTING RAILWAY CARRIAGES, &c., *J. F. Shallis and T. C. J. Thomas, London.—29th August*, 1883. 8d.

Relates partly to means for conducting away oil or spirit that may overflow or be spilt, and for preventing breakage of the dishes or bowls.

4181. PROPELLING VESSELS BY CENTRIFUGAL FORCE, *A. L. Segond, Paris.—30th August*, 1883. 6d.

The invention is based on the principle of employing centrifugal force by aid of a bent or arched tube or a partition, through which a mass is forced by means of an ejector or other apparatus having a similar effect.

4184. SHUTTLES FOR LOOMS, *W. E. Gedge, London.—30th August*, 1883.—*(A communication from J. P. Thompson, Maryland, U.S.)* 4d.

This consists in providing the loom shuttle with an adjustable eye piece having passages for the thread formed therein, whereby by the adjustment of the eye piece the tension of the thread may be regulated.

4188. GUN CARRIAGES, *W. Gardner, St. Leonards.—30th August*, 1883. 8d.

The essential novel feature of the invention consists in constructing the gun carriage upon the principle of a parallel ruler of that kind in which there are two bars or pieces, so connected by arms or links that the said bars may move nearer to or farther from each other, but always remain parallel.

4189. MACHINERY FOR SHAPING OR DRESSING WOOD, &c., *J. Wetter, Wimbledon.—30th August*, 1883.—*(A communication from A. Fischer and J. C. Schmidt, Leipzic.)* 4d.

A movable frame receives the material to be shaped and receives an up-and-down motion which causes it to pass in front of the edge of the cutting tool. To prevent the material coming in contact with the tool during the up movement the frame is caused to move sideways by means of two levers, a connecting rod and cams or curved grooves.

4190. ATTACHMENTS TO TRICYCLES AND OTHER VELOCIPEDES, *E. Weidlich and H. Mitchell, London.—30th August*, 1883. 6d.

The object is to provide velocipedes which are used by ladies with an attachment for shielding the feet and legs from view.

4195. COLOURING METALS OR ALLOYS, *H. H. Lake, London.—30th August*, 1883.—*(A communication from La Société A. Trélat et Cie., Paris.)* 4d.

Relates to methods or processes for colouring metals or alloys by means of electricity.

4196. MANUFACTURE AND COMPOSITION OF DISINFECTANTS, &c., *F. H. Atkins, London.—30th August*, 1883. 4d.

Consists partly in the manufacture of a composition composed of disinfectants or disinfecting or deodorising agents or compounds of various kinds by using either alone, or mixing, amalgamating, or adding with or to disinfectants of various kinds other materials or substances (obtained by the chemical treatment of water or other liquids).

4198. MAGAZINES FOR HOLDING CARTRIDGES, &c., *H. H. Lake, London.—31st August*, 1883.—*(A communication from N. de Loutkowsky, St. Petersburg.)* 6d.

Consists principally in the arrangement of a cartridge magazine with a movable side wall, in order to be able to fill the said magazine with a number of cartridges which are successively pushed into the breech chamber by means of a spring fixed in the magazine, and a cover operated by means of a projection on the breech bolt, which causes the said cover to open automatically at the extraction of an empty cartridge, to allow the introduction of a fresh cartridge into the breech chamber, the said breech bolt when closed preventing the next cartridge from being moved forward.

4199. SEPARATING WOOL FROM SHEEPSKINS IN THE FRESH STATE, *P. H. Picard-Goulet fils, Paris.—31st August*, 1883. 4d.

Relates to the general treatment of the skins for separating the wool therefrom.

4201. ANÆSTHETICS, *J. Wetter, London.—31st August*, 1883.—*(A communication from U. K. Mayo, Massachusetts, U.S.)* 2d.

Relates to a compound consisting of nitrous oxide gas and the vapours of an aqueous alcoholic tincture or infusion of hops and poppies.

4202. MACHINERY FOR WRINGING, MANGLING, AND CALENDERING OR FINISHING LACE, CALICO, &c., *J. M. Cryer and W. O. Matteson, Bolton.—31st August*, 1883. 6d.

Relates particularly to the means of increasing or decreasing the pressure upon the rollers.

4203. CONSTRUCTION AND ARRANGEMENT OF PANS OF VESSELS FOR BOILING FATTY OR OLEAGINOUS MATTERS, &c., *J. and D. Bell, Bolton.—31st August*, 1883. 6d.

Relates partly to the use and construction of cavity chambers for the purpose of distributing and equalising the heating surface in pans or vessels for boiling fatty or oleaginous matters and other substances.

4218. SAD-IRONS, BOX-IRONS, &c., *S. Siddaway and A. E. W. Clayton, West Bromwich.—1st September*, 1883. 6d.

Consists principally of an improved construction of fastening whereby the separable or removable handle is readily connected to and disconnected from the slab or body of the sad iron or other smoothing iron.

4225. INTERMITTENT COCKS, *B. H. Chameroy, Vesinet, France.—1st September*, 1883. 6d.

Consists in the manufacture and use of intermittent cocks or taps in which a body or volume of water is interposed between certain inner parts (such as pistons or the like) of the tap, the outflow of this water being regulated by the space provided for this purpose between the pistons or other interior parts, whereby an intermittent action is produced so as to prevent a continuous outflow of water.

4228. SPRING BALANCES OR WEIGHING MACHINES, *G. Salter and J. Hughes, West Bromwich.—3rd September*, 1883. 8d.

Consists in the combination in a spring balance or weighing machine of a spring-supported platform to which the scale or scale pan is connected, the said spring-supported platform having attached to it a vertical rod, through a rack on which its descending motion is transmitted through a pinion to an index finger or pointer, traversing a graduated scale supported above the scale or scale pan.

4243. GALVANIC BATTERIES, *A. Gutensohn, London.—3rd September*, 1883. 4d.

The zinc negative plate is covered with metallic lead to a thickness, of preferably one-eighth of an inch. Nitric acid and nitrate of lead are used as an excitant, a film of paraffin being used to prevent the escape of the fumes.

4267. VELOCIPEDES AND TRICYCLES, *T. O'Brien, New York.—5th September*, 1883. 6d.

The inventor makes use of seats for two persons, the seats being suspended so as to be swung, and from these there are connecting rods to the driving cranks.

4830. EVER-POINTED PENCIL CASES, *J. Appleby, Birmingham.—10th October*, 1883. 6d.

Consists in the construction of the cases, whereby the "movement" containing the lead or writing material, or the holder of the pen, may be made to fall by its own weight either into its projected or withdrawn position by first pressing upon and afterwards withdrawing pressure from the sliding top or cap of the case or holder.

4510. APPARATUS FOR RAISING SUNKEN VESSELS AND OTHER HEAVY BODIES FROM THE BOTTOM OF THE SEA OR RIVER, &c., *A. C. Henderson, London.—21st September*, 1883.—*(A communication from F. B. Picot, Nantes, France.)—(Complete.)* 6d.

Relates to the employment of sunken buoys, into which air is pumped.

5627. MULTIPLE PUMPS, *A. W. L. Reddie, London.—4th December*, 1883.—*(A communication from D. S. Hines, W. A. Perry, and C. C. Worthington, New York.)—(Complete.)* 6d.

Relates to a multiple pump consisting of independent pumps so constructed as to be interchangeable both as a whole and as to each particular part, each of said pumps being provided upon its opposite sides with openings, which are adapted to receive the stuffing-box of either the plunger or the plunger rod, and also with openings by which the induction pipe can be attached at either side.

5632. CONSTRUCTION OF GAS ENGINES, &c., *L. H. Nash, Brooklyn, U.S.—4th December*, 1883.—*(Complete.)* 6d.

Relates particularly to means for preventing the heating of the piston and that part of the power cylinder, within which it operates to compress the air, so that the piston may work in a comparatively cool air compression chamber, while the combustible gases are burned in a very hot combustion chamber where the power is produced and the heat converted.

5709. MANUFACTURE OF HYDROGEN GAS, *S. Pitt, Sutton.—11th December*, 1883.—*(A communication from E. G. Jerzmanowski, New York.)—(Complete.)* 6d.

A jet of liquid hydrocarbon and steam is caused to pass through a chamber containing heated lime, and then through a chamber containing hot anthracite, thereby converting the carbonic acid produced in the first chamber into carbonic oxide. When the lime and coal get cool they are re-heated by burning a jet of naphtha and air in one chamber, and causing the products of combustion to pass through the other.

5783. ASBESTOS CLOTHS, *S. Pitt, Sutton.—18th December*, 1883.—*(A communication from H. W. Johns, New York.)* 6d.

This consists in making from fibrous asbestos loose strands, ropes, or rolls by twisting or rolling the same into the form of rolls, making the rolls into a fabric by weaving, sewing or knitting the same within their strands of fibrous material, preferably asbestos, or with wire.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

294,231. GLASS WATER TRAY, *Augustus H. Heisey, Idlewood, Pa.—Filed December 29th*, 1883.

Claim.—(1) A glass pitcher provided with journal bearings, in combination with supporting standards having journals and provided with a suitable base, substantially as and for the purposes described. (2) A glass base or tray of sufficient width to hold a row of tumblers, provided with standards having journals, in combination with a pivotted or swinging pitcher

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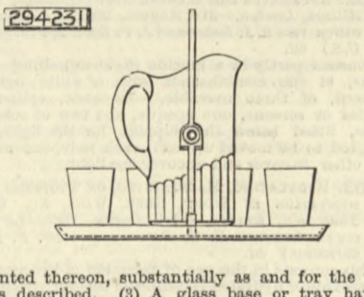

mounted thereon, substantially as and for the purposes described. (3) A glass base or tray having standards for supporting a swinging pitcher, and provided with brackets on the standards, for receiving and supporting goblets and similar articles, substantially as and for the purposes described.

294,303. HYDRAULIC DREDGE, *John H. Anderson, Shelby, Nebr.—Filed September 20th*, 1883.

Brief.—An injection tube having trunnions at the upper end to permit its vertical play, has at the lower end a nose provided with upwardly-opening valves on its upper face. *Claim.*—(1) A hydraulic dredge tube having its nose closed at the end and provided on top

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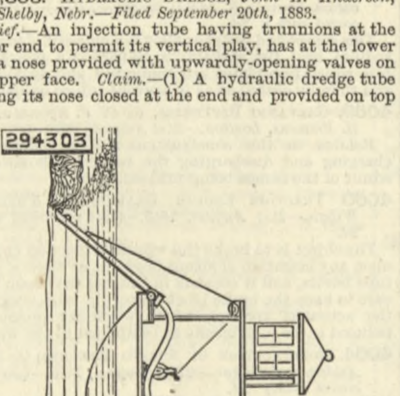

with upwardly opening valves, as and for the purpose specified. (2) The dredge pipe, constructed substantially as described, with the nose, valves, and trunnions, and adapted to be secured to the boat and to have a vertical motion about the trunnions, and to carry a stream of water.

294,364. SOLDERING IRON, *William B. Choate, Aurora, Ill.—Filed November 2nd*, 1883.

Claim.—(1) A soldering copper or iron having a ball head, in combination with a spring shank adapted to grip and hold such head, and to permit its adjustment therein. (2) In combination, the iron made with a ball head, the shank C, having the described arms *d* and *e*, united at one end, and each having its other or gripping ends made annular, and a slide *h* on said shank, all substantially as set forth.

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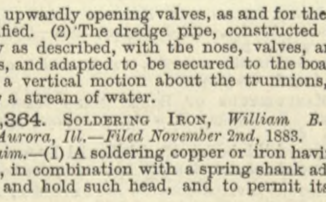


294,380. LIFTING JACK FOR STARTING CARS, *Henry Grimm, Quincy, Ill.—Filed August 2nd*, 1883.

Claim.—The combination of the lever, pivotted standards adapted to grip or take hold of the track or

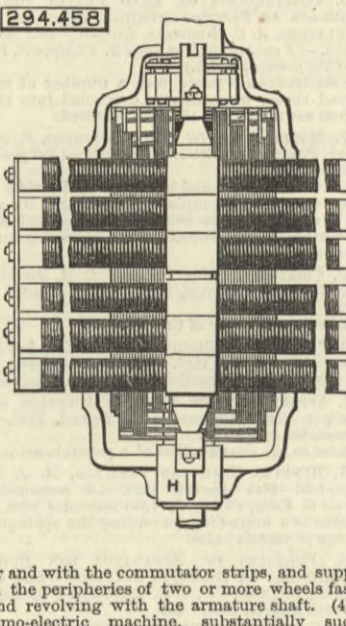
294.380

way, and the arm B, pivotted to the lever between the standards, and adapted to bear against the car, substantially as described.

294,458. DYNAMO-ELECTRIC MACHINE, *George W. Fuller, Norwich, Conn.—Filed February 19th*, 1883.

Claim.—(1) In a dynamo-electric machine, having stationary field magnets and a cylindrical armature, a rotating system of induction bars, arranged in the form of a cylindrical cage and loosely surrounding a stationary cylindrical iron core. (2) In a cylindrical armature for a dynamo-electric machine, provided with longitudinally circumposed groups of induction bars, a series of nests of insulated connecting rings at each end of the armature, for effecting the appropriate electrical connections of the induction bars with each other, substantially as described. (3) A cylindrical armature for a dynamo-electric machine, having an internal iron core loosely mounted upon the armature shaft, and a rotating system of induction bars or coils independent of the said iron core and appropriately connected with each

294.458



other and with the commutator strips, and supported upon the peripheries of two or more wheels fastened to and revolving with the armature shaft. (4) In a dynamo-electric machine, substantially such as described, in which the cage of induction bars or coils is rotated around a cylindrical iron core loosely mounted upon the armature shaft, one or more sleeves *h h*, each provided with the oil supply holes s^1, extending through the upper part of the sleeve and terminating at its lower end in the oil cavity S, formed in the interior surface of the sleeve and containing a strip of suitable material for absorbing oil, in combination with the enlarged part of the shaft H, which the sleeve surrounds, as and for the purposes set forth.

CONTENTS.

THE ENGINEER, April 11th, 1884. PAGE

THE largest cotton mill in the world is said to be the Ponemah, at Taftville, Conn. The old mill is 750ft. long by 75ft. wide, the new part 500ft. by 100ft. in dimensions. Both parts form a continuous structure.

HORIZONTAL CONDENSING ENGINES FOR THE ROYAL ARSENAL, WOOLWICH.

MESSRS. SIMPSON AND CO., GROSVENOR ROAD, PIMLICO, ENGINEERS

(*For description see page 282.*)