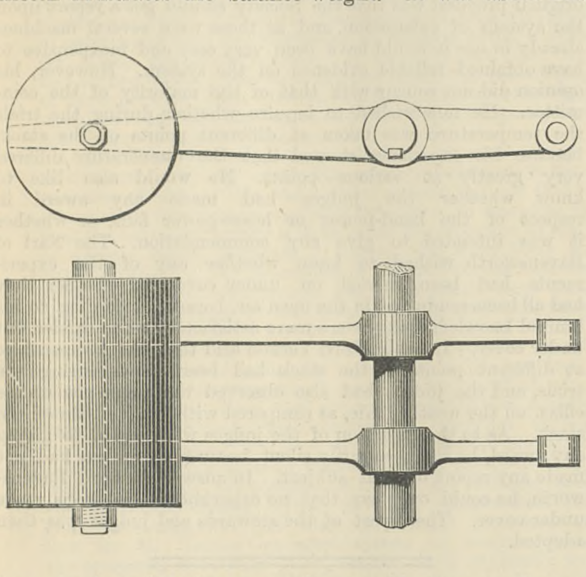
THE GREAT EASTERN RAILWAY ACCIDENT.

THE daily press has already made our readers aware of the fact that a very curious accident occurred on the Great Eastern Railway last week. After the 4.40 p.m. up express train from Norwich had passed Ely a short distance, and was traversing the Fen district, the balance-weight of the link motion of the engine drawing the train fell off, dropped between the rails, and escaping from beneath the train, jumped across the six-foot into the down track. In getting from beneath the down train it struck and damaged an axle-box of the second coach from the engine.

At the moment that it entered the down road the 5.15 train from London was passing, and the balance weight came in contact with the engine drawing this train, which shortly afterwards left the rails, taking seven vehicles with it. The engine thrown off the rails was one of the new uncoupled type, built by Mr. M. Bromley while locomotive superintendent of the line. It weighs with water 42 tons, and without water about 40 tons; the weight of the tender is 25 tons. This is a bogie engine with outside cylinders 18in. by 26in. So far as can be surmised, the balance weight seems to have got into the bogie and probably bent an axle or smashed an axle-box. As the engine is now lying in the ditch half sunk in mud, nothing is certainly known on this point. The whole distance from the centre of the engine to the first mark of damage on the near or left-hand rail of the down line is only 114 yards. The balance weight was carried by the engine which it struck a distance of about 70 yards, but how this was done cannot be ascertained until the engine is examined, and even then it may not be known. The engine, after being hit, did not at once completely leave the rails. The ballast is not torn up, but chairs are smashed and rails bent, so that in point of fact the engine seems to have wandered about until a final oscillation threw it off the rails.

Probably in the annals of railway travelling no more remarkable accident ever occurred. The accompanying sketch illustrates the balance-weight. It was about 2ft.



long, and weighed, as we have said, 3 cwt. It was secured, as shown, by being slipped on to two levers, and then secured with a through pin, this pin having a head at one end and a nut at the other. The pin was not broken; the nut worked loose, and then the pin was shaken out. The link-motion was in such a position that the levers carrying the weight were nearly horizontal, and the weight slipped down their slope. Had the train been heavier, and the engine one notch more in gear, the slope of the levers would have been the other way, the pin-head could not have cleared the frames, and the pin could not have got out. Even though it had got out, the slope of the levers would have kept the weight on, and not permitted it to fall off. A most remarkable feature of the accident is the escape of the weight through the wheels of its own train, which followed each other over any given spot on the rails in very quick succession, the engine running at a high speed at the time.

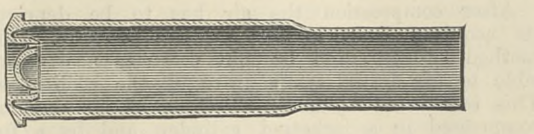
There has not yet been an accident which more conclusively proves the value of the automatic brake. The four trailing vehicles of the train stood on the rails entirely uninjured. Just in front of them was a London, Brighton, and South Coast saloon, with its leading wheels off the rails, but unharmed, save that it has a broken headstock and buffer. One of the coaches next the engine stood on its trailing wheels and leading end, the leading wheels being gone, but the next coaches were all upset; but the noteworthy fact is that not one of these vehicles telescoped with another or attempted to climb on it. Although the whole distance run was but 114 yards after the balance weight struck the engine, and although the speed was over forty-five miles an hour, there was no piling up of carriages, and in this respect this accident stands almost unique. If any other than a powerful automatic brake had been used the whole train would have been, beyond any question, piled up more or less on top of the engine, and the loss of life would have been dreadful. As it is, no one has been killed, and the damage done to property is comparatively small.

To get the engine out of the ditch in which it now lies will tax the skill of Mr. Worsdell, the locomotive superintendent of the Great Eastern Railway. The line is at this point almost a floating road raised about 5ft. above the fen. The ground all about is so soft that a walking stick can be readily thrust into it up to the handle. Probably a large area will have to be covered with planks to provide a platform for operations. We have not the least doubt, however, that Mr. Worsdell will be quite equal to the emergency, and the very softness of the ground may have served to protect the engine from severe injury.

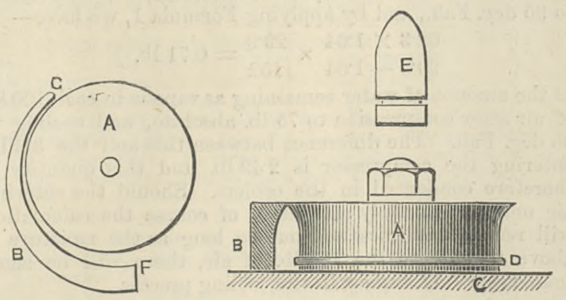
VISITS IN THE PROVINCES.

MESSRS. GREENWOOD AND BATLEY'S WORKS, ARMLEY ROAD, LEEDS.

ONLY two afternoons are set apart in the official programme of the summer meeting of the Institution of Mechanical Engineers at Leeds, commencing on Tuesday, the 15th inst., for visiting the numerous works which will be open for their inspection, but they will be open on other days, so that the members and visitors can make their own arrangements. The works which will perhaps excite the most general interest are those of Messrs. Greenwood and Batley, for here the visitors will find themselves in the manufactory of professional inventors, or at least in the works of a firm to which Governments and private capitalists turn when they want machinery to do work for which no machine has yet been made. Messrs. Greenwood and Batley are well-known as makers of machine tools; but Governments know them equally well as makers of machinery for the production of all the implements of war, from the smallest parts of cartridges to the largest of modern ordnance. The visitors will be able to see in course of completion a set of rifle-making machinery for an American Government, to turn out two hundred rifles per day; and in another part of the works a set of machinery for making metallic cartridges and bullets. From a mechanical and metallurgical point of view, the metallic cartridge-making machines are of remarkable interest, and have probably afforded M. Tresca some good illustrations of his ideas on the flow of solids. It has now long been known that comparatively elastic materials, such as wrought iron and soft steel, may be moulded cold, provided the operation be performed sufficiently gradually, or, in other words, provided the application of a a suitable pressure continues over a sufficiently extended length of time, the latter being as important an element in the process as pressure. Brass having 83 per cent. by weight of copper and 17 per cent. of zinc., or having 74·58 per cent. copper, 25·42 per cent. of zinc, or an alloy of 49·47 of copper and 50·53 zinc will work well, but is not so strong as the others. Such brasses have long been chosen by plate-workers, though the addition of a third and fusible constituent into the alloy is advantageous and necessary when cutting tools have to be employed; but a strong and ductile alloy must be employed for the production, from a flat disc punched out of a plate, of a cartridge cylinder of the section shown by the annexed engraving.



This form is of course obtained by several successive stampings and pressings, the first press turning out a simple cup with depth and diameter of about equal dimensions. The next press materially increases the length of the cylinder, and finally, when it is increased by gradual changes to its full length, the head receives the finishing moulding and the open end is pressed into its smaller diameter. That the material need be good-tempered will be seen when it is mentioned that the change from the larger to the smaller diameter is effected by simply forcing the cylinder into a smooth, cylindrical, but slightly bell-mouthed hole in hardened steel. Both France and Brazil are about to receive from these works a set of bullet-making machinery, which includes the lead rod squirting machines; and for Russia machinery to turn out 600 rifles a day is being made. The bullet pressing and finishing machines are exceedingly ingenious pieces of mechanism, which could not be explained without drawings, and hardly with. The apparatus for finally sizing the bullets is, however, of that simple character which calls for remark. It consists simply



of a disc A, running slowly on a horizontal table C, the periphery of the disc being in form nearly half the profile of the bullet E, while the guard B, adjustably fixed to the table, has a similar form on its inner face, but is without the rib D which forms the groove in the bullet. The bullets are placed by a boy on their bases, and pushed between guard and disc at F, and when caught they roll round and round, and come out, of the proper size, at G. In another part of the works will be found a very powerful lathe, with 75ft. bed, for the French Government, for very heavy guns—a lathe which may be taken as forming part of the set of plant which would include the 100-ton and 160-tons steam crane, and 80-ton steam hammers, which we illustrated in THE ENGINEER of the 10th of May, 1878, and 28th of June, 1878.

In another part of the works will be found a large number of small printing machines of the treadle and power sizes, for circulars and bills, and similar work. These are in a shop or shops specially devoted to their manufacture, and visitors may here see the way in which tool makers use tools and templates. The frames of these machines are dropped into and fixed in a "jig" or frame in which are holes, the counterparts of all those for bearings and fixing purposes, which have to be bored in the frames. When once in this "jig" the machine frame does not come out until every bearing or hole has been bored or drilled, and yet not one of these has been set out or marked. In the same way visitors will see the holes for the magnet bolts and bearings being bored out, without marking, in the frames of dynamo-electric machines of well-known make, for one of the largest electric lighting companies. These machines are being made in large numbers by Messrs. Greenwood and Batley, but the winding of the magnets and armature, or what may be called the electricians' work, is being done in London. The armature ring is carried on its spindle by means of a four-armed centre and boss, and some visitors will be surprised to see that this centre is of German silver of good quality, and is for the large machines of considerable weight. This metal is employed as being more completely non-magnetic than brass or gun-metal, of which these centres were formerly made. Messrs. Greenwood and Batley are also making a set of machine tools for the manufacture of these dynamo-electric machines by the electric lighing company to which the machine belongs.

A great variety of work is turned out of these shops, and the quantity of their machine tool plant is enormous. As may be expected milling machinery is very largely used as well as manufactured for others. Small milling machines are used in large numbers, and every year makes it more necessary to design details, so that everything may involve the least possible amount of hand work. The cost of production, as compared with a few years ago, has thus been enormously decreased, but as every year for the past decade has added from five to ten per cent. on the cost of labour, this application of machines and expenditure of ingenuity in their design has been a matter of absolute necessity rather than choice. Thus small hand milling machines to which fitters may turn for rapid and easy shaping work are numerously employed, where a short time ago the file would have been used. Band saw machines are used extensively, but even those who are accustomed to employ them for cutting ironwork will be surprised to see a machine at work cutting planished bar steel into short lengths for spindles. These machines, however, do this work economically when the saws are not worked too fast or too long, and for keeping them in order a self-acting sharpening and setting machine is employed. The manufacture of screw and rotary gills for silk and worsted machines is carried on at these works, and here visitors may see the backs for the screw gills being drilled with holes about 0·03in. in diameter, with drills running at about 20,000 revolutions per minute. The little drill spindles are set to run at 22,000 per minute, and are driven by a thin cotton web belt, but slip probably reduces the speed 2000 per minute. About forty holes per minute are drilled through 0·3 of brass in these backs per minute, and experiments are being made with the object of drilling steel backs as rapidly. The construction of silk and wool combing, preparing, and spinning machinery may also be seen in these works, and visitors will marvel at the price at which the spindles for these machines are made. A large quantity of lock and key making plant has recently been made at these works for English lock manufacturers, so that American competition in this work will probably soon, if it has not already died out. Visitors will also be interested in the boot-sewing machinery department, where they will see not only the machines in course of construction, but the ½in. deal boards covered with leather sown on to the boards by the machines. There are many machine tools in course of construction to which we have not referred, but readers will, from what has been said, see that there is more in these works that will interest them than they will be able to see in one afternoon.

MESSRS. BUCKTON AND CO.'S 11FT. SHEARING MACHINE.

In our short account of Messrs. Buckton and Co.'s works we referred to the modern design of machine tool frames by which they are made independent of foundations. We now give illustrations of a very large shearing machine, which is a good example of this class of design. The machine illustrated will cut steel or iron plates cold up to 1½in. thick 26in. from the edge; it has 11ft. face of knife, and a plate 8ft. wide will go clear through the machine; such a plate the machine will cut right across at any part of its length at a single stroke. The moving shear slide is balanced with a counterweight and fitted with a stop motion, so that while the engine, fly-wheel, and gearing may run continuously, the action of the shear can be stopped until the plate is put into position, when the two stop blocks are slid by a coupled motion simultaneously into their places, and the slide is pressed down by a parallel motion, being acted upon at its two extremities by connecting rods driven by parallel excentric pins on the two ends of the main shaft. All the wheels in this machine are cast with split bosses, planed at the joints and hooped with wrought iron rings. There are two overhung wheels about the machine; they each work between a pair of brass bearings, in which any wear that takes place does not prevent the teeth from still bedding fairly across the faces. The main excentric shaft is of wrought iron 20in. diameter, and works in solid brass bushes each 18in. long. At each stroke of this machine it overcomes a resistance in the plate of about 4000 tons of breaking load. The whole machine, with engine complete, is so self-contained that steam has been put into the cylinder at the makers' works, just as it stands depicted, on the floor, and a plate of the maximum dimensions cut into slabs with repeated strokes of the machine.

At present there is a machine of similar design, but for plates 1¼in. thick, in course of construction, at these works, and a machine of the size described is at work at the Bowling Iron Company's works, near Bradford.

THE MECHANICAL REFRIGERATION OF AIR.

By T. B. LIGHTFOOT, M. Inst. C.E., M. Inst. M.E.

No. II.

Having now briefly described the laws relating to compression and expansion, we may pass on to consider their application to the mechanical refrigeration of air.

Seeing that if air be compressed adiabatically and expanded, also adiabatically, back to its original pressure, the final temperature must be precisely the same as before compression, it is obvious that if it be desired to produce colder air after expansion, means must be provided for getting rid of heat at some part of the process. It is for this reason that the air is compressed. In this operation, the temperature being raised above that of surrounding objects, the air is placed in such a condition as will permit of it imparting heat to a body at normal temperature. Any substance capable of receiving heat would act as such an agent, but from its plentifulness at suitable temperatures—from 50 deg. to 60 deg. Fah. in England, and from 80 deg. to 90 deg. Fah. in the tropics—and from its comparatively high specific gravity and heat, water has been selected and used for the purpose.

The heat imparted to the cooling agent is therefore the sole measure of reduction in temperature after expansion, and with a given weight of air the more heat abstracted the greater the degree of cold produced, so that as the temperature of the water in any locality is generally fixed, and the extent to which the compressed air can be cooled thereby determined, it is evident that for any one form of compression the more work done by the piston—that is to say, the greater the amount of heat developed—the lower will be the final temperature.

Knowing the temperature to which the compressed air can be cooled, and having the final temperature and pressure after expansion fixed, we can at once calculate by Formula 5 the pressure necessary to produce this result by adiabatic expansion, or more simply by referring to Table III.

As an example, suppose it is desired to produce cold air at atmospheric pressure, and at a temperature of 50 deg. below zero Fah., the air being cooled after compression to 65 deg. Fah. The ratio of initial to final temperatures being 460 + 65 to 460 − 50, or 1·28 to 1, from Table III. it will be found that with adiabatic expansion this ratio of temperatures requires a ratio of absolute pressures of 2·4 to 1, and therefore, as the final pressure is to be 15 lb. per square inch, the initial pressure must be 15 × 2·4, or 36 lb. per square inch absolute. If, then, we can provide a supply of air at a pressure of 36 lb. per square inch, and at 65 deg. Fah., we have with an expansion cylinder all that is necessary to produce cold air at the desired temperature and pressure.

The air refrigerating machines we have to consider are constructed to carry out the operations just indicated. They consist of a compressor in which ordinary atmospheric air is compressed to any desired pressure, a heat exchanging apparatus in which the heat of compression is imparted to the cooling agent, water, and an expansion cylinder in which the air is caused to perform mechanical work while being expanded to its original or other pressure. Various forms of machines have been designed, each professing to attain some special object, but they one and all agree in this general cycle of operations. The compressor is driven from a shaft at such an angle with the expansion crank that the work given out during expansion, which is roughly about 60 per cent. of that required in compression, is most effectively utilised for turning the machine. The difference between the power absorbed and that returned, plus friction, must be applied by a steam engine acting directly on the shaft, by a gas engine, or by any other convenient method.

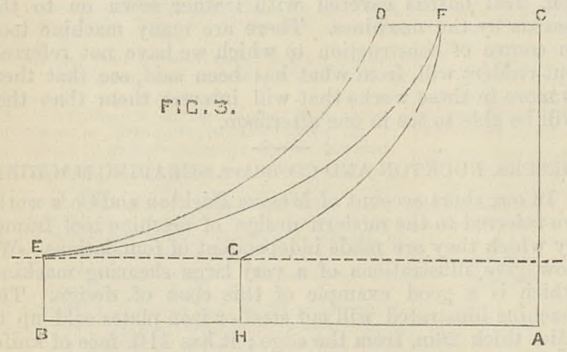


Fig. 3 shows graphically the whole operation of compression, cooling, and expansion. A B is a volume of air at atmospheric pressure, adiabatically compressed to pressure A C and volume C D. By the application of a cooling agent the heat imparted during compression is abstracted and the volume reduced under constant pressure to C F. Expansion is then effected adiabatically to volume A H. If t and t_{1} be the absolute temperatures before and after compression, and t_{11} and t_{111} those before and after expansion, the relations between temperatures and volumes may be put thus—

$$\frac{A\,H}{A\,B} = \frac{C\,F}{C\,D} = \frac{t_{11}}{t_{1}} = \frac{t_{111}}{t} \quad . \; . \; . \; . \; . \; . \quad (6)$$

and each of these expressions gives the efficiency of the whole process, showing the work that should be restored during expansion. The area E D F G is the deficiency to be supplied by the motive power, and this is, of course, greater, as the extent of compression is greater. On the other hand, however, assuming the temperature of cooling agent to be uniform, the cold produced after expansion will be correspondingly greater. Instead of cooling by a subsequent operation the heat may be abstracted during compression, and in this case the curve E F, which is a hyperbola, would represent the rise in pressure, and the area E F G the work to be applied in driving.

In actual practice we have not to deal with a perfect gas alone, but with air mixed with varying quantities of aqueous vapour. It is proposed, therefore, to follow out the actions taking place in an air-refrigerating machine working with ordinary atmospheric air, applying the rules and formulæ already laid down, and showing in what manner it is necessary to modify them to meet the actual case.

Neither adiabatic nor isothermal compression are ever quite carried out, though the two extremes are sometimes nearly reached, the former in a quick speed compressor with badly water-jacketted cylinder, and the latter in compressing at slow speed with a well-arranged injection of cold water. Each system has its advantages; the water jacket when it is important to keep the air dry and free from impurities which might enter with the water, and the internal parts of the cylinder and the valves from any deleterious action which might be caused, especially if salt water be used, and the water injection when saving of power is of most consequence, and when a considerable quantity of pure fresh water can be obtained. With a proper circulation of water in a well-constructed jacket of a high-speed compressor the absolute terminal temperature may be taken at about 90 per cent. of the adiabatic temperature, but of course varies more or less according to special conditions. With efficient water injection and moderate speed the temperature can be kept down so that it does not exceed that of the cooling water by more than about 1 per cent.

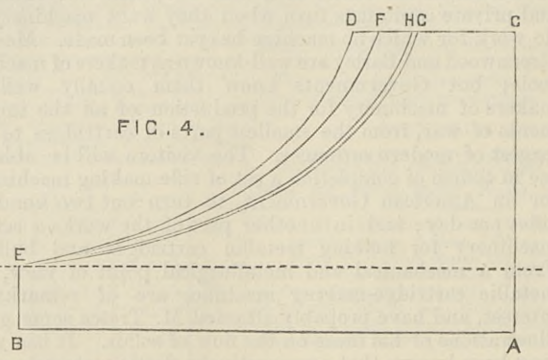


Fig. 4 gives the various curves of compression. E D is the adiabatic line and E F the curve in a high-speed compressor with efficient water jacket. E G is the isothermal line and E H the curve with well-arranged injection. The difference between the areas gives the difference in power required. The choice of the method of compression is purely arbitrary, but there is probably less liability of danger and derangement of working parts with the water jacket.

During compression the presence of aqueous vapour entering in solution with the air is of no consequence as regards its effect upon the power taken up in compression, whichever system is adopted. With injection the reason is obvious, and with a jacket, owing to the great rise in temperature, the capacity of the air for holding moisture in solution increases in a much larger degree than it is diminished by increase of pressure.

After compression the air has to be deprived of its acquired heat, greater or less according to the method adopted, and brought down as nearly as possible to the initial temperature of the cooling water. This is effected by surface cooling in the case of air compressed in a jacketted cylinder, and by a further actual intermixture with water if compression has been carried out with internal injection. In either instance, with proper care, the air may be cooled to within 5 deg. Fah. of the temperature of the water. In ordinary conditions during this process, more especially with surface cooling, an important deposition of water takes place, for the air, losing to a large extent its power of retaining moisture in solution, a portion of the vapour it contains is condensed and precipitated as mist, which may be collected and run off as water if suitable means be provided. During injection compression, if the temperature be sufficiently reduced, part of this condensation takes place in the cylinder itself, a result which at first sight seems somewhat of a paradox, as the air may be actually dried by its intermixture with cold water when under pressure.

To take an example, suppose that air at 90 deg. Fah. and 29·9in. pressure is entering the compressor; then by Table I. every 100 lb., if saturated, will carry with it 3·2 lb. of aqueous vapour. With cooling water at 90 deg. Fah. the air compressed to say 75 lb. absolute, will be reduced to 95 deg. Fah., and by applying Formula 1, we have—

$$\frac{62{\cdot}3 \times 1{\cdot}64}{29{\cdot}9 - 1{\cdot}64} \times \frac{29{\cdot}9}{152} = 0{\cdot}71 \text{ lb.}$$

as the amount of water remaining as vapour in each 100 lb. of air after compression to 75 lb. absolute, and cooling to 95 deg. Fah. The difference between this and the 3·2 lb. entering the compressor is 2·49 lb. and this quantity is therefore condensed in the coolers. Should the entering air only be partially saturated, of course the calculation will require modification, but so long as the moisture is above 0·71 lb. to the 100 lb. of air, there will be some condensation of vapour in the cooling process.

The quantity of cooling water required is dependent on the efficiency of the heat exchanging apparatus. If this was perfect the ratio of weight of water to weight of air to be cooled would be inversely as the ratio of specific heat of water to specific heat of air under constant pressure, plus that amount requisite to take up the heat given out in the condensation of the aqueous vapour. But the apparatus in use is very far from perfect, and as a rule is only capable of raising the water through about 40 deg. Fah., while the air is reduced perhaps 200 deg. Fah. With injection the amount of water required is very large, as from the nature of the cooling process it can only be raised through some 5 deg. Fah., otherwise the air is not cooled as much as it might be. In any case knowing the range through which the air is to be cooled, and that through which the water can be raised, the determination of the volume to be supplied is an easy matter. In some localities, however, where water is expensive and scarce, it is desirable to specially construct the coolers with the view of economy, or if admissible, to provide tanks which would receive and cool the water after its passage through the machine, and from which it would be again used after being mixed with a small portion of fresh cold water.

As the subsequent process of expansion is carried out under different conditions in three distinct types of machines, it is proposed to deal with this final operation under three heads:—First, those machines in which the cooled compressed air is expanded to about atmospheric pressure in one operation, nearly all the contained moisture being converted into ice; second, those in which the compressed air before expansion is subjected to a further cooling action, derived from the cold expanded air itself, with the object of inducing a condensation and deposition of moisture, and is then expanded at one operation; and thirdly, those machines in which a condensation and abstraction of moisture is effected by carrying the expansion at first only to such extent as will give a terminal temperature of about 35 deg. Fah., the moisture thus condensed being separated from the air as water, after which the air dried in this manner is finally expanded to atmospheric or any other desired pressure.

THE ROYAL AGRICULTURAL SHOW AT READING.

At the monthly meeting of the council of the Royal Agricultural Society held on Wednesday, under the presidency of the Duke of Richmond and Gordon, K.G., the prizes won at the recent Reading Show were ordered to be paid, and cheques were accordingly drawn and signed. Lord Vernon, senior steward of implements, reported in reference to the trial of hay dryers that the hay has all been stacked, and some of the stacks are probably sufficiently dried, but others require further exhaustion. During the absence of the judges, Mr. Box, assistant steward, has been left in charge with instructions to observe and record the temperature of the hay stacks, and to make the necessary arrangements for a further trial. The trials have been carried far enough to enable the judges to reduce the number of competing fans from seven to three, viz., Mr. James Coultas's fan driven by steam, Mr. C. D. Phillips's fan driven by steam, and Messrs. R. A. Lister and Co.'s fan driven by steam. The judges propose to try these fans upon the produce of forty acres of barley which have been secured for that purpose at Twyford, about three miles from Reading. In presenting this report Lord Vernon remarked that one of the greatest difficulties in the way of these trials had been the weather, and it seemed extraordinary that this should be the case, inasmuch as it was supposed by some very sanguine people that hay could be made with ease in wet weather. That had proved to be certainly not the case, and the trials had been very much prolonged owing to that particular cause. Mr. James Howard, M.P., as a member of the Implement Committee, wished to absolve himself of any responsibility in the great outlay incurred by the trials of hay dryers. His original proposal was that the Society should get a report upon the system of exhaustion, and as there were several machines already in use it would have been very easy and inexpensive to have obtained reliable evidence on the system. However, his opinion did not concur with that of the majority of the committee. He now wished to inquire whether during the trials the temperature was taken at different points of the stack, because his experience showed that the temperature differed very greatly at various points. He would also like to know whether the judges had made any award in respect of the hand-power or horse-power fans, or whether it was intended to give any commendation. The Earl of Ravensworth wished to know whether any of the experiments had been carried on under cover, or whether they had all been conducted in the open air, because, according to his limited knowledge, they were more satisfactory when carried out under cover. In reply, Lord Vernon said that the temperature at different points of the stack had been taken during the trials, and the judges had also observed the difference of the effect on the weather side, as compared with the lee side of the stack. As to the intention of the judges with regard to giving any award, he was necessarily silent, because the judges had not made any report on that subject. In answer to Lord Ravensworth, he could only say that no experiments had been made under cover. The report of the stewards and judges was then adopted.

LETTERS TO THE EDITOR.

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

SEWAGE AND AIR.

Sir,—The treatment of sewage has, perhaps, occupied of late years more attention from scientists than almost any other question. Indubitably there is good reason why this should have been the case, for the daily increasing tendency of mankind to congregate in large centres renders this question one of vital importance. It is not my purpose now to review the different methods adopted by a thousand-and-one inventors to apply certain definitely received principles. Ingenious as these methods have been, they are, after all, but modifications on certain lines which have been accepted as a basis ever since the disposal of sewage, apart from the old system of cesspits, has occupied men's minds. New departures have been rare in the extreme; at least, those have been so which have been brought to the test of practical experience, and success with them has in all cases been but very partial, and but few have possessed merit enough to be proceeded with beyond the experimental stage. Results observed by myself during the course of many years incline me, however, to think that there may be much in a new system which has recently been patented by M. Mouras, of France; or, rather, I should say, in the principle which that gentleman's system is intended to practically develope. This principle may be briefly described by stating that it recognises the fact that in animal excreta there are contained certain agents which, when unfructified by germs contained in the atmosphere, react upon each other and cause almost complete and innoxious liquefaction. What these agencies are is as yet matter of almost entire conjecture, nor have I anywhere seen recorded the results of M. Mouras' proposed apparatus on a sufficiently large scale to warrant the assumption that he has succeeded in proving by practice that his theory can be successfully applied. It is with that theory, and not with M. Mouras's particular proposed application of it, that I propose to deal.

It has not needed any particularly close observation to lead to the conclusion that in many cases nature has seemed to point out that animal excretæ should be kept from contamination by external agencies, and she appears to have kept apart, as it were, in her wise provision, those forms of it which are the production of carnivorous and herbivorous animals. Those of the latter are useful as the habitat in which a large proportion of insect life is matured, and we therefore find that with them there is a comparative absence of the mucous or fatty envelope which guards for a certain period the excretæ of the carnivoræ from the effects of air. It seems to have been recognised by nature that such excretæ should be buried out of reach of all contamination as soon as possible. Witness the fact that many carnivorous animals, more especially the cleanly felines, endeavour to cover up their droppings immediately after dejection, while such habits are quite absent in the herbivorous animals. It does not do to argue too far upon this presumption of nature's intent, but it undoubtedly may be accepted as pointing towards a conclusion, and when taken in connection with other well-established facts, it certainly strengthens the inference I desire to consider.

To a very considerable extent the earth closets introduced by the late Rev. Mr. Moule fulfilled the purpose of an agent by which effect was given to what I surmise to be one of nature's laws. Not that the inventor appears to have considered that the action of his system was in the least dependent upon the exclusion of air, but that in effect the results obtained by him were mainly due to such exclusion, although but partial; only he did not go far enough, and from having worked on an erroneous or only half correct theory, he was led into laying down certain conditions for the working of his invention which really militated largely against its success. It was one of Mr. Moule's dicta that urinary fluid should as far as possible be kept distinct from the solids, and in doing so I believe that he was mistakenly endeavouring to keep away the really active agency for producing defecation. My own experience with the dry-earth system was commenced in an engineering establishment employing about 400 hands. I was at first careful—in compliance with Mr. Moule's recommendations—to obtain the driest possible and clayey earths, and found that with their use all the disadvantages that gentleman asserted to be due to an admixture of urine became largely developed, for unless removal was rapidly made, most offensive exhalations were soon noticeable. Certain circumstances led me to the use, as a temporary measure, of rather fine sand, and it was then found that all the complaints made of the condition of the latrines ceased. There was no smell whatever from them, even when their contents were purposely left for days without removal, and when at last this was effected, the process of defecation was so complete that nothing of an offensive character was noticeable to the sight, and there was further a complete absence of objectionable smells. I gave careful consideration to the probable cause of this effect. There could be nothing in the chemical constituents of the sand which could be answerable for the result. Almost pure silex could certainly not have produced them; to my mind, there must have been a mechanical agency at work which had permitted certain natural and self-contained principles to have had free and unrestrained action. What, I argued, can have caused the total disappearance of the offensive urinary gases? I tested the two systems of earth and sand on a small scale side by side. I found the dried pulverised clay rapidly absorb the urine and present it over its whole surface to the action of the atmosphere. As it evaporated, the clay again drew it up from the lower layers until it was exhausted, and when the clay was completely dry, air, no doubt, passed down through its interstices, and the excreta exposed to it was largely and offensively contaminated, and did not disappear until the living organisms bred in it had done their work. The sand system presented a singular and most striking contrast. Its non-porous nature prevented any rising of the urinous liquid to its surface, and the closeness of its particles prevented any permeation of air. From the instant of its application—as I thoroughly satisfied myself—there was not the least exhalation noticeable, and when, as before stated, the admixture was removed, not a trace of sewage was apparent. My contention was and is that the agencies contained in the urine and in the fœcal matter mutually re-acted on one another to effect their innoxious decay. The conclusion was forced upon me that such agencies are a wise provision of nature, and that the endeavour to separate them, enjoined by Mr. Moule, was a fatal mistake. It was apparent, however, that had air had access to the solid matters before the chemical agents of the urine could have time to act, the germs so communicated would have caused putrefaction in both classes of deposit, and the wise intent of nature would have been defeated.

I now come to the point at which M. Mouras' theory runs concurrently with my own. His primary insistence is the total exclusion of air. In his water-sealed cesspits he finds that in but a very short time there is complete defecation, so complete indeed that the only solid matter is to be found in suspension in the form of scarcely visible filaments. During the trials there was an entire absence of any formation of gas, but it was immediately produced on the admission of air. I therefore seem forced to the same conclusion in the case of M. Mouras' experiments as I was in the result of my own, viz., that, given no contaminating influence or absorption by the atmosphere, the grand self-contained agencies of nature for preserving health had free play. There is one further important consideration to which attention should be given. Does this apparent annihilation destroy the fertilising ingredients and render the residuum useless for manuring purposes? My own experience enables me to answer this question by a positive negative. The contents of my soil carts were spread over a grass field close to my residence, and with the most stimulating effect, while no disagreeables resulted from its contiguity. It may be further considered as to how far M. Mouras' proposed system of cesspits, in which the operation is to take place, can be made applicable to large cities. House-to-house visitation would, it is to be feared, be necessary to ensure the proper action of such arrangements, and much would be gained could the system be carried out on a large scale at some point of general reception. It is well known that the gases contained in fœcal matter do not burst the fatty envelope for some six hours after deposit. Such a time might be sufficient for it to arrive at a defecating station; but then there arises the question as to whether the large admixture of water during its course would not have seriously reduced the effectiveness of the urine as a defecating agent. The sand system is wholly free from such an objection; but then, on the other hand, the cost of collection and removal would be an insuperable difficulty in large towns. For such, M. Mouras' proposal seems to offer the only feasible course, and it should not, perhaps, entail the risk of disordered apparatus any more than our present system of closets does. But such considerations are offshoots only from the object of this letter, which is solely to point out what grounds exist for believing that, if we but look to nature herself, she will indicate to us a Royal Road of escape from the difficulties which beset a most important subject. A. F.

St. James's-street, London, July 31st.

STEAM LAUNCH FOR BRAZIL.

SIR,—In THE ENGINEER of July 21st there is a letter respecting a steam launch built by me for Mr. Alexander Mitchell, of Dundee, residing at Para. From the wording of the notice your readers will get a wrong impression. The design referred to by Mr. Mitchell was placed in my hands to build from, with the exception that a locomotive boiler was to be substituted for a wagon type of boiler. I had no desire that the launch should appear as my design, although as a light draught passenger steamer it was admirably adapted for the purpose intended, and does Mr. Mitchell much credit as the designer.

I had nothing whatever to do with the notice and illustration of this launch which appeared in your issue of August 5th last year, and it was not inserted by my instructions. I may add that I consider the locomotive boiler far preferable to the old form of wagon boiler, more especially for a steamer using fresh water. By the substitution of a locomotive boiler the centre of gravity could not be materially interfered with, as the launch was only 56ft. 6in. long and the beam 13ft. 10in. on the water line.

Mr. Mitchell must have been under the impression that I gave instructions for the notice and illustration referred to to appear, which was certainly not the case. EDWARD HAYES.

Stony Stratford, July 22nd.

THE READING FAN TRIALS.

SIR,—I have seen with some interest the account of the trials of hay-drying fans in your last issue, but I am rather disappointed with the small amount of information obtained. Last April I was asked by a firm of manufacturers to go down and see a fan which had been made for the above purpose. I found one similar to that described in your last issue but one as a "remarkable structure," but through some delay it was not fixed for driving.

From what I saw I designed a fan which I intended merely as an experimental fan, but which was afterwards sold by the firm referred to in considerable numbers. The fan was 2ft. 6in. diameter across the tips of the vanes. These were radial, and 8in. wide and 7in. deep. The casing was 10in. wide, leaving 1in. clearance at the sides of the vanes. The outside of the case was spiral, commencing at just clearing the vanes to about 6½in. clearance. The suction was on one side 9in. diameter, and the opening into the fan case was 10in. diameter. It was mounted on a wooden frame and driven by a band from a pulley mounted on a short shaft with two handles. The pulleys were 10in. and 4in. respectively, and the handles 16in. radius. I tested it roughly by inserting a ⅜in. gas tube in the side of the suction, as near the centre of fan as possible, and in a direction parallel with the axis. To this was attached a short length of flexible tube, in which a small glass syphon was fixed. The speed was roughly obtained by hanging up a plumb-line the proper length to mark the times for the revolution of the handles, and the observations were taken when they appeared to coincide. The following results were obtained, which, of course, are only approximate. One man turned the fan during the experiment, and two would do it easily when at work:—

(1) With suction open and the fan doing full work:

At 300 revolutions,	0·2in.	of water	supported
450	,, 0·35in.	,,	,,
600	,, 0·5in.	,,	,,

(2) With suction closed and fan doing no work:

At 300 revolutions,	0·75in.	of water	supported
450	,, 1·5in.	,,	,,
600	,, 2·0in.	,,	,,

THOMAS FARDON.

106, Queen Victoria-street, August 2nd.

BREWING IN ENGLAND.

SIR,—We have noticed the correspondence between "Brewers' Architect" and Messrs. Stopes. Being largely engaged in malt kilns, we should like to state that our long practical experience with the working of both double and single kiln floors has taught us that "Brewers' Architect" is quite right to consider Messrs. Stopes' design too confined for the capacity named. No practical maltster would go to the very lowest possible limit in erecting a new malting; there is a difference between what is possible and what is economical and advantageous.

Messrs. Stopes' experience may have taught them that steeping and drying in thick layers is more economical, but we should very much doubt it. It is quite possible, as we know from experience, that fair malt can be made in thick layers, but although we are acquainted with many eminent maltsters who have made numerous trials in growing and drying on this system, we are not aware of a single instance where the result showed that such mode of working was more economical.

True, the maltsters we know do not employ economical electric force, and indeed it would take some time to convince them and us that electricity is more economical. They would say that electricity has first to be produced by steam, and that it is cheaper to produce the necessary work "direct" by steam, instead of "indirect" by electricity.

With regard to Messrs. Stopes' arrangements of bins, separators, steeping cisterns and loading arrangements, we do do not want to detract anything from the merits due to them for any improvement they may have made in these appliances, but on the other hand it appears to us that they claim too much.

There are many maltings which are fitted with improved labour-saving appliances, and although they may not be driven, as yet, by electrical force, it would be really too much to imply that other kiln manufacturers do not supply improved labour-saving appliances equal to or better than those named by Messrs. Stopes.

We also cannot agree with Messrs. Stopes' opinion that Burton practice is "a long way in the rear of the best system." Some very good malt is required and made in and around Burton, and it would probably be very difficult to prove that maltings, with such confined space as constructed by Messrs. Stopes, can produce "better malt" at "less cost." Further, with reference to Messrs. Stopes' claim that they have first introduced double kiln floors into this country, we can state positively that our firm has erected double wire kiln floors long previous to the kilns of Messrs. Stopes, either at Brighton or at Stortford. We are now erecting a double floor kiln in Hertfordshire, and we have also lately supplied another large double floor. CORCORAN, WITT, AND CO.

30, Mark-lane, London, E.C.

FLAMELESS COMBUSTION.

SIR,—This matter has excited a considerable amount of interest, and the question of its practical application has been raised. That it can be applied immediately to many existing furnaces there is, I think, no question, and for those interested it may save trouble if the following suggestions are utilised. Their publication may also have the effect of preventing some of the speculators in patents hampering the matter by their interference. If we take the gas from say the Wilson or Dawson producer and supply it under pressure through a jet placed in the centre of an air tube, these can be so adjusted to each other in size that the gas supply will at any pressure act as an injector and draw in exactly the quantity of air necessary for combustion. Once adjusted, the variation in gas supply will, in practice, pull in exactly the quantity of air needed for the gas which is passing, and a reduction of the gas supply entails a corresponding reduction in the air drawn in. If this mixture is thrown into, say, the fire-box of a boiler filled with rough blocks of fire-brick which have been heated first by withdrawing the compound jet a little way, the gas and air will be perfectly burnt without flame by simple contact with the hot fire-brick, making a flameless fire which may possibly fill both fire-box and flues. No extra air supply being needed to cause a flame or to burn the distilled gases from a solid fuel, of course the fire-brick, which would take the place of the solid fuel, might be built so as to completely fill the fire-box and also the flues. The same system may also be applied to crucible furnaces, which may be filled with open fire-brick, leaving only a recess in which the crucible fits.

It would no doubt be advisable to allow the mixed air and gas to enter in several places or over one comparatively large area, to prevent the intense heat which would be evolved at the point of entry. The space necessary for the open work lining is exceedingly small, requiring to be no greater than will allow the passage of the products of combustion through the interstices.

I have found also by experiment that if a correct mixture of gas and air are passed into a close coke fire the heat is enormously increased, whilst the combustion of the coke is practically stopped; so far as the rough experiments go, I believe that it is entirely prevented. There can be no doubt that a spray of petroleum oil can be burnt in precisely the same way as gas, without any flame, the only difference in the arrangement being that a thicker layer of the heated surface is necessary to give time to permit of conversion into vapour, and after mixing with air, which of course can only take place after vaporisation. So far as experiments go, it would appear that this system of flameless heat is the only one which is perfectly applicable to the economical use of petroleum oils in furnaces, and all experiments point to the fact that if a steam jet is to be used to create an air blast it should be placed in the chimney, as the passage of steam through the fire, at all events in small furnaces, lowers the temperature so much as to entail great waste. Any attempt of my own to utilise a steam jet in the place of a dry air blast has reduced the available temperature so much as to make the furnaces quite useless for my own purposes. It has frequently been urged in favour of a steam jet that the heat absorbed by decomposition of the water is again given off by the combustion, but it is a very doubtful question whether the after combination ever takes place in practice, owing to the mechanical interference of the products of combustion, which dilute the oxygen and hydrogen to such an extent as to make their combination difficult if not impossible. The matter is one which to me has no interest further than its chemical and theoretical points, but I shall be glad to render any assistance in any way within my capacity to those who wish to experiment on a small scale, and any apparatus or conveniences I have, so far as time will permit, are in this, as they always have been in other matters, at the service of any experimenters without question of cost. THOS. FLETCHER.

Museum-street, Warrington, July 31st.

AN EXPERIMENTAL GAS EXPLOSION AT CHATHAM.

THE importance of the experiment made at Chatham last week upon the Bullfinch requires an accurate statement of the details to be properly appreciated. It will be remembered that the court martial which sat upon the loss of the Doterel came to the conclusion that an explosion of gas generated in the coal bunkers might primarily have given rise to the explosion of the magazine. This view was not concurred in by the Constructive Department of the Admiralty, and the Committee on Gas Explosions, which was instituted to investigate the circumstances attending the loss of that vessel, and other matters relating generally to this group of subjects, has now carried out an experiment designed as a crucial test of the power of a gas explosion to effect the results supposed by the court martial. The Doterel was a composite vessel, with iron frames and steel bulkheads, consequently of greater general strength than the wooden hull of the dismantled gunboat appropriated to the present experiment. Moreover, the intimate mixture of the most explosive proportions of gas with air, and the full volume of the cubic capacity of the bunker space, 3100 cubic feet, employed, rendered the conditions of the explosive mixture in power far beyond what it is in within the bound of probability could ever arise under ordinary circumstances. Thus, the structure being more easily assailable, and the explosive force attacking it being far more violent, the success in exploding a case of powder placed in the magazine of the Bullfinch should have been accomplished if it were really attainable. The fittings on board the hulk were not exactly the same as in the Doterel, which it would have been an expensive undertaking to have realised, but they were quite sufficiently near for the result to be truly applicable.

The Bullfinch is a wooden vessel about 170ft. long and 25ft. beam; the freeboard portion of the sides being of 7 by 6in. timbers and 5½in. of planking with diagonal iron stringers. The forepart of the hull is shut off from the boiler-room by an iron bulkhead. A similar bulkhead of steel has been rivetted up 11ft. 6in. in advance, the intervening space representing the coal bunker of the Doteral, and being 12ft. in depth from the deck to the bottom of hull. Another space, 11ft. 3in in. length, and, like the bunker, extending the full width of the ship, was then screened off from the magazine, placed still farther forward, by a wooden bulkhead, the interspace in this case representing the tank room of that vessel. The magazine was formed below the level of this lower deck, its "flat" or floor being 2ft. 10in. away from the bottom of the hull. On the deck above it was a copper ventilating pipe, such as in the Doterel was worked by a hand fan. The hatchway over the bunker, 4ft. by 4ft., was battened over with 3in. planking bolted down to the frame. The deck over the bunker was of planking, originally 3in. but worn down to 2½in., and this planking was secured to three iron transverse beams of bulb angle iron, 6in. in the webb by 3in. in the flange, as well as to the flanges of the two bulkheads, by numerous ⅝in. bolts. The middle portion of the deck was composed of 4in. of planking, with a breadth of about 4ft. of iron plating beneath. The planking of this upper deck terminated along the line of the iron bulkhead, but the planking was continuous forward over the steel bulkhead. The interior of the bunker was coated with marine glue to make it gastight. The gas employed was the ordinary carburetted hydrogen used for lighting the Dockyard, and it was conveyed on board by a 1½in. iron pipe, the open end of the pipe being brought through the deck into the upper part of the bunker space. In the lower part of the steel bulkhead a small hole was made for the exit of the air forced out of the bunker by the entry of the gas above, the proportion of gas admitted being one-sixth of the cubic space of the bunker. The air and gas within were then intimately commingled by a fan, which pumped the gas mixture through a pipe let into the upper part of the bunker space, and forced it in again by another pipe descending to nearly the floor of the bunker. The test corresponded with the measured quantity, and gave 16 per cent. as the relative proportions of gas to air in the well-churned mixture.

All being ready, the Bullfinch was moored over on the Upnor shore, and at six o'clock the Committee went on board the Bustler, which took station on the Medway, a short distance from the experiment ship. The whole of the Committee, with one exception, were present, and consisted of Vice-Admiral Laurd, C.B., president; Professor Abel, F.R.S.; Mr. Warren, chief constructor at Pembroke Dockyard; Mr. Iceley, chief inspector of machinery; Mr. James Dunn, of the Admiralty; Mr. Weston, Admiralty chemist; and Mr. Watson, of the Admiralty; secretary, Mr. Warington Smythe, the other member being absent from illness. The experiment was also witnessed by the Admiral-Superintendent of the Dockyard, Rear-Admiral Watson, R.N., and by the Commander-in-Chief at the Nore, Vice-Admiral Rice, R.N. The firing of the gas charge was performed from the shore by Mr. W. O. Brown, of the Laboratory Department of Woolwich, with a single tension fuse and a small charge of a few grains of gunpowder. The explosion was very sharp in effect but not noisy, the hatchway was blown up about 30ft., and with some loose deck stuff fell overboard. Immediately after the explosion lambent flames appeared in the air, and then dense volumes of black smoke poured forth from the ignition of the marine glue surfacing. The 18lb. powder charge placed in the ship's copper store canister in the magazine had not been exploded; and the fire continued to rage for more than a quarter of an hour, when the black smoke having somewhat subsided, the police boat and steam floating fire engine were allowed to go alongside, Admiral Laurd himself going on deck and directing the service of the hose.

When the fire was allayed, the Committee went on board and took a brief survey, a further and closer examination being made next day of the details. The sides of the ship were uninjured, but the bulkheads were both distorted. The forward one, of steel supported by vertical angle irons, 3in. by 3in. in section, and 2ft. 6in. apart, and held rigidly in mid-height by the lower deck of the tank room, was bulged some few inches in each bay, and bowed slightly from side to side; but the after-iron bulkhead, similar in construction to the steel one, was, although stiffened midway by a longitudinal beam of timber, 12in. by 8in. in section, strutted with six round struts of 7in. or 8in. diameter, bulged out to the extent of at least 2ft., and the portion on the port side was doubled to a sharp angle of the like extent along the angle-iron frame at the deck-line. The deck over the whole area of the bunker was seen bulged up as by a great sphere, and the portion towards the after part of the ship, including the iron beams across, was seen curved over in an arched form from side to side, the extent of rise at the centre from the level of the deck-line being over 3ft. The marks of the bolts which had secured the iron stringer-plate on the starboard side were to be seen upon the bulwarks, thus proving that the whole of that side of the deck had been lifted up like a box lid, of which the hinge was formed by the footplate of a strong iron stay bolted down upon the upper flange of the steel bulkhead, and that it had been brought down again to its position by the spring of the deck planking. The 3in. planks which covered the boiler-room for about 14ft. square abaft the bunker had been lifted bodily, turned over, and deposited on the deck. The deck was raised more than 1ft. above the steel bulkhead, allowing the fire to get into the tank-room and to seize upon the wooden bulkhead. The contortions of the iron bulkhead were very severe, and the effects of the whole experiment are most interesting, as being the first of real importance in this direction. The inference from the result would appear to be entirely against the theory of the ignition of the Doterel's magazine by a gas explosion in the coal bunkers.—*Standard.*

THE NIEDERBAUM SWING BRIDGE, HAMBURG.

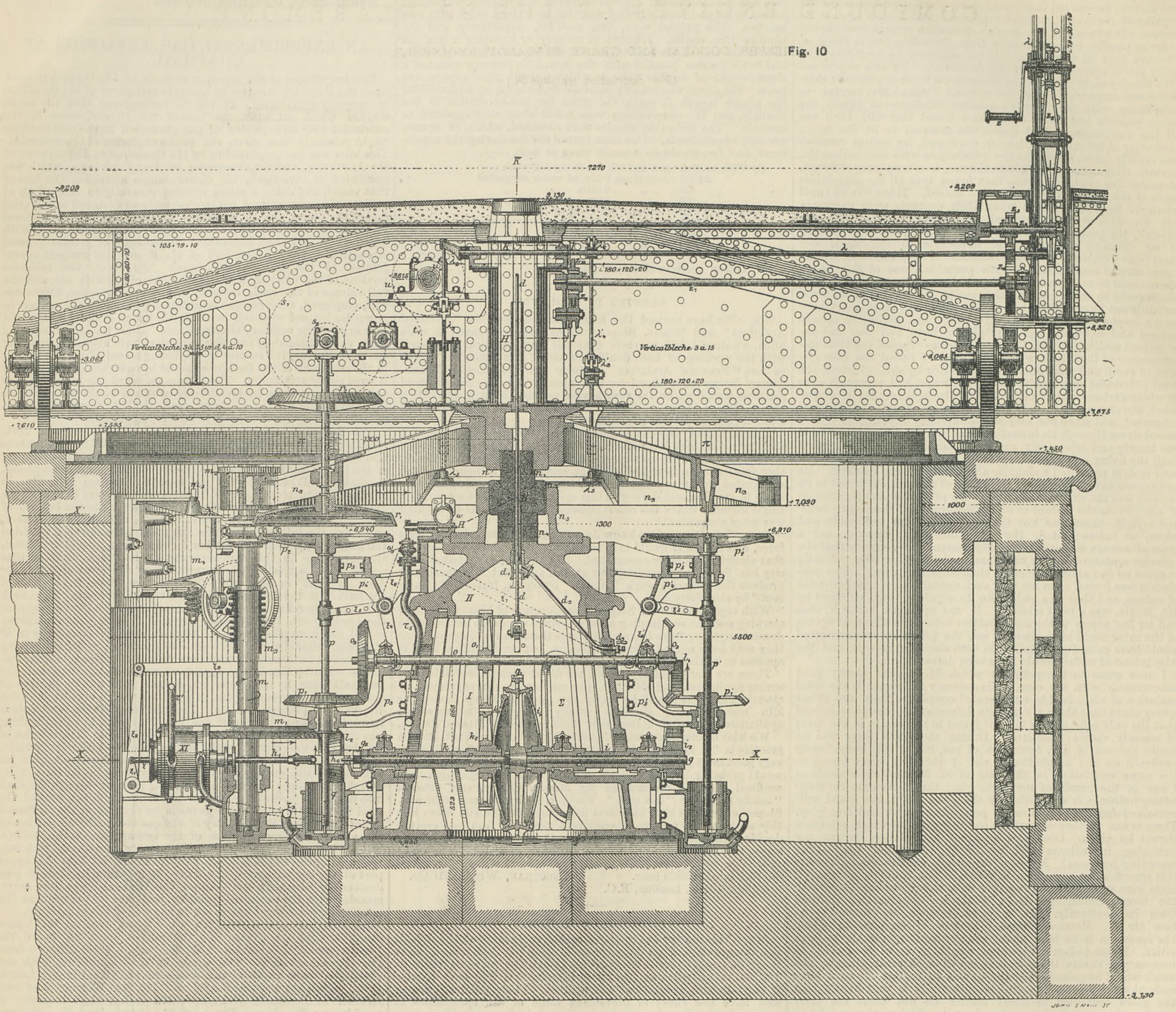


Fig. 10

THE NIEDERBAUM SWING BRIDGE.

No. II.

We now proceed to a description of the mechanism in the case of this bridge, of which a general description and drawings have already appeared in our issues of June 23rd and July 21st. In the details we have only fully illustrated those of special interest. In a succeeding impression we shall give additional illustrations.

The motors for turning the bridge are two water pressure engines (II. and III., Fig. 9), which take their water originally from the main A, shown in Fig. 2. This main is connected with C, which is led along the brackets of the footway to the pier F, and then dips under the harbour to join the pipe VII. (Figs. 8 and 9) in the central pier. Through the air vessel V. it passes to the valve chamber IV. (Fig. 8), which is a cylinder containing a piston worked by a piston rod *b*, and having inlet and outlet pipes at either end. The piston rod is connected by levers to the upright shaft *d*, which passes through the pivot *n*, and its step n_2, and is worked by the lever *e* and handle *f* at the top. To prevent shocks a dash-pot A is provided at the other end of the cylinder. From this cylinder the water passes, as required, to the motors II. and III. These are of the type made by A. Schmid, of Zurich, and have 160mm. diameter, 200mm. stroke; they are intended to run at 90 revolutions per minute. They are coupled at right angles to the shaft *a*, Figs. 8 and 9, and can be reversed like a locomotive, so as to turn it in either direction. This is effected by an arrangement in the valve gear, which, on altering the position of the central shaft *d*, changes the inlet to the outlet and *vice versâ*. The exhaust water from the motors passes back again through the valve and thence by the pipe VIII. into the Elbe. The turning of the bridge to the right is effected by lowering the central shaft *d*, and that to the left by raising it.

On the first motion shaft *a* (Fig. 8) is fixed a wheel a_1, gearing into the bevel wheel g_1 on the shaft *g*. This shaft traverses the conical pedestal I., on which rests the cap II., carrying the step n_2 of the bridge pivot n_1. At its further end the shaft *g* is connected by the piston rod h_1 (Fig. 10) to a horizontal hydraulic cylinder XI., by which the shaft can be traversed endways about ⅘in. without putting the wheels g_1 and a_1 out of gear. On either side of the wheel g_1 are two hollow sleeves *i* and *k*, fixed longitudinally, and carrying friction cones i_1 and k_1, which can bear against corresponding cones fixed on each side of the wheel g_1. If the shaft *g* is pushed to the right, so as to bring the cone i_1 into action, the sleeve *i* is made to rotate; if to the left, the sleeve *k*. Now on *k* is fixed the spur wheel k_2, which gears with the wheel o_1 on the shaft *o*. This shaft carries at its ends bevel wheels o_2 and o_3, which gear with wheels p'_1 and p'_1 on the vertical shafts *p* and p^1. The bosses of these wheels are held fast in the brackets p_3 and p'_3, but the shafts, which are driven by means of feathers, are capable of vertical movement. This movement is given them, to a distance of about 4in., by admitting or withdrawing pressure water under the pistons *q* and q^1. On their upper ends are friction wheels p_2 and $p_2{}^1$. One or other of these, when raised according to the position of the bridge, gears with the friction wheel r_1, while the other merely bears against a point for the sake of balance, but turns idle. The hydraulic cylinder XI. is worked through an independent lever λ (Fig. 8) which opens or shuts communication with the air vessel V. By a special arrangement this lever can only be made to manipulate the valve when the bridge is in one or other of its positions of rest. There are two attendants, one of whom works the lever λ, and the other the lever *f* of the hydraulic cylinders.

The operations of opening are as follows:—The first thing to be done is to lift simultaneously the ends of the main girders by means of the counterweights shown at *v* (Fig. 7), and acting through a system of levers. The "pendulum bearing," δ_2, which enables the bridge to contract and expand freely with temperature, can then be swung out of the way by the lever β_2; and the bridge end is then made to rise about ¾in., which makes it free to turn. The power for these operations is thus obtained:—The shaft *r* (Fig. 10), which is put in motion by means of the friction wheel *r*, as already described, actuates through the train of wheels, r_2, s_2, t_1, and u_1, the shaft *u*. This shaft is hollowed and screwed internally at each end, the thread at one end being right and the other left-handed. Into each end is inserted a screwed rod, which is attached to a forked key, allowing it to move endways but not to turn. These rods, in moving, actuate through the rod u_3 the shaft w_1 (Fig. 11), and this, through another series of cranks and levers not shown, moves the counterweight lever v_1, and so works the series of levers v_2, v_3, and v_4, which actually raise the end of the girder. In the section Fig. 11 the block v_5 is shown down upon the fixed pedestal XIII., and the pendulum bearing δ is also in place. The effect of the lever action is to force the block v_5 further out from below its guide XIV., thus raising the end of the girder, and freeing the pendulum bearing δ. The swinging of this pendulum bearing out of its place is accomplished by the bridgeman from the centre of the bridge by the crank traveller *z*, worked from the footpath (Fig. 10). This handle, by means of a train of wheels z_1 to z_6, turns the shaft z_7. On the other end of this shaft is a pinion z_8, which gears above and below into two racks z_9 and z_{10}. These racks belong to rods running along the bridge, and by turning the shaft z_7 one way or the other the bolt *y* (Fig. 7) fastening the bridge end is shot or withdrawn as required, and the pendulum bearing is afterwards swung into or out of place respectively by means of the system of levers β_2 (Fig. 8).

In order to bring the bridge easily to rest, a buffer arrangement *x*, Fig. 5, with counterweight x_1, is fixed at the jib end of the bridge and at its axis. When the bridge is to be turned, this buffer frame is lifted by the counterweighted bar x_1, so as to pass clear of the buffer guide rails x_2. As the bridge comes round to its place of rest, the frame being lowered strikes against the end of the rails x_2, and then drops into the recess x_3, the force of the shock being taken up by the buffer springs x_4. The bridge is now in its closed position, and the bolt *y* (Fig. 7) can be shot into a socket prepared for it and fixed to the pier. It is then possible to swing into place the pendulum bearing, which is provided with a counterweight slightly in excess to keep it raised till required.

The following is a sketch of the succession of operations in opening the bridge:—The two bridgemen, after ringing a bell, and lowering the bar E (Fig. 1) to stop traffic, proceed to the middle of the bridge. One of them inserts his lever *f* (Fig. 8) in the socket *e*, the other grasps the handle *z* to release the bolt. The first, acting by his lever *f* on the shaft *p*, and thence through the wheel *r* on the shaft *w* (Fig. 7), lifts the end of the girders. The second releases the bolt and swings away the pendulum bearing. The first lifts the end still further, and until it can swing clear. The second now takes the other lever λ (Fig. 8), puts the friction wheel g_1 into gear with i_1—for opening the bridge—and depresses the upright shaft *p*. The bridge is now free to move. The motors are started and turn the hollow shaft *i*, Fig. 10, through the friction wheel i_1. On the outer end of this shaft is the wheel i_2, which, through a train of wheels, actuates the shaft *m* (Fig. 8), and the wheel m_2 on this shaft gears into the large wheel n_3, fixed to the underside of the main girders, and so turns the bridge. As the motors are made to revolve one way or other, so the bridge turns to the right or left. When it has moved through 180 deg. and has stopped, the motors are placed by the valve gear in the middle position, and the bolt *y* (Fig. 7) is run into its socket by means of the handle *z*, thus precisely fixing the position of the bridge, which has already been fixed approximately by the buffer gear; and the pendulum bearings are then swung down against their bearings. The second bridgeman then adjusts the motors for lifting the ends of the girders, and the first then lifts them, by manipulating the lever until they are at their highest point. The pendulum bearing can now be swung fairly into place, and the ends of the girders are then lowered, so that the bridge rests on its bearing. The bridgeman then puts in a catch to hold the levers in their mid-position, takes away the lever *f* and handle *z*, and returns to the ends of the bridge to throw up the bar E, and admit the traffic.

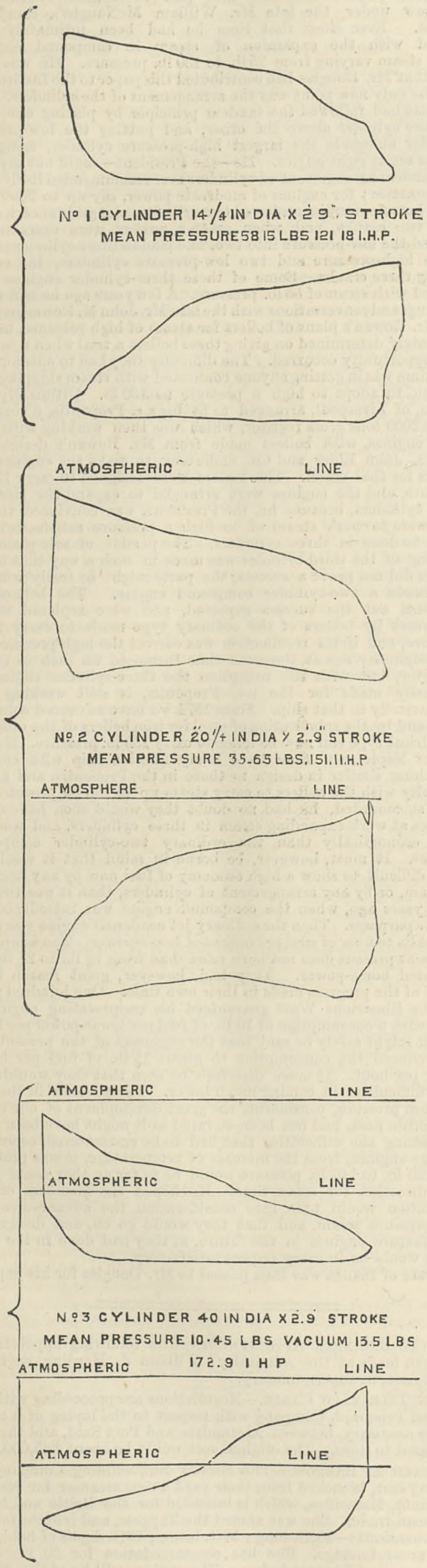
The working of the bridge by hand is arranged either for two men or four. The setting up gear for the end girders is counterweighted, and as this is connected with the rest, the power required is so small as to enable the same mechanism to be applicable for hand or hydraulic power. The hand gear for setting up—which is not shown in the drawings—is worked by handspikes turning

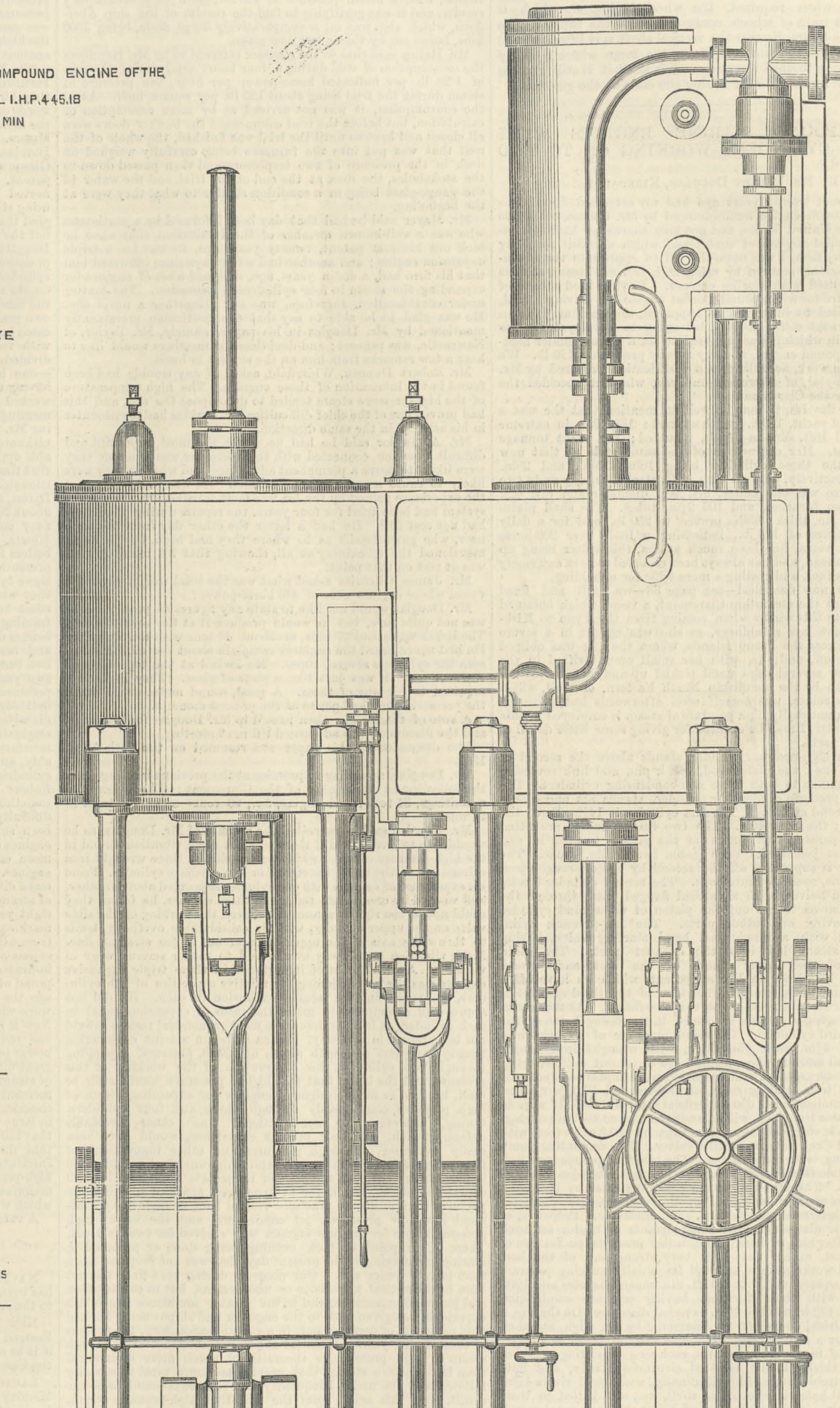
COMPOUND ENGINES OF THE S.S. CLAREMONT.

MESSRS. DOUGLAS AND GRANT, KIRCALDY, ENGINEERS.

(*For description see page 84.*)

DIAGRAMS TAKEN FROM 3 CYLINDER COMPOUND ENGINE OF THE S S "CLAREMONT" TOTAL I.H.P. 445.18 79 REVOLUTIONS PER MIN





a vertical shaft placed at the middle of the bridge, near the lever f, Fig. 8. By shifting one of the intermediate shafts the working arrangements of the bridge are put out of gear with the motors and into gear with this hand-shaft. Two powers are provided to suit two or four men. For swinging, however, since the workmen must themselves stand on the moving bridge, a different arrangement was necessary. A toothed ring π, Fig. 8 and Fig. 9, was fixed all round the circuit of the central pier, and into this gears, when required, the wheel b_1, Fig. 8, which is actuated by a train of wheels connected with the capstan. To disengage the hydraulic gear the vertical shaft m is lifted (Fig. 8) so as to disengage the pinion m_2 from the large wheel n_3. By means of a long toothed sleeve upon this shaft it is still kept in gear with the mechanism for raising the ends of the girders.

ON COMPOUND MARINE ENGINES WITH THREE CYLINDERS WORKING ON TO TWO CRANKS.*

By Mr. Robert Douglas, Kirkcaldy.

Having about twenty years ago had my attention directed to the type of steam engine manufactured by Mr. Corliss, of Rhode Island, in the United States, and not long thereafter having commenced to build engines of that class, which are still regularly supplied by my firm, I was naturally led to appreciate the advantages and economy secured by using high-pressure steam, such as is generally used with Corliss engines. Having used steam of 160 lb. pressure for a compound Corliss engine for driving a mill, we were applied to in regard to supplying the machinery for an iron steam yacht called the Isa, belonging to the Royal Thames Yacht Club, in which it was proposed to fix a three-cylinder high-pressure compound engine, to carry a daily pressure of 120 lb. We undertook the work, according to a specification prepared by Mr. Alexander Taylor, of Newcastle-on-Tyne, who also specified the machinery for the Claremont.

Regarding the Isa, it may be well to mention that she was a double-masted yacht, 118ft. length of keel; 18ft. 9in. in extreme breadth; and 10ft. 5in. in depth, moulded; her yacht tonnage being 248 tons. Her engine was of the same style as that now illustrated, the three cylinders being 10in., 15in., and 28in. diameter respectively, and all with a 2ft. stroke, driving on to two cranks. There was one boiler, 8ft. 9in. diameter and 8ft. 6in. long, with two furnaces, and 106 2⅜in. tubes. The shell plates were of iron, 1in. thick; boiler proved to 250 lb., and for a daily working pressure of 120 lb., indicating a little over 200-horse power. This vessel has been much at sea, this winter being up the Mediterranean, and has always been reported to us as extremely economical in fuel, and costing a mere trifle for upholding.

The engine now described—see page 83—we built and fixed lately on board the steamship Claremont, a vessel which obtained some notoriety this winter when coming from the Tyne to Kirkcaldy to receive her machinery, as she was caught in a severe westerly gale near the Farne Islands, where the tug was obliged to throw her off, and she, with her small crew, drifted in the North Sea for several days until picked up and towed into the Firth of Forth by the steamship North Eastern, of Hull, which vessel, sad to relate, was herself soon afterwards lost, with all hands. As an unusually high pressure of steam is employed in this engine and boiler, I may be excused for giving some little detail of the principal parts.

The first, or high-pressure cylinder, stands above the second or intermediate one; the piston rod, crank pin, and link reversing gear being common to both these non-condensing cylinders. The third, or low-pressure condensing cylinder, stands aft and alongside of the second cylinder. The first cylinder is 14½in. bore; the second 20½in.; the third 40in. The two first cylinders are fitted with hard, separately cast, liners for the pistons to work in, and they are steam jacketted. Each piston has a 33in. stroke. The first cylinder is supported off the second by three wrought iron turned columns, socketted into both. The second cylinder has its cover made in halves, with a vertical flanged joint, through the stuffing box, so as to get out the piston of the second cylinder without removing any other parts. The low-pressure cylinder is fitted with a gun metal hand starting valve, having the escape steam led into the exhaust port. The slide valves are of cast iron; those of the first and second cylinders are balanced, on Dawes' patent, which we have often used, and found satisfactory. The valve of the third cylinder is two ported for steam and single ported for exhaust. As the cranks are at right angles, a receiver is formed in the casing between the second and third cylinders. The steam pipes are of wrought iron welded tube, 4½in. bore, ⅜in. thick, with wrought iron flanges screwed on and brazed. The pistons are cored out hollow, being stiffened by internal ribs, and are fitted with improved steel coils inside of cast iron packing rings, on Mather and Platt's system. The surface condenser has 650 superficial feet of tubes, 17 w.g. in brass tube plates 1in. thick, with glands screwed on cotton packing. The air pump is single acting, with a capacity of 1⅞ cubic feet, with Kinghorn and Coe's patent metallic valves. The circulating pump is double acting, with same valves. The two feed pumps have ball valves. Crankshaft is reversible; has four bearings, each 8¾in. diameter by 13in. long. The crank pins are 8¾in. diameter by 9in. long. The cranks are at right angles. Propeller shaft is 8¾in. diameter throughout; intermediate shafting, 7⅞in. diameter. Propeller, of cast iron, 12ft. diameter; 14ft. pitch; points of blades set back 6in. behind after end of boss. The boiler presents no feature of special interest, except that it is very strong and of the best materials and workmanship, adapted for a daily working pressure of 150 lb. per square inch. It is 11ft. 8in. mean diameter and 10ft. long, with three furnaces having separate combustion chambers and 182 iron tubes 3½in. external diameter. On the top, a vertical cylindrical dome, 3ft. 9in. diameter by 4ft. high, attached to the boiler by a strong neck ring. The shell of boiler is formed of two rings of Siemens steel plates, each ring consisting of three plates 1⅛in. thick, double rivetted circumferentially, and butt strapped and treble rivetted longitudinally, with steel rivets 1⅛in. diameter. All holes in the boiler shell, &c., are drilled in their place. All below in the centre line of boiler shell are countersunk outside and in. The boiler was tested with cold water to 300 lb., and with steam raised by its own furnaces to blow off at 185 lb. The heating surface is about 1300ft., being under 3ft. per indicated horse-power. The boiler is covered with silicate cotton and galvanised sheet iron. The ship is 180ft. in length, 29ft. breadth, and 13ft. depth of hold, carrying 500 tons of coal. Registered, gross 672 tons, net 431 tons, and 90 nominal horse-power. On a trial trip, when loaded, the Claremont made a mean speed of 9½ knots, the engine making 79 revolutions, indicating 446-horse power. Steam easily kept up. The consumption of Newcastle coal approximately computed at 1·3 per horse-power per hour. The owners, Messrs. Fisher, Renwick, and Co., of Newcastle-on-Tyne, have every confidence that this style of engine will be a commercial success, and before we had the Claremont's machinery fixed on board, gave us an order for another engine and boiler the same. The diagrams—see page 83—are reduced from those taken from the engine, on the loaded trial trip, by Richard's indicator. No. 1 cylinder: Diagram to one-sixteenth scale; valve set to cut off at three-fourths stroke. The initial pressure in cylinder is about 4 lb. under the pressure in boiler. Mean pressure in this cylinder, 58·15; horse-power, 121·18. No. 2 cylinder: Diagram to one-eighth scale; valve cutting off at three-fourths stroke. Initial pressure, 62 lb. Mean pressure in this cylinder, 35·65, giving 151·1-horse power. No. 3 cylinder: Diagram to one-fourth scale; valve cutting off at about one-half stroke. Initial pressure above atmosphere, 11 lb. Mean pressure, 10·45, giving 172·9 Total horse-power, 446·8.

In the after discussion, Mr. Mansel said that in the paper just read they had a description of a well-devised piece of mechanism, to carry out in the best practical shape the correct principles of thermodynamics as applied to steam.

Mr. James Hamilton, jun., said that as he had referred to this principle, although in a different connection, he might be allowed to say that these engines were now working satisfactorily, and that the consumption had been as low as 1·3 lb. This three-cylinder engine, with a steam pressure of 125 lb., gave very satisfactory results, and it was gratifying to find the results of the ship Aberdeen, which ship was on a comparatively large scale, being 3800 tons, borne out by the figures now given.

Mr. Halley said that in the steamer referred to by Mr. Hamilton the consumption of coal during a four hours' trial was at the rate of 1·28 lb. per indicated horse-power per hour, the pressure of steam during the trial being about 125 lb. per square inch. As to the consumption, it was not arrived at by mere assumption or calculation, but before the trial commenced the bunker doors were all closed and kept so until the trial was finished, the whole of the coal that was put into the furnaces being carefully weighed on deck in the presence of two inspectors and then passed down to the stokeholes, the fires at the end of the trial and the water in the gauge-glass being in a condition similar to what they were at the beginning,

Mr. Mayer said he had that day been informed by a gentleman who was a well-known member of the Institution, that when he took out his first patent, twenty years ago, it was for a triple expansion engine; and another had a few days since informed him that his firm had, a dozen years ago, designed a set of engines for expanding the steam in four cylinders in succession. The matter under consideration, therefore, was not altogether a novel one. He was glad to be able to say that the gentleman prominently mentioned by Mr. Douglas in his paper, namely, Mr. Taylor, of Newcastle, was present; and doubtless the members would like to hear a few remarks from him on the subject in hand.

Mr. Robert Duncan, Whitefield, asked if any trouble had been found in the lubrication of these engines. The high temperature of the high-pressure steam tended to decompose the oils, and this had proved one of the chief difficulties Mr. Perkins had to encounter in his attempt in the same direction.

Mr. A. Taylor said he had no doubt the most important and difficult question connected with these engines was whether they were likely to prove a permanent advantage, and whether they were likely to cause a great deal of repairs. He was glad to say that the experience gained by the Isa was most satisfactory. When the system had been tried for four years, the repairs during that time had not cost £10. He had a letter the other day from the engineer, who gave details as to where they had been, but he never mentioned the machinery at all, showing that his mind at least was at rest on that point.

Mr. James Gilchrist asked what was the total weight aboard a vessel whose engines were of 446 horse-power?

Mr. Douglas would not like to state any figures at present as he was not quite sure, but he would produce it at the next meeting. The boiler was about 27 tons, or about 40 tons with the water in. He had never heard the engineer complain about the oil. He had seen the cylinders several times. He looked at the top one, and observed that it was just like a piece of glass. They had never required to file any of them. A good, sound metal would stand the pressures they had got to at the present moment.

A vote of thanks was then passed to Mr. Douglas for his paper, and the discussion was adjourned till next meeting.

The discussion of this paper was resumed on the 25th April, 1882.

Mr. Douglas, according to promise at the previous meeting, gave the following as the weights of the Claremont:—The boiler and mountings, 31 tons; and engine, &c., 60 tons—making a total of 91 tons.

Mr. Howden said he regretted the absence of Mr. Douglas, as he would like to have asked if there was not some vibration found in the high-pressure cylinder which was carried by three wrought iron columns from the top of the second or intermediate cylinder. From his experience of engines with one cylinder supported above another, and worked by one piston rod, as in these engines, he found they could not be too rigidly connected. Even the working of the slide valve on the upper cylinder, with its considerable overhang, tends to throw the axis of the upper cylinder out of the straight line. Much vibration in this way would lead to rather serious wear in working. Another point of importance in these triple expansive engines was the proportioning the relative capacities of the cylinders, and regulating the rates of expansion in each. He did not approve of attempting to make the ratio of expansion equal in each cylinder, as he considered the most economical results would not be obtained in this way. When he began marine engineering twenty-two years ago, with steam of 100 lb. pressure, expanding through two cylinders, his observation of the working of this pressure, and the belief that still higher pressures would soon be used, led him to make designs of engines for expanding steam of high pressure continuously through three and four cylinders. Owing, however, to constructional and other avoidable defects, which, with our present experience, would have been easily overcome, the high pressures and other innovations of these days fell into disfavour, and shipowners who had been induced to try them, in the hope of immediate success—which all experience shows, has never at once been attained in great departures from ordinary practice—rushed back in their disappointment into low pressures, jet condensers, and the use of high pressure steam for marine engines was shelved for twenty years. There is, in point of fact, nothing being done or proposed in marine engineering at the present day that was not proposed more than twenty years ago. Our progress during that time has not been in theoretical knowledge or new designs, but in construction and practical experience, and in the greater confidence which this experience has given both to the engineer and shipowner. He had now prospects of carrying out, in a good practical way, the designs of these earlier years. It should not be supposed, however, though steam of high pressure is theoretically much more economical than low-pressure steam, that greater economy must necessarily follow from its use. Frequently the reverse is found to be the result, and this arises from the fact that high-pressure steam, or rather its contained heat, can be wasted much more easily than the heat of the low-pressure steam. It is an instructive fact that the most economical result in actual propelling at sea which his firm has probably, yet attained, has been got recently from a steamer with a maximum steam pressure of 75 lb. in her boilers. It would bring the case more intelligibly home to those who may compare the performance in carrying with that of other steamers if he stated the particulars. The steamer is 270ft. in length, 33ft. 6in. in breadth, and carries 1850 tons dead weight on 17ft. draught. At an average speed of 9½ knots per hour, the consumption of coal over two voyages to the West Indies and back has been 9½ tons per twenty-four hours. At the same time greater economy should be obtained from steam of a high pressure, if properly used, and if pressures considerably above 100 lb. are used, this steam will, in large engines at least, be most judiciously expanded through more than two cylinders, as has been done in the engines which Mr. Douglas has brought before the Institution.

Mr. Moore remarked that the pressure in Cornish engines varied from 35 lb. to 45 lb., and the expansion was all made in one cylinder. It is recorded that the pumping engine at Fowey Consols mine in 1834 raised 122 million pounds 1ft. high by the consumption of 94 lb. of coal, or 1·48 lb. of coal per horse-power per hour. Of course the Cornish engine lifts a dead weight which is the most favourable for economical working. He did not mean to say that higher pressures would not lead to greater economy, but merely to note what had been done with comparatively low pressures and single cylinders. (See "Coal and Coal Mining," page 187.)

Mr. H. R. Robson was of opinion that the adoption of an increased pressure of steam would effect a further saving of fuel. For much higher pressures than at present in use some such method of expanding the steam in several cylinders as that brought before them by Mr. Douglas would be necessary in order to avoid shocks on the shafting, rods, &c., and although the present type of two-cylinder engine was well adapted for such pressures as at present generally used, much increase in pressure would, in his opinion, necessitate intermediate cylinders.

Mr. D. Halley said, with regard to a remark made by Mr. Robson, that it did not necessarily follow that steam of 125 lb. pressure would give better economical results than steam of 75 lb. pressure. It might even give worse results, provided the steam was used injudiciously, but better economy could be obtained with the higher pressure, by properly taking advantage of the greater amount of expansion that could be got out of it.

The President said, perhaps there was not any member of the Institution that had a longer connection with the compound engine than himself, and he asked their consideration whilst he said a few words on the subject. In 1847 he was placed in charge of erecting the alterations made on the engines driving the cotton mills of Messrs. Johnstone and Galbraith, near the canal basin, Port Dundas. These were the first pair of engines worked in Glasgow under the late Mr. William McNaught's compound patent. Ever since that time he had been intimately connected with the expansion of steam in compound engines, using steam varying from 25 lb. to 130 lb. pressure. He was very glad that Mr. Douglas had contributed this paper to the Institution, but the only new point was the arrangement of the cylinders. Mr. Douglas had followed the tandem principle by placing one high-pressure cylinder above the other, and putting the low-pressure cylinder alongside the largest high-pressure cylinder, using two cranks set at right angles. He—the President—could not say that the tandem arrangement of cylinders ever recommended itself to his own practice; for engines of moderate power, say up to 3000 indicated horse-power, he preferred two cylinders alongside of each other with two cranks, and when greater powers were necessary he divided the low-pressure into two, and made a three-cylinder engine—one high-pressure and two low-pressure cylinders, the engine having three cranks. Some of these three-cylinder engines were worked with steam of 85 lb. pressure. A few years ago he had many meetings and conversations with the late Mr. John M. Rowan, regarding Mr. Rowan's plans of boilers for steam of high pressure, and he ultimately determined on giving these boilers a trial when a favourable opportunity occurred. The difficulty they had to encounter at that time was in getting anyone connected with steam shipping bold enough to adopt so high a pressure as 130 lb. Ultimately Mr. Dixon, of Liverpool, arranged to fit his s.s. Propontis, a vessel of about 2000 tons gross register, which was then working with ordinary engines, with boilers made from Mr. Rowan's design, and Messrs. John Elder and Co. undertook to make the engines and boilers for that vessel. The boilers were designed to carry 130 lb. pressure, and the engines were arranged to expand the steam in three cylinders, because he, the President, was convinced that if they were to work steam of so high a pressure satisfactorily, it must be done in three cylinders. The portion of sole plate and framing of the third cylinder was made in such a way that if the boilers did not prove a success, the parts might be easily removed and made a two-cylinder compound engine. The boilers did not turn out the success expected, and were replaced within two years by boilers of the ordinary type made to carry 90 lb. pressure, and if his recollection was correct the high-pressure—or first—cylinder was at the same time increased an inch or two in diameter, but with this exception the three-cylinder engine, as originally made for the s.s. Propontis, is still working very satisfactorily in that ship. Since 1874 we have advanced considerably, and by the substitution of steel for iron boilers of the ordinary cylindrical type can now be made to carry 150 lb. pressure. Messrs. Robert Napier and Sons have lately fitted a ship with engines something similar in design to those in the Propontis, and as the difficulty with the boilers to carry steam up to 130 lb. pressure has been surmounted, he had no doubt they would soon have many engines at work expanding steam in three cylinders, and working more economically than the ordinary two-cylinder compound engines. It must, however, be borne in mind that it would be more difficult to show a high economy of fuel now by any pressure of steam, or by any arrangement of cylinders, than it was twenty-eight years ago, when the compound engine was introduced for marine purposes. Then the ordinary jet condenser engine was using from 4 lb. to 6 lb. of coal per indicated horse-power. The compound engine at present does not burn more than from 1¾ lb. to 2¼ lb. per indicated horse-power. They had, however, great reason to be proud of the progress made in their own time. One hundred years ago the illustrious Watt guaranteed his reciprocating engine to work with a consumption of 10 lb. of fuel per horse-power per hour. Now it might safely be said that the engineers of the present day had reduced the consumption to about 1½ lb. of fuel per horse-power per hour. It must therefore be seen that they would have great difficulties in coming much lower. The advance in the way of steam pressure, considering the great development of our steam mercantile fleet, had not been so rapid as it might have been; but considering the difficulties that had to be encountered, especially in large engines, from the increase of temperature, it was probable that 130 lb. to 140 lb. pressure would be as far as they could go in that direction for some time. He hoped the members of the Institution would take into consideration the advancement of high-pressure steam, and that they would go on, and design and manufacture engines in the future, as they had done in the past, which would be in every respect satisfactory.

A vote of thanks was then passed to Mr. Douglas for his paper.

* Read before the Institution of Engineers and Shipbuilders in Scotland, 21st March, 1882.

Naval Engineer Appointment.—The following appointment has been made at the Admiralty: William J. Harding, engineer, to the Asia, as supernumerary.

New Telegraph Cable.—Negotiations are proceeding with the Eastern Telegraph Company with respect to the laying of a cable, if it be necessary, between Alexandria and Port Said, and through the Canal to Suez. The original cost would be about £45,000.

Launch at Barrow.—The Barrow Shipbuilding Company, on Monday last, launched from their yard a new steamer for Messrs. Fraissinet, Marseilles, which is intended for the Baltic and Mediterranean trade. She was named the Taygete, and is of the following dimensions:—260ft. long; 37ft. beam; 23ft. depth of hold, and 1850 gross tonnage. She has accommodation for 20 first-class passengers and 24 second-class. The engines will be of the direct-acting surface condensing type, of adequate power to obtain 12 knots per hour.

Co-operative Building Contracts.—A scheme has been presented by M. Floquet, the Prefect of the Seine, under which associations of workmen will be admitted to compete for public works in Paris. The workmen's delegates have maintained that if the Administration would consent to make regular fortnightly or monthly payments on account, they would undertake to leave as a guarantee until completion a deposit of from 20 to 30 per cent. on each of these payments. The Administration has agreed to this arrangement, but stipulated—(1) The creation of a special fund in aid of those of the associated workmen who may fall ill or be wounded in the execution of the work, and for the widows and children of the deceased partners; (2) the establishment of an arbitration board of three members to regulate disputes between the men, without prejudice to the authority conferred by the regulations upon the official architects and engineers; (3) the nomination of one or more syndics, furnished with full legal powers to act on behalf of the association and with certificates of capacity and good conduct; these syndics will draw up the tenders, and, in case of their being accepted, will superintend their execution as clerks of the works, under the supervision of the architects and engineers. The *Architect* thinks it is probable that M. Floquet's scheme will be almost unanimously approved by the Council.

RAILWAY MATTERS.

A PETITION has been presented to the Queensland Government praying for immediate extension of the Central Railway, which at present has its terminus at Bogantungan—227 miles from Rockhampton.

THOSE who have not visited Fenchurch-street Station lately will be surprised to find that it is not only being completely renovated, but that under the Great Eastern Company great improvements are being made in the station and platform accommodation.

THE Cleveland extension Mineral Railway is now being completed. The line is eleven miles in length, and starts near Lofthouse, on the Cleveland branch of the North-Eastern Railway, runs nearly straight south to Glaisdale, where it joins the North Yorkshire and Cleveland branch of the same railway. Mr. John Waddell, of Edinburgh, is the contractor.

IN the report on the collision which occurred on the 31st March last, at St. Austell station, on the Cornwall Railway, when the 10 a.m. up passenger train from Penzance ran into the down loop line at St. Austell station, and there came into collision with two trucks which were being loaded with fish, Major-General Hutchinson says: "This collision would probably have been avoided had the passenger train been fitted with continuous brakes."

WE regret to have to record the death of Mr. John Stirling, chairman of the North British Railway Company. His first connection with railway work was in the promotion of the Dunblane, Doune, and Callander line, completed in 1858. Since that date he has occupied a prominent place in Scotch railway matters. In 1866 he became chairman of the North British, got it out of its difficulties, and remained chairman since. He will be succeeded by his son, Mr. Patrick Stirling.

THE North Staffordshire Railway Company have made a profit on last half-year's working of £174,490 against £98,784 in the corresponding period of the year previous. The dividend proposed on the ordinary stock is at the rate of $2\frac{3}{4}$ per cent. per annum, leaving £2678 to be carried forward. The half-year's expenditure on capital account was only £4000, and it estimates that during the current half-year, chiefly for new works and working stock, £8200 will be required; and subsequently an additional £11,800.

A ST. GOTHARD train was recently, it is reported, saved from what might have been a serious disaster by an act of rare courage and devotion on the part of a workman. As the noise of the train was heard in the distance, a large stone fell from the rocks above, at the outlet of the Polmengo Tunnel. A way guard who was on the spot succeeded, by a great effort, in pushing the obstacle aside, but only at the sacrifice of his life, for at the same instant the train came up, and before he could get out of the way he was caught by the locomotive and cut to pieces. If this is true that man's memory ought to be treated as that of a hero.

AT the meeting of the Leicester Tramways Company yesterday it was announced that the total receipts from all sources amounted for the half-year—including the sum of £335 12s. 4d. brought forward—to £10,858 6s., and the expenses to £7134 18s., leaving a balance of £3723 8s. for disposal, with which the directors recommend a dividend of £10 per cent. per annum for the past half-year, leaving a balance of £359 6s. 6d. Out of this balance the directors propose to add £300 to the Contingency Fund, and to carry forward £59 6s. 6d. to the next account. The company now owns 139 horses and 34 cars. Allowing three horses for working the omnibus and wagonette owned by the company, this is only four horses per car, even supposing all at work.

WE observe that a tramway has been authorised and is about to be constructed up Highgate Hill on Hallidie's cable system, from the Archway Tavern to a point near the historic Highgate "Gatehouse." This system was fully illustrated by us as carried out at San Francisco, in our impression of the 10th October, 1879, and it has there been so successfully at work for eight years that it has been adopted in a number of places, including Philadelphia. The cost of haulage is very small compared with horse traction, and is much smaller than any other extensively employed system, as might be expected from experience with rope haulage in mines. The company, which has acquired the Hallidie patents for Europe, and by whom the tramway above mentioned is about to be constructed, have retained Mr. Joseph Kincaid and Mr. James Cleminson, MM.I.C.E., as consulting engineers, a sufficient guarantee that the system will not lack practical experience and ability to make it as great a success as it has become on all hands in the United States.

THE earnings of all the railways in operation in the United States in 1881 equalled 725,325,119 dols., being an increase over the previous year of 110,000,000 dols.—the rate of increase being very nearly 16 per cent. The earnings equalled 13·60 dols. per head of our population. Their net earnings were 276,654,119 dols., an increase of 21,500,000 dols. over those for 1880. Their current expenses were 449,565,071 dols. The amount of interest paid during the year on their funded debts was 128,887,002 dols.; the amount paid in dividends was 93,344,200 dols., against 77,115,411 dols. for 1880. The cost of working these roads for the year was 449,565,071 dols., or 65 per cent. of their gross earnings. The total amount expended in the construction of new lines and in operating and improving the old ones was over 750,000,000 dols.—the greater part of this sum being paid in wages. The number of persons employed in operating them averaged fully 12 to the mile of operated line, 1,200,000 in all. The number employed in the construction of railroads equalled 400,000.

A MEETING of the shareholders of the Epping Forest Tramways took place on Tuesday, August 1st, at the offices of the company, the chairman, Mr. Mark Shephard, presiding. There was a large attendance. Mr. C. B. King, one of the company's engineers, stated that although the rails had only been delivered a few weeks, about 500 yards of line were already completed, and the first section will be opened for traffic in about three weeks' time. The company intend to apply in the next session of Parliament for power to use steam, and for this purpose the line is very substantially laid. Mr. Hammock, a director, mentioned that at Batley, in Yorkshire, where both steam and horse-power had been in use, it had been proved that a saving of $2\frac{1}{2}$d. per mile had been made by the adoption of the former. The engines were constructed by Merryweather and Sons, the only firm who have had any very great experience in this branch of engineering. Messrs. B. Cooke and Co., of Battersea, are the contractors for the works, and Messrs. Merryweather have the contract for the cars.

THE Downham and Stoke Ferry Railway, which was inspected on the 28th July by General Hutchinson, R.E., and opened for traffic by the Great Eastern Company on the 1st August, is single, and about seven miles long. Commencing by a junction with the Ely and Lynn branch of the Great Eastern system at Denver—a goods siding and former passenger station about two miles south of Downham—it runs in an easterly direction to the town of Stoke Ferry on the river Wissey, with intermediate stations at Riston Hall and (Dereham) Abbey. By skirting the Fenlands of the river Wissey, the line has been made practically level, the steepest gradient being 1 in 200 for a short distance near the commencement. The buildings throughout are built of white brick relieved by red string courses and arches. At Stoke Ferry, where, in order to provide for the future extension of the line it was necessary to place the terminal station on a fen in which the depth of peat varies from 10ft. to 18ft., the whole of the buildings are supported on brick arching resting on a substratum of hard silt below the peat. The line has throughout been laid out with a view to its forming an important link in the future east and west communication through Central Norfolk. The works have been carried out by Mr. J. Waddell, of Edinburgh, who has constructed the Ely and Newmarket and other railways in the eastern counties, under the direction of the engineers, Messrs. W. Shelford, of Westminster, and J. K. Rodwell, of Bury St. Edmunds.

NOTES AND MEMORANDA.

THE earliest suggestion for increasing the sensitiveness of the barometer was made—1668—by Hook, who fixed over the mercury a narrow tube containing spirit, a device every now and then brought out as new.

M. CAILLETET recommends the employment of *vaseline* as a lubricant wherever mercury is present; for, as is known, most oils and fatty matters clog with finely-divided mercury, and are objectionable on this account.

ACCORDING to a paper in the *Comptes Rendus* "On the Coal Basins of Tong-King," by M. Fuchs, the workable coal in this district, at not more than 330ft. below the sea level, is estimated to be over five million tons. There are four different species in distinct groups of beds.

THE number of lives lost on the coasts of the United Kingdom during 1880-1 was 984, which, the *Nautical Magazine* says, is 753 in excess of the number lost in the preceding year, and 387 higher than the average for the four preceding years. As before observed the increase was almost entirely due to the gales of 28th and 29th October, in which considerably over 300 lives were lost on our coasts.

THE following has been given for cleaning dull gold:—A solution of 80 grms. chloride of lime, 80 grms. bicarbonate of soda, and 20 grms. common salt in 3 litres distilled water is prepared and kept in well closed bottles. The article to be cleaned is allowed to remain some short time in this solution—which is only to be heated in the case of very obstinate dirt—then taken out, washed with spirit, and dried in sawdust.

DURING a heavy thunderstorm in the Shetland Islands on the 25th ult., which lasted several hours, a hill, three miles from Lerwick, was struck by lightning, and huge masses of rock and *débris* were thrown down on the public road which the hill overhangs, filling up the road and the valley at the other side, and suspending traffic. The weight of the fallen rock has been estimated at 400 tons. Here is electricity helping geology.

MM. WITZ and Osmond have extracted vanadium from the basic scoriæ of the Creusot Ironworks in industrial quantities. They stated at the Séance of the Académie des Sciences of July 3rd that the Creusot scoriæ contained vanadium which they estimated to be equal to 60,000 kilogs. annually; and that they are able to extract either metavanadate of ammonium or other vanadic products, specially applicable to the manufacture of aniline blacks with chlorides.

AN extensive deposit of bismuth in the form of metal and oxide has been discovered in the north-east of New South Wales. Hitherto the bismuth of commerce has chiefly been derived as a bye product in the treatment of zinc, cobalt, and silver ores, and has commanded a price quite out of proportion to the cost of production. From the new mine, the *Journal* of the Society of Chemical Industry says, the metal can be sent into the market at a cost which, if the present price—6s. 8d. per lb.—were maintained, would insure a profit of more than £500 per ton.

AT a recent meeting of the Paris Academy of Sciences a paper was read "On Various Hydrates Formed by Pressure and Release from Pressure," by MM. Cailletet and Bordet. They compressed phosphuretted hydrogen in presence of water; on sudden release crystals of what is doubtless a hydrate of phosphonium were formed within a tube. The critical point was + 28 deg. Other hydrates were had on treating similarly equal volumes of carbonic acid and phosphuretted hydrogen with water, dry phosphuretted hydrogen, and sulphide of carbon, and ammoniac gas in presence of a saturated solution of that substance—a hydrate of ammonia was formed in the latter case on the admission of some air.

M. CAILLETET has invented a new pump for compressing gases to a high degree of compression. The main point in its construction is the method by which he obviates the existence of useless space between the end of the piston-plunger and the valve, which closes the end of the cylinder. This he accomplishes, *Nature* says, by inverting the cylinder and covering the end of the plunger with a considerable quantity of mercury. This liquid piston can of course adapt itself to all the inequalities of form of the interior space, and sweeps up every portion of the gas, and presses it up a conical passage into the valve. The valve by which the air enters the body of the pump is opened by cam-gearing after the descent of the piston below the point where the air rushes in.

DR. FLEISCHER, of Germany, describes a new system of hydraulic propulsion for ships. He dispenses with a turbine, and allows the steam to act directly upon the water in two large vertical cylinders placed amidships. These two cylinders communicate with the ejecting nozzles, which are situated on either side of the keel. In each cylinder there is a "float" or piston of nearly the same diameter as the cylinder, with a closed spherical top; when this float is in its extreme upper position, the cylinder is full of water. Steam is then admitted into the upper part of the cylinder above the float, the latter is pressed down, and the water is expelled through the nozzle-pipe with great velocity. At a certain portion of the stroke, the admission of steam is shut off automatically, the remainder of the stroke being performed during the expansion of the steam, and the velocity of ejection of the water gradually diminishing. At the conclusion of the stroke, the exhaust-valve from the steam space to the condenser is opened, the steam rushing out, forming a partial vacuum above the float, and the water enters, pressing the float up.

A VALUABLE contribution to the subject of the electricity of flame has been lately made by Herren Elster and Geitel. The discrepancies in previous results are attributed largely to the behaviour of the air layer immediately outside of the flame having been left out of account. The authors used a Thomson quadrant electrometer for measurement. They find the supposed longitudinal polarisation of flame merely apparent, and due to unequal insertion of the wires used as electrodes. On the other hand, flame is strongly polarised in cross section; an electrode in the air about the flame is always positive to one in the flame. The theory the authors adopt is this: By the process of combustion *per se* free electricity is not produced in the flame; but the flame-gases and the air-envelope have the property of exciting, like an electrolyte, metals or liquids in contact with them. To this electrolytic excitation is added a thermo-electric, due to the incandescent state of the electrodes. The amount and nature of the electric excitation is independent of the size of the flame, and dependent on the nature, surfaces condition, and glow of the electrodes, and on the nature, *Nature* says, of the burning gases. It is remarked that flames may be combined in series like galvanic elements, and so as to form a "flame battery."

CHINA grass is generally cultivated a long distance from the market. About a ton of raw, woody material has thus to be transported to produce $1\frac{1}{2}$ cwt. of fibre, and the gum in the grass becomes dried up during transport, making the separation of the fibre from the wood and epidermis difficult and expensive. To cheapen the production of fibre generally a simple and inexpensive process has been devised by M. Favier, and is being introduced in England by Messsrs. Brogden and Co., of 40A, King William-street, London. This process consists in steaming the fibre-producing plants at the place of culture and sending only the epidermis with the fibre attached to it across country to the mills. The apparatus employed consists merely of a stout deal box 8ft. long by 2ft. wide and 20in. deep. This box has a false bottom, under which runs a $\frac{3}{4}$in. iron steam pipe, connected with a boiler and having perforations. At the bottom of the box at one end is an outlet for the condensed steam. Into this box the grass is placed, the lid closed, steam at a low pressure is turned on, and in twenty minutes the fibre is found to be in excellent condition for stripping the epidermis with the fibre from the wood, the gum having been partially dissolved and the samples properly softened. It is stated that the cost of producing the fibre ready for the scutching machine is only £2 per ton.

MISCELLANEA.

PORTABLE engines of 8-horse power can be obtained in New South Wales for £260, but in Victoria, owing to the duty, the *Colonies and India* says, they cost £310 each.

THE *concours régionaux*, or agricultural shows under the auspices of the French Government, are announced to take place next year at Caen, Vannes, Amiens, Blois, Troyes, Bourg, Rochefort, Foix, Aurillac, Mende, Nice, and Digne, at dates to be hereafter determined.

THE July number of *Art and Letters*, conducted by Mr. J. Comyns Carr, and published by Remington and Co., contains, as usual, a selection of good wood engravings. The subjects treated are: "The Embarkation of the Queen of Sheba," "Modern Landscape," "Carle Vernet," "Examples of Old German Metal Work," "Sarah Bernhardt's Paintings and Sculpture," serial story, &c.

THE August number of *Art and Letters*, edited by Mr. J. Comyns Carr, and published by Remington and Co., has some good engravings under the titles, "Milton Dictating Paradise Lost to his Daughter," "Carle Vernet," "Modern Landscape," "The Gate of the Loggretta, Venice," "The Hamilton Palace Sale," "La Fortuna," &c., and the information accompanying these is well written and entertaining.

AN application was made on the 28th July to Mr. Justice Chitty by the Edison Electric Light Company, Limited, in an action brought by the company against the Swan United Electric Light Company, Limited, to restrain that company from supplying incandescent lamps alleged to be infringements of Mr. Edison's patent rights, which have been purchased by the plaintiffs. The motion was directed to stand over until the hearing of the action, the defendants undertaking in the meantime to keep an account.

A simple but very welcome improvement has been carried out by the Manchester Corporation by abolishing the open portable coal fires which have hitherto been used when any pipe connections or other similar work has been carried out in the streets, and substituting in their place a charcoal stove, which is perfectly smokeless, and does not cause the nuisance of the open coal fires. This stove has been introduced by Mr. Bennett, of South Parade, and is a very handy apparatus, suitable for such light work in connecting the smaller main and service pipes.

AT one of seven balloon ascents made in Paris on the 14th ult. one of the balloons exploded at 2000ft., and, *Nature* says, "the aëronauts were precipitated to the ground with terrific velocity, happily without any loss of life or injury in consequence." It appears, however, they were not precipitated to the ground with that velocity, for the same journal continues "they were saved by a miracle, their car having been suspended in a gap between two houses. The catastrophe was produced by their imprudence, having placed their canvas in a net which was not quite large enough."

AT the half-yearly meeting of the Mutual Sick Benefit Society in connection with M. Albert Piat's engine works, Paris, on 23rd ult., M. Piat, who has introduced the system of participation by the workmen in the profits of his establishment, announced that those of the men who had fulfilled the stipulated conditions were credited with $8\frac{1}{2}$ per cent. of their wages. Half of this sum was paid in cash, and the other half was carried to a kind of reserve fund, payable to the men or their heirs. M. Charles Robert pointed out the principles and advantages of this system of participation by the workmen in the profits of the undertaking.

THE litigation between the owners of the s.s. City of Rome, the Inman Company, and the Barrow Shipbuilding Company, her builders, is understood to have been compromised, so that the intended trial at the Liverpool Assizes will not take place. The Inman Company's claim was for £140,000 for various alleged discrepancies between the vessel as finished and the specification under which she was built. It is believed that, as a result of the compromise, the City of Rome will cease to belong to the Inman Company, but will in future form part of the Anchor fleet of Transatlantic vessels trading to Barrow-in-Furness.

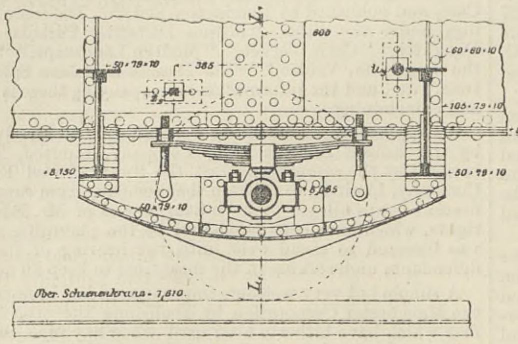
A COMPANY, under the name of the Ascot District Gas Company, has been formed, and proposes to carry out at once the works authorised by the Ascot District Gas Act, which received the Royal Assent on the 24th July last. The area to be supplied is a district with a large growing population. The works have been designed by Messrs. J. Quick and Son, of Westminster, and under a general contract between the company and Mr. R. A. Meyer, of Westminster, are to be carried out by Mr. Alfred Williams, of 64, Bankside, S.E., well known in the gas world. The authorised capital is £60,000, with borrowing powers of £15,000, the first issue of shares being limited to 4000 shares of £10 each. The offices of the company are the same as those of the late Brighton Gas Company, with Mr. Wm. Liddall as secretary.

TAKING the value of the steamships lost in 1881 at £15 per ton, and of the sailing ships £8, the value of the ships totally lost would be—steamships, £1,217,025; sailing ships, £2,136,408; total, £3,353,433, as compared with an estimated value of £2,844,338 for the ships lost in the previous year. Assuming that the vessels which met with serious and unimportant casualties were damaged or depreciated by 25 per cent., the loss to British shipping by casualties not resulting in the total loss of the vessels would be £5,853,862, which added to the value of the vessels totally lost would raise the loss to British shipping by casualty, collision, or shipwreck to £9,207,295. If, says the *Nautical Magazine*, the value of the cargo sacrificed in the vessels totally lost, or damaged in the vessels which met with serious casualties, were added to the above estimate, the amount of the loss sustained by British commerce and shipping by sea casualties would certainly appear enormous.

AN electrical exhibition is to be opened in the Westminster Aquarium on the 1st November, and to remain open until the 1st March, 1883. It is to be strictly an exhibition relating to the development of the practical applications of electricity to useful purposes, and £1000 is to be distributed in prizes, which will be offered for:—(1) Best systems of storage and generator suitable for railway systems; the generator to be worked from an axle in motion on the train. (2) For best systems of storage battery, including (*a*) large size for central depôt work—model, if preferred—and (*b*) small size to drive six Swan or other incandescent lamps, and made self-contained and portable. (3) For the design in models, showing the best method of utilising (*a*) wind, water; (*b*) tidal forces; for the purposes of electrical storage of energy. (4) For best electromotor for stationary work, or for tram-car work; (*a*) absorbing $\frac{1}{2}$-horse power; (*b*) absorbing $2\frac{1}{2}$-horse power; (*c*) absorbing 5-horse power. (5) For best automatic—shunt or otherwise—system of dynamos for compensating change of resistance in external circuit, and economising power absorbed by machine. (6) For the best model or drawing with estimates on any system, of a central station to drive 20,000 incandescent lights over a radius of one mile. (7) For best electric meter to measure supply of electricity from mains to houses. (8) For best set of twenty-five fancy fittings for electroliers, &c., suitable to (*a*) arc or (*b*) incandescent lights. (9) For the best set of fittings suitable for restaurant or hotel bars and counters. (10) For best application of electric light fittings to purpose of photographic studio. (11) For the best set of fittings, &c., for drawing and other private rooms. (12) For best system of street mains or leads for transmission of electric energy — complete—for public supply. (13) For best system of electric coupling for trains. (14) For best photometer, if possible, self-recording. (15) For best electro dynamo-meters; (*a*) to measure direct currents; (*b*) alternating currents; both combined in one instrument. (16) For the best thermopyle adapted to the utilisation of waste heat, and its conversion into light or power by means of storage. (17) For best lamp and arrangement for illuminating mines—especially with reference to coal mines, or for submarine operations. (18) For most complete apparatus for remedial appliances, especially with regard to use of a bath in which the patient is immersed. Mr. W. D. Gooch is the engineer for the exhibition.

THE NIEDERBAUM SWING BRIDGE, HAMBURG.

(*For description see page 82.*)



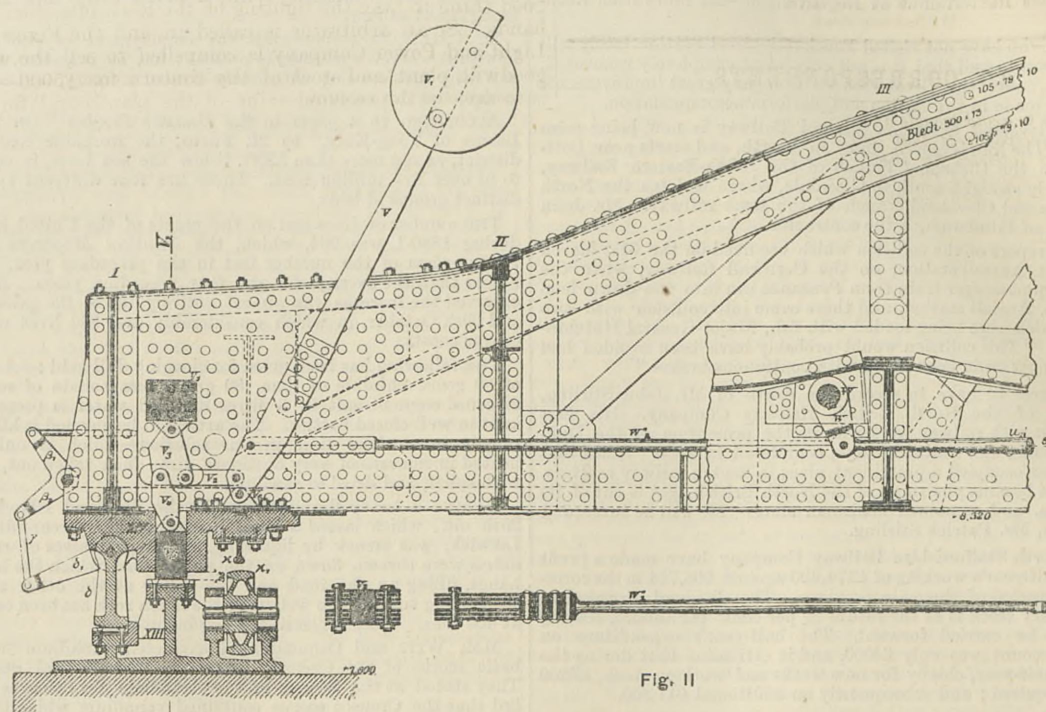
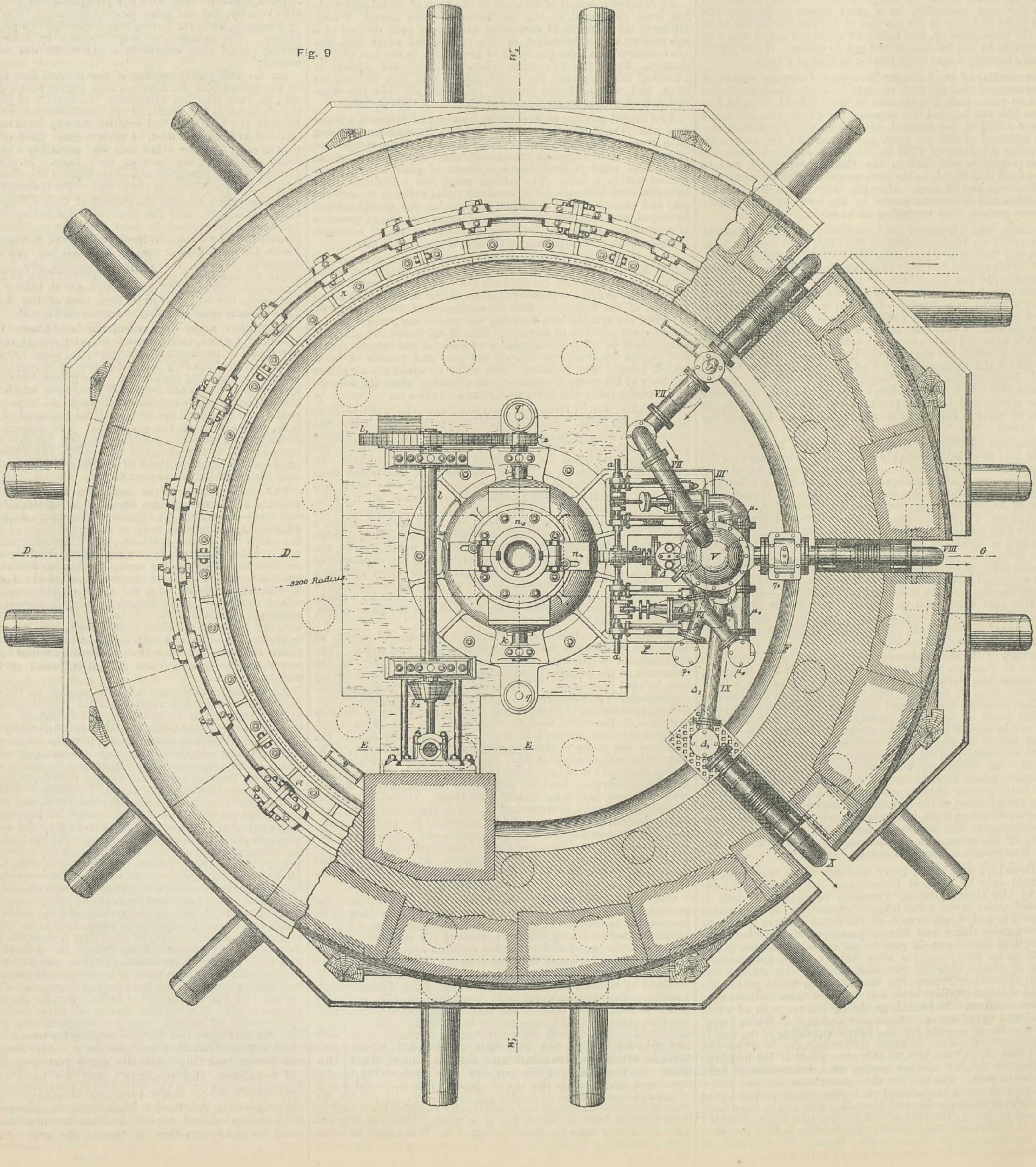


Fig. 11

Fig. 9



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J. C.—*The smaller quantity of water would pass through when the barge passed through the lock.*

F. R. (Penge).—*The address is given in the paragraph to which you refer. The number is* 14.

BENDING COPPER PIPES.—*H. and J. R. may obtain machinery they require by application to P. and F. Gougy,* 143, *Boulevard Montparnasse, Paris.*

J. P.—*The height of a conical pendulum governor is to be measured to the point where the arms carrying the balls would, if prolonged, intersect the vertical line. You are quite right in your views, and your opponents are wrong.*

RAW HIDE MALLETS.

(*To the Editor of The Engineer.*)

SIR,—You will oblige us by allowing us to ask for the name of the manufacturers of raw hide mallets. L. AND CO.
London, July 31st.

CARPET BEATING MACHINE.

(*To the Editor of The Engineer.*)

SIR,—I have somewhere seen a notice of a new carpet beating machine, and shall be glad if any of your readers can send you for me the name of the inventor or maker of this machine. A. S.
Vienna, July 28th.

ENGINEERS IN AMERICA.

(*To the Editor of The Engineer.*)

SIR,—I should be much obliged to any of your readers who have had experience in America, if they would inform me whether there is much scope for a young civil engineer without influence in the United States or Canada, and what paper is the best as an advertising medium for a be-th in either of the countries mentioned. S.
Doncaster, August 2nd.

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*** *Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of* THE ENGINEER, 163, *Strand.*

THE ENGINEER.

AUGUST 4, 1882.

THE ELECTRIC LIGHTING BILL.

SIR FREDERICK BRAMWELL has been one of the first, if not the first, to call attention tc an aspect of the Electric Lighting Act, which deserv some attention. Sir Frederick wrote in the first inst nce to the *Times*, and his letter was published in that jc rnal on the 21st ult. He has since re-published his letter in the form of a pamphlet. He deals with but one point in connection with the Act, namely, the clause provided for the purchase by corporate or municipal bodies of the plant and goodwill of electric lighting companies. It is known that these can be purchased, whether the companies like it or not, at the end of fifteen years, dating from the time when the works began to discharge public functions, or if not then, five years subsequently, and so on apparently for ever. To make this point quite clear let us suppose that the Fixed Star Light and Power Company, Limited, undertakes to supply the rising town of Pipeantwistle with the electric light. The company takes land, erects buildings, puts down engines and dynamos, and expends in this way £50,000. For a dozen years the company keeps on only just paying its way, and getting no return for its outlay. At the end of this time things take a turn for the better and the company begins to make money. No one would assert that it had made too much if it had earned in dividends in the twelve years £30,000, that being interest at 5 per cent. on £50,000 for the time stated. As a matter of fact, however, at the end of the statutory fifteen years the company has earned but £6000, and its plant, being fifteen years old, is, to say the least, depreciated, but still quite serviceable for the company's purposes. At this juncture the Mayor and Corporation of Pipeantwistle conclude that it would be a good thing to take the lighting of the town into their own hands. So an arbitrator is called in, and the Fixed Star Light and Power Company is compelled to sell the whole goodwill, plant, and stock of the concern for £5000—that is to say, the depreciated value of the plant—and for this sum the Corporation obtain the power of earning £6000 a year. If now, at the end of the fifteen years, the Mayor and Corporation find that the Fixed Star Company is not making money, they can let it alone; but at the end of five years they can pounce down, and compel a sale to be made to them. Sir Frederick Bramwell calls particular attention to the fact that "The Electric Bill, by clause N of section 14, provides that where the lighting is done by an individual or by a private company, under a provisional order confirmed by Act of Parliament, then at the end of fifteen years the local authority of the district lighted shall be entitled to say that it desires to purchase the undertaking, and thereupon the undertakers shall be compelled to sell. This in itself would be a sufficiently hard provision were the terms of payment fair; but the terms of payment are most unfair, for the arbitrator who, failing agreement, is to fix them, *is forbidden to take into account in so doing either past profits, goodwill (which means present profits), future profits, or any allowance for compulsory sale*, and, having been thus told what he is not to allow, he is directed to ascertain the then value of the land, buildings, machinery, and plant, having regard to their suitability for the purposes for which they are intended, and this is to be the sole payment for the acquisition of the undertaking."

Now at first sight such a provision appears, to use Sir Frederick Bramwell's own words when he was examined by the Committee on the Electric Lighting Bill, "monstrous." It is, however, worth notice that none of the existing electric lighting companies, which now represent a nominal capital of £12,000,000, took much exception to the clause; on the contrary, they appeared to be on the whole very well satisfied with the Bill. We may therefore, we suppose, conclude either that these companies believe that they can make a sufficient profit in fifteen years out of any lighting enterprise they undertake, or else that they are determined to enter upon no enterprise of the kind; very probably the last conclusion is that which is nearest the truth. But, on the other hand, if streets are to be lighted by electricity, the work must, we imagine, be done by companies, for we very much doubt if any corporation will feel itself justified in spending town taxes on what must be to a large extent at all events an experiment. This means, in practical working, that none of our towns will be lighted by electricity, at all events for a considerable period; until, in short, the electricians are satisfied that they can make money enough in fifteen years to recoup them. During the last year or so they will let depreciation of plant do its worst, and the purchasing corporation will probably find that what it has acquired would have been dear at any price. It is apparently difficult to plan any measure more calculated to put a stop to the progress of the electric light. How, then, are we to account for the fact that all the great electric light companies regard the Act with complaisance? Sir Frederick Bramwell has entirely ignored this circumstance; but it is beyond question that he has expressed in this matter only his own views, and that no one has publicly endorsed them. The companies we should have thought to be most concerned, have for chairmen and directors shrewd business men. The Committee heard a great deal of evidence before it fixed on the fifteen years' limit, which was defined by Mr. Chamberlain. Nay, we believe we may go so far as to say that some of the companies were not indisposed to accept the seven years first proposed as a sufficient interval between the establishment of an electric light works and its purchase by the local authority. Supposing that these companies know better what is good for them than Sir Frederick Bramwell, it is difficult to resist the conclusion that he has made a mountain out of a mole hill.

It must not be forgotten that the Act gives powers to a corporation to obtain property for which it does not pay. It is quite well known that in the ordinary transactions of business life a going concern is a different thing from one which is not going. A man who buys an ironworks in full work, turning over money continuously and executing orders, expects to pay a good deal more for it than the bare market value of the whole plant and place if sold by auction as a non-going concern. Some special and adequate return must be made for this concession to the local authority, and this is just the point that Sir Frederick Bramwell has entirely missed, and that the electric lighting companies have not been slow to perceive. During the statutory fifteen years each of these companies will enjoy a virtual monopoly in the town which it undertakes to light, and it will also have advantages in the way of cutting up the streets, suspending wires, temporarily interfering with street traffic for its own purposes, and so on, which cannot fail to prove of extreme value. The prominent idea is, of course, that the enjoyment of a monopoly for fifteen years should be quite sufficient for any company, just as fourteen years is held to be enough for a patentee; and there is, no doubt, a good deal to be said in favour of this view of the case. The House of Commons at all events held that there was so much to be said, that it has passed the Act in the form to which Sir Frederick Bramwell takes exception.

It would be unfair to suppose that Sir Frederick writes in favour of electric lighting companies only. On the contrary, he attacks the general principle of the Act whose provisions he criticises; maintaining "that the most cruel conditions of compulsory giving up of the undertaking which are imposed in the Bill upon electric lighting will, at the very first opportunity, be imposed in all cases where private enterprise seeks parliamentary powers to enable it to supply public needs;" and holding that "as there is nothing in the nature of electric lighting to justify exceptional harshness; on the contrary, it is regarded with approval, and thus, if there be any exceptions, it is to be supposed they would be exceptions in favour of this useful, desirable, but undeveloped industry. I fear the obvious conclusion to be drawn from the foregoing considerations is that in all future applications to Parliament for a Bill to light a town with gas, or to supply it with water, or to make a new railway from A to B, there will, in the interests of consistency, be inserted provisions that at the end of the fifteen years the local authority may buy the gas undertaking at the then value of the fifteen years' old pipes and fifteen years' old works, that it is to get the waterworks on similar terms, while the railway, extending over the districts of many local authorities, will be doomed to be acquired by the Government for the then value of the land, works, rails, and rolling stock." "Is the country," he asks, "prepared for this? Has the time come when private enterprise, which, I believe, has made this country what it is, shall be discouraged, and such undertakings shall pass into the hands of governing bodies, be they corporations, local boards, or the Imperial Government?" He then goes on to point out that no parallel for the harshness with which the electric lighting companies are treated is to be found save, perhaps, in the Tramways Act of 1870. The conclusion at which Sir Frederick arrives is that companies will not undertake enterprises of much risk at all under the system inaugurated by the Electric Lighting Bill. He holds, indeed, that the passing of the Bill must be looked upon as the beginning of the end of the carrying out of public enterprises by means of private capital.

As we have already said, Sir Frederick Bramwell's letter is one which deserves consideration. We are none the less certain that he has taken an exaggerated view of the whole question. The relation between supply and demand is after all that which always controls such matters, and in the long run the electric lighting companies may be trusted to lose nothing, no matter what Acts of Parliament are passed. There is such a thing as contracting out of an Act of Parliament, and if a local authority wants something done and cannot get it done unless a particular clause in a particular Act of Parliament is ignored, it will be ignored. That similar clauses to "clause N, section 14," will find their way into specific agreements or Acts for railway, water, or gas companies, is to the last degree unlikely, for reasons which should be quite obvious. Such questions must be dealt with on a far larger basis than Sir Frederick has seen fit to adopt. The laws of supply and demand are far more powerful than Acts of Parliament, and we cannot resist the conclusion that "clause N, section 14," closely resembles the notable curse once pronounced in Rheims, the result of which was that "no one appeared one penny the worse."

STEAM ENGINE ECONOMY.

WE have lying before us the annual report for 1882 of Mr. Michael Longridge, chief engineer to the Engine, Boiler, and Employers' Liability Insurance Company of Manchester. This report contains a great deal of matter which deserves careful perusal, and concerning which we may have something to say at another time. For the present we must confine our attention to certain diagrams published at the end of the report, and to comments made by Mr. Longridge concerning the economy of different types of engine. We have before now broken a lance with Mr. Longridge, and may have to do so again; but in the present case we have nothing depreciatory to say concerning his work. On the contrary, he has dealt with his subject at once like a man of science and a practical engineer—two characters not too often found combined in the same individual. It is well known we believe to most of our readers that THE ENGINEER has always maintained that the compound engine is not necessarily more economical than the simple engine, because it admits of mathematical demonstration that the efficiency of a fluid acting in a heat engine is independent of the number of cylinders in which expansion is carried out. Now for a considerable period after the compound engine began to find a place at sea, many individuals held that there was a reason for economy to be found in the principle of the action of the compound engine. This view we have often endeavoured to dissipate, and we think it may be said that during the last eight or ten years little or nothing has been heard of an absurdity which ignored Carnot's famous theorem, and set all the laws of heat at defiance. Driven from their original standpoint, the advocates of the compound engine now assert, and have asserted for years, that the specific advantage of the compound engine lies in the fact that the range of temperature in the cylinders is much smaller than it can be in a single cylinder. At the risk of going over old ground, we must put this argument into figures. Let us suppose that steam of an absolute pressure of 100 lb. is expanded tenfold; the initial temperature will be 328 deg., the terminal temperature before the exhaust opens will be 193·3 deg., and the temperature during exhaust will be 120 deg. or thereabouts. Thus the whole range of temperature will be 208 deg., and through this a certain weight of the metal of the cylinder and the piston, &c., must rise and fall at each stroke. If, on the contrary, the same expansion was got in two cylinders, the minimum temperature in the high-pressure cylinder would never fall below, say, 212 deg., corresponding to about 15 lb.; and the range in it would be only 116 deg., while that in the low-pressure cylinder would be between about 240 deg. and 120 deg., or 120 deg. To this we reply now, as we have replied before, that the economy resulting in this way exists principally in the fancy of engineers. We do not dispute that there is a saving, but it is a very small one. In any case the large cylinder must be at least the same size in a compound engine that it would be in a single engine of the same power, working with the same piston speed and grade of expansion and pressure; and we have besides the condensation which takes place in this cylinder, that which takes place in the small or high-pressure cylinder. The surface to be heated and cooled in this cylinder at each stroke will be about one-third of that in the large cylinder.

To be consistent, the advocates of the compound system must admit that the transfer of heat will take place in the ratio of the range of temperature. We shall not be far wrong if we assume that the weight of metal heated and cooled will vary as the surface. We may then make the following calculation:—Let the weight of the single cylinder of a simple engine, or the large cylinder of a compound engine be 1000. If we multiply this by the range of temperature in the single engine, viz., 208 deg., we have as a co-efficient of condensation 208,000. If we deal with it in the same way, regarding it as the low-pressure cylinder of a compound engine, we have 120,000. To this must be added, for the high-pressure cylinder, 333 × 116 = 38,628, giving as a total 158,628, which, deducted from 208,000, leaves a balance of 49,372 in favour of the compound engine, or about 23 per cent. This is not very much, but even with this the compound engine cannot be credited, because it is well known that owing to the fall in pressure between the two engines, there is a gap in the diagrams which represents loss of power. For this reason the low-pressure cylinder of a compound engine must be made larger for any given power than would suffice if it were used alone as a single engine. Furthermore, we have said nothing about the continuously varying temperature in the intermediate receiver, nor have we taken into account the extra dimensions and surfaces of ports and passages. Including all these things it will be found, we think, that, as we have said, the saving in condensation due to the use of two cylinders is mythical, and of course we have to set against it, even if it existed, multiplication of parts and additional friction. We have over and over again pointed out that the modern marine engine is popular and is excellent, because it gives more regular turning than any single engine could, or even any two-cylindered non-compound engine; and that it is not more complex than an ordinary pair of engines, while the overwhelming argument in its favour is that it allows high pressures and measures of expansion to be used without the complex valve gear which would be indispensable if a single engine were employed. Let us speak well of the compound engine, especially for marine work, but let us form a rational appreciation of its merits, and praise it for what it has, and not for that which it has not.

Now let us see what Mr. Longridge has to say on this subject, and let it be borne in mind that he brings to bear not his own experience only, but that of other engineers. Mr. Longridge has combined in a convenient table the results of a large number of experiments carried out in this country by himself, and quite independently by the Société Industrielle de Mulhouse, which appointed a committee under M. Hallauer to report on certain engines in the district. The table goes to show that there is not a pin to choose between the compound and non-compound engine in the matter of economy of fuel. The general conclusions proved by the experiments quoted are (1) that for each class of engine there is a certain ratio of expansion which gives the best result; (2) that the limits within which the ratio of expansion may be varied without materially affecting the economy differ with the relative proportions adopted for the cylinders; (3) that steam-jacketted single-cylinder engines give practically as good results as compound. Now these are just the very truths which we have been pointing out for years. "The question of simple *versus* compound engines," says Mr. Longridge, "is still a matter of controversy, owing to the absence of any reliable data for forming an opinion. . . . . At pressures varying from 40 lb. to 65 lb. above the atmosphere the experiments show that the results are practically as good with a simple as with a compound engine," precisely what we have urged on our readers for years. The true test of the economy of an engine is the weight of water used per horse per hour. In the case of a single-cylinder Corliss engine, Hallauer found the best result to be 17·58 lb. of feed-water per indicated horse-power per hour. A single-cylinder unjacketted engine required 22·28 lb., but when the steam was superheated to 419 deg. the consumption fell to 15·65 lb. The best result obtained with a Woolf engine, steam jacketted, was 18·58 lb., so that the single-cylinder Corliss was the more economical of the two. A compound horizontal engine tested by Mr. Longridge, unjacketted, used 16·81 lb. The best result got by Hallauer with compound jacketted horizontals working cranks at right angles was 16·44 lb.; and it is worth notice that a similar engine unjacketted used but 16·86 lb. of feed-water per horse per hour. With another compound Mr. Longridge got down to 16·26 lb; but with a Woolf beam engine jacketted the best result M. Hallauer got was 17·99 lb. Mr. Longridge draws instructive comments from such figures. "Isolated experiments," writes Mr. Longridge, "unless they form part of a series are delusive. Compare, for instance, the compound engine, No. 29, with the simple engine, No. 2, both steam jacketted; the simple engine has the advantage by 43 per cent. Compare, again the simple engine No. 4 with the compound No. 15, both unjacketted; the compound beats the simple by 32 per cent. In making a comparison the initial pressures ought to be the same, and each engine should be worked with the best ratio of expansion. Let us see what the figures tell us when compared in this way. Take first the lower pressures, and compare No. 5 unjacketted simple engine with No. 12 jacketted compound; the consumption per indicated horse-power per hour differs by 1·22 lb., or 6·5 per cent. If the simple engine had been jacketted, and the consumption per horse-power developed at the brake compared, the difference would have been considerably less, and might have vanished altogether." It must be carefully borne in mind that we are not dealing here with theories, or assumptions, or deductions from mathematical formulæ, but with hard facts; and we feel some pleasure in reproducing such facts, because they support views the soundness of which has been keenly disputed by many who permitted prejudice to blind them to the truth.

The diagrams which Mr. Longridge publishes are many of them so remarkable that they appear at first sight to be fancy sketches. Nor is our wonder at these diagrams greater than our amazement at the ignorance which has led to their production. It is indeed almost incredible that engineers should exist to construct and manufacturers use engines with the defects revealed by the indicator. In one case the company was called in to examine a new engine which could make only 42 revolutions per minute although put down to make 50. The slide valve had been altered several times without effect. The indicator showed a rise in the back pressure to an enormous extent near the middle of the stroke, and it was found on examination that the slide valve had a travel of 8¾in., while the exhaust port was only 2in. wide, and the bar between it and the steam port only 1⅝in. The result was that the valve entirely closed the exhaust port during a portion of the stroke. The travel was reduced to 4½in. and the lap of the valve shortened, when the engine worked very well. This was a small tandem compound, the cylinders being 11in. and 24in. diameter, by 48in. stroke. It can hardly be credited that any engineer, capable of building an engine at all, should make such a mistake. But Mr. Longridge mentions a worse case than this. An engine, intended to develope 350 indicated horse-power, could hardly be got to turn round. On examining the valves, they were found to have 3½in. lap on the exhaust edge. This was reduced to ¾in., and the engine then worked, but not well. The ports were found to be too small. But what shall we say of the man who designed the condenser? The air-pump was horizontal, double-acting, the bucket being worked by a prolongation of the piston-rod. Unfortunately, it was placed above the level of the condenser and above the level of the exhaust pipe, so that, before water could enter the pump at all, both the condenser and the exhaust pipe must be filled with water, and the outlet from the cylinder sealed. Comment seems to be superfluous. It would be impossible to do adequate justice to the genius of the man who planned this engine. The extended circulation of Mr. Longridge's report may, perhaps, reduce the chance of such blunders being made in future.

RECENT ACCIDENTS ON THE GREAT NORTHERN AND GREAT EASTERN RAILWAYS.

The accident on the Great Eastern Railway, which occurred to the down express train near Ely on Friday evening, the 28th ult., and to which we have more fully referred in another page, arose from a curious cause, and affords another illustration of those emergencies which may at any time arise, and how they may best be met. It seems that when the up express to London, due at Cambridge at 6.57 p.m., was about to pass the down express about three miles from Ely, the balance weight on the arms of the weigh-bar shaft fell off, and rolled in front of the advancing down train, which was travelling at a speed of over fifty miles an hour, and the engine left the rails, and after running about 100 yards, turned quietly over into the ditch upon the same side of the line. Fortunately the train was fitted throughout with the Westinghouse automatic brake, which had at once been applied by the driver. No one was killed, though several passengers received serious injuries, the only wonder being that the result was not more severe. The front carriages do not appear to have left the line until the engine turned into the ditch, and the rear part of the train was brought to a stand upon the rails. This accident furnishes another instance of what we have for years insisted on, viz., the value of an automatic brake, for though in this instance the brake was not self-applied, it remained hard on after the engine had separated from the carriages, and thus the rear part of the train was prevented from overrunning the front. Colonel Yolland's report on the accident at Werrington Junction on the Great Northern Railway on the 26th June last has just been issued, and a comparison of the circumstances attending this accident with those of the one mentioned above will be instructive. In this case the engine of the 6.30 p.m. express from York to London broke a side rod; the train was fitted throughout with the Smith vacuum brake, and the broken rod appears to have struck a portion of the engine brake work, which, being thrown under the tender, caused it to leave the rails and break away from the engine. The latter, entirely bereft of a brake, ran on for very nearly a mile, taking with it of course the power for working the brakes on the train. The tender and the remainder of the train came to a stand, having run 470 yards from the first indication of anything being wrong. All the carriages were off the rails, and some were lying on their sides. Colonel Yolland says he "was not able to obtain any distinct evidence whether the opening of the valve of the brake by the engine driver had the effect of putting on any of the brakes of the train or not," but he does not go on to say that even if they had been applied it could only have been for a moment, and that they must all at once have been released when the engine separated from the tender. It is instructive to learn too that although "the whole of the vehicles remained coupled to each other and to the tender in front," nevertheless "the vacuum brake gear was more or less damaged throughout the train." A list of the damage to the train is given in an appendix to Colonel Yolland's report, and from this it appears that the vacuum pipes were broken on almost every vehicle. What we mean to point out is that, although the carriages may not separate in an accident, they have practically separated, so far as the brakes are concerned, when the pipes are injured, and, if non-automatic, the brakes are released; if automatic, they remain on, as illustrated by the accident on the Great Eastern Railway. The contrast between a train running 470 yards all off the rails, and another being pulled up in 100 yards on the rails is sufficiently striking. Had the circumstances been reversed, and the Great Northern engine, instead of running away for a mile, been turned into a ditch at the end of 100 yards, the consequences must have been of the most fatal character.

THE GREAT EASTERN STORAGE AND REFRIGERATING COMPANY.

For some time past the Great Eastern Railway Company has been carrying out works which are perhaps without a parallel in any part of the United Kingdom. We refer to the conversion of the area below the old terminus at Shoreditch into a meat, fish, fruit, and vegetable depôt. In the midst of a densely populated district, the establishment of such increased facilities for the disposal and distribution of provisions cannot fail to be of immense importance to the metropolis. Already about one-third of the total fish supply is conveyed over the lines of the Great Eastern Railway Company, and it is expected that so soon as the depôt is fully opened, which it will be in a very short time, a great impetus will be given to the fish traffic from the North-Eastern Counties, especially on the completion of the joint lines with the Great Northern Company in the neighbourhood of Spalding. A very important feature in connection with this depôt will be the establishment of large cold dry-air storage chambers by the Great Eastern Storage and Refrigerating Company. This company has leased two of the largest arches near to Wheeler-street and Bethnal Green-road, the cellars of which are to be immediately fitted up for the preservation of all sorts of meats, fish, fruit, vegetables, and dairy produce by the cold dry-air process. There will be eight large chambers, insulated with a new material, by which a saving of nearly 6000 cubic feet of space will be effected over what would have been available with the non-conducting substances generally in use. Two dry air refrigerators, together capable of cooling 100,000 cubic feet of air per hour, are to be erected at first, and these are to be driven by a pair of double-cylinder gas engines, indicating nearly 200-horse power, which will be specially constructed by Messrs. Crossley Bros., of Manchester. The company proposes to receive and store fresh meats from all comers, and either to sell to wholesale buyers on the spot, or to deliver to the metropolitan market or other centres of consumption certain quantities daily as required, so as not to overstock the market, thus acting as an insurance against loss to those using the stores. The company will also act as consignees and agents, when required, at inclusive rates, and will take in and dispose of produce, whether from America, Canada, Australia, or the home counties. The whole of the work is to be carried out from the plans and under the superintendence of Mr. T. B. Lightfoot, M. Inst. C.E., the consulting engineer to the company.

FRENCH STEAMERS AND BOUNTIES.

It had been expected that the effect of the adoption by France of the bounty system would have been a very great development of the shipping industry; and this impression was apparently confirmed by the orders that were given from France to British shipbuilders. But it turns out that many of these orders are for fleets of vessels which are subventioned, and do not therefore receive the bounty. The Messageries Maritimes has at the present time not fewer than five large and costly vessels so being built, and others of the companies receiving State subventions have such contracts, so that the number of the shipowners who would be entitled to receive the bounty must be much less than had been expected. The accounts of two of the great lines of France show that during the past year there has been—without the bounty—a tolerably good profit on the working. The Messageries Maritimes divide seven per cent. amongst its shareholders, after having added to the reserve fund and provided out of revenue for the partial redemption of debentures; and the dividend of one other company is the same. Both are likely largely to increase their fleets; and in the report of one it is stated that the directors are hopeful that the mail contracts that expire in a year or two will be renewed, but if not "the navigation bounty, which is not allowed to subventioned mail lines, with the savings that would be effected from the charges imposed by the mail contracts, would be a very appreciable substitute for the loss of the subsidies." It is now beginning to be shown that the bounty will be of less effect in increasing the tonnage of the country than had been expected, because it will be of less benefit to the individual vessel, seeing that so many of them are not native built, whilst in the aggregate its cost to the country will be not small, and it will add to the extraordinary financial burden that the French ratepayer is now growing restive under; and even then it will be doubtful whether it would enable the bounty-aided vessels to compete with those of this country, which are built cheaply, and worked without the conditions that the bounty system exacts from those in France who apply for it.

EXHIBITION OF LIFE-SAVING APPLIANCES.—ALEXANDRA PALACE.

No. II.

In last week's impression of The Engineer mention was made of a few of the more important exhibits in the first section of the Exhibition, and we have now to briefly notice the other classes. In Class 2 were found many inventions and appliances for the saving of life in "marine emergencies," and under the heading of this section some eighty more or less ingenious inventions were exhibited. The first exhibit we came to, if endeavouring to work by the catalogue, was No. 44, Marr's automatic life raft, an elaborate apparatus for the saving of life in the event of shipwreck. The raft is composed of a number of waterproof tubes placed side by side, and inclosed by a light framework of hinged flanges; a system of thin cordage is arranged underneath the framework, and there is a deck of canvas above the tubes. The tubes are at low pressures impervious to the water, but by means of what Mr. Marr calls "breathers," or spaces on their surface, allowance is made for the admission of air. In the model exhibited there are eighty-two such tubes, and each of these has from sixteen to thirty-two such means of access for the air. When the raft is stowed on board, the tubes lie flat together, but when it reaches the water, being merely cut adrift, the wetted cords contract, and so open out the framework and the tubes, which latter inspire the air through the breathers, and the raft having greatly increased its dimensions, is ready for use. There can be no doubt that all river or coasting steamers should be provided with some simple and efficient means of saving life such as this raft, which seems to require no preparation, save only the mere cutting adrift; but as we have not seen it at work, we cannot say what it could do in practice. The next exhibit, good in its way, but hardly capable of being squeezed in under the head of life-saving appliances for marine emergencies, was No. 36, Gandy's improved belts or bands for steam engines. Mr. Sutherland came next with his scheme for providing ships with a floating saloon deck, which, in the event of a vessel sinking, would remain on the surface of the water, and in the form of a raft be capable of saving many lives. Buoyancy is obtained by making the floating deck double, the interval between the planking being filled with cork. The best invention of this kind which has been brought before the public recently was that of Captain Fewster, which was shown at the Naval and Submarine Exhibition in April. Instead of constructing the life-saving part of his ship in the form of a raft, which must be under all possible circumstances very imperfect, unsafe, and miserably uncomfortable, Captain Fewster gave it the form of a boat, which took up but little room on board the ship, and in the event of a catastrophe, being provided with mast, sail, rudder, &c., this little ship, which was called the Duck, could be sailed to land or until succour came. Contrivances of this kind, however, are by no means to be advocated, and it is open to serious question whether in the case of wreck they would not do more harm than good. It is a very poor criterion of the utility of such inventions to show them doing their duty, on a very small scale, in very smooth water, in a tank. To be of any practical use these inventions must be so designed as to be ready for duty at a moment's notice, and for this reason they must not be lashed into their berths on board ship. But all practical sailors, and many landsmen who have been to sea, know the inadvisability of having anything loose on deck in bad weather; they know well what immense volumes of water come tumbling on to the decks, and we fancy that few captains of ships would care to be in constant fear of seeing a saloon deck leaving its proper place to come on to the bridge. Mr. Sutherland's invention might beyond question be of great use on board river or inland water steamers, but neither ducks, floating bridges, floating saloon decks, or any such inventions, which can get loose and do much damage on board, are likely to meet with approval amongst owners of ocean-going ships.

Messrs. King and Co. displayed some fine, serviceable lifeboats, and close to their stand was an exhibit of the Royal National Lifeboat Institution. The principal item of the exhibit was a full sized lifeboat and transporting carriage with a complete equipment of stores. The boat is 32ft. long, 7½ft. wide, and is to be pulled by twenty oarsmen, each oar being double banked. The boat was placed in a position to which it had the highest claims, that is to say, just below the organ, at the north end of the great central hall, where it attracted the primary attention of all visitors to the Exhibition. The Institution has under its authority on the coasts of these islands 271 such boats, which, during the past year, effected the saving of upwards of 1000 lives. Its motto during the fifty-eight years since its establishment has been, "the preservation of life from shipwreck," and in the carrying of this motto into practice, it has saved, either by its lifeboats or through its direct instrumentality, nearly 29,000 lives. In addition to the boat above mentioned were to be found on the stand improved fishing boats recommended by the Institution, working models of a lifeboat of the Institution, and an ordinary ship's boat shown in a tank; a model of the first English lifeboat constructed, 1790, lifebuoys, life-belts, swivel rowing crutches, liquid boat compass, telescopes, &c., adopted by the Institution; also droques or drags used in the lifeboats for the purpose of checking their speed when necessary, and for keeping their stern towards the sea when running for the land; models of lifeboat houses, and of a pistol and cartridge for making night signals.

Close to this exhibit was that of another philanthropic body, the Royal Humane Society, which showed (1) ice boat made with runners for the ice. This boat is used, or always held ready for use, during the skating season in Hyde Park; (2) rowing boat, used during the bathing hours in Hyde Park; (3) ice ladders; (4) iceman's cork jacket; (5) iceman's hand line; (6) large rope drag; (7) small ditto; (8) bar drag; (9) pole drag and lifebuoys.

The Marine Department of the Board of Trade showed their rocket apparatus for the relief and succour of shipwrecked crews, which was also shown very fully at the Naval and Submarine Exhibition, and spoken of at length in these pages. Mr. McCarthy showed a very wonderful life-saving apparatus, which has the appearance of a huge life buoy, made in sections, by means of which independent oscillation can be obtained, and the danger of being overturned minimised. This is in a way a useful and efficient affair, but its size renders its use quite out of the question in yachts or small boats, and it would be a highly objectionable feature, even for a larger craft. Mr. Cornish's life-saving mattresses and other appliances were exhibited, and excited some interest and curiosity among the unfortunately too small number of visitors; while close by Commander Robinson might be seen explaining his boat-disengaging gear, which is, perhaps, one of the best in the crowded field. Messrs. Hill and Clarke, who are Messrs. Willans and Robinson's most dangerous rivals, were conspicuous by their absence. Messrs. Gardner and Son exhibited a very remarkable boat, which they call a tent and lifeboat; it is simply a rectangular box with pointed ends, and is made of one layer of canvas waterproofed. The gunwale is of cork, and presumably it is on account of this same gunwale that the claim is laid to the title of "lifeboat." The canvas sides have no ribs, and are merely held in their place by the vertical ends of the thwarts, and by guy ropes which pass over a stumpy mast in the centre of the craft. A hood or tent descends from the top of this mast to the sides, but for what purpose this is intended it is impossible to imagine. There are apparently no compartments in it, and were it to get a hole in the one layer of canvas or in any other way allow of the entrance of water, the condition of those on board would not be enviable; two eye holes resembling a pair of spectacles are provided in the tented part of the boat at either side, presumably for the look-out man.

Messrs. Gardner and Son's next neighbour was Mr. Copeman, who once more displayed his now well-known sea raft. The raft can be rapidly put together, and consists of two or more deck seats connected at a distance of a few feet by means of strong spars, the backs of the seats when used on deck being capable of being folded down so as to form the deck of the raft when required for life-saving or purposes of general utility, as painting or scraping ships' sides, &c. The seats themselves are buoyant boxes, and have in them several air-tight compartments, some of which are filled with provisions and other necessaries. The size of the raft, when single, would be about 15ft. long and 8ft. broad, and Mr. Copeman asserts that this could be prepared in two minutes. Were it desirable, several such rafts could be connected and many lives saved, for being provided with sails, oars, &c., they are not absolutely helpless in the water; but still this method of saving life is open to all the objections urged against rafts of any kind. So long as the seas are long and heavy and not breaking, a raft may answer fairly well, but when the seas are short, cross, or breaking, a raft is merely an instrument of torture, and only tends to prolong the agony which must result in death from exposure if not from absolute drowning. Take any raft as an example and place it, fairly laden, in the upper reaches of a river on a day when the wind just curls the top of the water, and it will be found that all passengers get more or less wet about the feet and legs; then imagine such a craft in a sea-way, and those who know anything about a sea will understand that in a very little time all hands would inevitably be washed off the best raft ever designed or constructed. Rafts may answer well for use in a sudden emergency, where help is near, and they certainly are useful to hang on to until relief comes; in smooth waters also they are admirably adapted for the saving of life, but when heavier demands than these are made they cannot fail to be found wanting, and it were a fact much to be regretted if any ship went to sea unprovided with a boat because supplied with a useful raft. That an abundance of life-saving appliances should be carried on board of every ship is a statement beyond contradiction; that every ship should be supplied with life-saving rafts is a hope to be earnestly indulged in, but that on account of the carriage of such the available boat power should be reduced, is a result which must be protested against.

Messrs. Woolfe and Son showed some nice models and a pair of fine boats, one of which is an unsinkable lifeboat for ships' use. It is 25ft. long, and has a beam of 7ft., and is asserted to be capable of carrying twenty passengers in addition to her proper crew. Seats run round the sides of this boat, and under these seats are fitted movable air-tight cases, which ensure the buoyancy of the whole and give it its life-saving qualifications. An attractive display was made by Messrs. Bullivant and Co., who showed some fine steel hawsers of flexible wire, a material which is rapidly supplanting chain cables, hempen hawsers, &c., and which has been very largely adopted for use in the Royal Navy and in the Mercantile Marine, as well as by foreign Governments and shipping companies. This firm also showed its patent sea anchor, which is invented for the purpose of enabling a ship to ride out heavy gales, or for use in the event of accident to machinery for keeping a steamer's head to sea. It consists mainly of a series of canvas troughs arranged one below the other and fixed to iron framing, and when thrown over the bows, and attached to the ship by means of a steel hawser, it holds the water in its troughs and keeps the ship's head up to the sea. At the back of this stand, as at the Agricultural Hall in April, was suspended a large piece of torpedo netting made of steel wire, the dimensions of which are about 20ft. by 15ft., and this particular exhibit attracts a considerable amount of attention at this present time, and for the reason of its being well known that Messrs. Bullivant and Co. have supplied our fleet with these protectors against the attacks of torpedoes. Many other interesting exhibits were to be found on this stand, undoubtedly one of the best in the entire Exhibition. On the next stand a couple of fine anchors, Tyzack's patent, were exhibited. They have been made by Messrs. Hawks, Crawshay, and Sons, and have only one central fluke, which, canting on a spindle, is capable of taking the ground on whichever side it happens to fall, and this being in a direct line with the cable, the strain is of necessity more central and more uniform than where two flukes are used. Mr. Wells showed some very pretty models of lighthouses, constructed on screw piles, one of which is erected in the straits of Malacca. He also showed models of a screw pile breakwater and pier for deep water; a screw pile station with lantern; shank screw mooring; and screw mooring with chain, as fixed in the river Hooghley and Madras Harbour. Messrs. Higginson and Co., of Liverpool, exhibited one of their "steam quarter-masters." This is the ordinary hand gear with steam added to do the work, and the helmsman draws upon the engine for just the amount of power he requires. The change from hand to steam, or *vice versâ*, can be effected instantaneously. The feed and cut off are operated upon automatically by simply moving the hand wheel from half a link to full helm, the engine cutting off steam just as the helm is hard over. This successful gear has been illustrated and described at length in our pages already. Messrs. Hathorn, showed one of their air compressors working in connection with one of their patent Eclipse Rock drills. These drills are fitted with a very curious valve for the admittance and exhaust of the compressed air, which is the invention of Mr. Parnell, a member of the firm. This same valve excited a considerable amount of interest amongst the visitors to the Naval and Submarine Exhibition, and though apparently very simple, all the engineers who examined it were puzzled as to its action. It would be hopeless to describe this detail of the rock drill without drawings, and even with them a considerable demand would be made on our readers' patience. Mrs. Vansittart showed the Lowe-Vansittart propeller; Messrs. W. D. Marks, proposed Channel steam ferry; Parsons and Atkinson, method of raising sunken vessels; Chadburn and Sons, reply, engine and steering telegraphs; Sample and Ward, automatic detaching gear for ships' boats; Whitby, life buoy; Berthon Boat Company, collapsible boat, recently described in these pages, and to which the jurors have awarded the gold medal of the class.

Messrs. the British and Foreign Boat Lowering Company exhibited their gear, which is Carpenter's Patent, and which which, on account of its simplicity, may be accorded a first rank amongst the boat-lowering patents. A few words will explain the whole thing. The blocks by which the boat to be lowered is carried are fitted, not with ordinary hooks, but with spindles having balls at their ends. At the bow and stern of the boat, and so fixed that the strain comes on to the keel, is a flat metal plate with a round hole in the centre, through which the ball of the block will easily pass. Underneath each of these plates a sliding one having a slot in it is so placed as to be advanced or withdrawn, as may be necessary, by means of a pair of levers worked by the coxswain. The slot in the lower plate is of such dimensions that when advanced, with the block balls in position, it embraces the spindle just above the ball, and the boat is held securely. By means of the levers placed close to the coxswain's hand the lower plates may be both withdrawn, and the boat drops on to the water, or if it is desirable to tow the boat, the after lower plate alone may be withdrawn, and the bow one kept attached. The method of raising the boat is very simple, as it is only necessary to drop the block balls into their places and to move the levers. The great advantage of this gear is undoubtedly the absence of all hooks, which are always likely to give trouble, the simplicity of the whole arrangement, the instantaneous manner in which the boat can be released, and the control exercised over her by the coxswain.

ROBERT CHARLES MAY.

We deeply regret to have to record the death of Mr. Robert Charles May, M.I.C.E., an engineer of uncommon ability and sound judgment, and of a genial temperament and benevolent disposition which caused him to be held in high esteem by all with whom he was acquainted. He died at Marseilles on the 20th ult. of an aneurism of the heart. Robert May was the son of Charles May, and was born in April, 1829, at Ampthill, in Bedfordshire, and was thus fifty-four years of age at his death. Charles May was a man of remarkable native practical engineering ingenuity, and one whose ingenuity grew rapidly in the atmosphere of splendidly varied experience in which men of ability moved and worked hard during the early busy years of railway and collateral engineering, in which he was a partner in the firm of Ransomes and May. He became a partner with the Ransomes when his son Robert was only seven years of age, and during the fourteen years he was at Ipswich his inventive skill, and that of those round him, enormously increased the work at the Orwell Works, though, curious to say, very little of that class of engineering on which Charles May was most engaged is now carried out in these shops. Railway wagons, chairs, wedges and treenails, points and crossings, bridges and other plant, were made in large quantities then, as well as mill work and engines and agricultural machinery, still the leading work, and Robert Charles May was apprenticed to the firm in this busy time. Before he left Ipswich he had become an outdoor manager, and from this he moved to an appointment under the South-Eastern Railway Company as a resident engineer or as superintendent in charge of plant other than rolling stock. In 1854, about three years after his father had left Ipswich and settled in London as a consulting engineer, he followed his father's example, and soon acquired a very considerable practice in gas, mill, and railway engineering, and was largely employed as superintending engineer in the construction of fixed and moving railway plant for home and foreign railways. He constructed in 1853 the outfall of the Walland and Denge marshes at "Jury's Gut," or "Jew's Gap," in Kent, and placed there a reservoir or tidal pen at the sea end of which were draw gates and at the land end self-acting tidal doors. The tidal water was thus penned in, and formed a sufficient scour to keep the outfall clear of the shingle and sand which travel west to ease with the tide on that coast. In later years he devoted some attention to mining work, and was also largely employed as an expert witness and arbitrator in patent infringement cases and engineering disputes. It was in connection with mining pursuits that he had been to Sicily, on the return journey from which he died at Marseilles. He was consulting engineer for the Gallizzi and Giona sulphur mines. Mr. May was elected Associate of the Institution of Civil Engineers in 1861, and became a Member in 1864. He was well known at the Institution, though his contributions to the "Proceedings" are not numerous; but he took great interest in the affairs of the Institution, and his genial disposition made him most popular amongst the students, at whose meetings he frequently presided.

ROBERT WILSON.

We regret to announce that Mr. Robert Wilson, C.E., F.R.S.E., died at Matlock on the 28th ult., at the age of seventy-nine. Mr. Wilson was the late managing partner of the firm of Nasmyth, Wilson, and Co., of Patricroft, Manchester, of steam hammer celebrity. He was born at Dunbar in 1803, and received but meagre education in his early years, but by dint of great force of character and mechanical bent of mind succeeded in reaching the highest eminence of the engineering profession. His experience in engineering was as varied as the ingenious versatility of his talents in application to many of the wondrous forms of modern mechanical constructiveness. He had a large share in the perfecting of the steam hammer, under Mr. Nasmyth, and in late years was the constructor of the great double-acting hammer in the Royal Arsenal at Woolwich. Mr. Wilson early gave his attention to screw propulsion. In 1833 he submitted his models to the Admiralty, and then they reported against the utility of the principle. One of his latest honours was an award of £500 by the late Administration for "improvements of the fish torpedo." Mr. Wilson was very ill for about six weeks before his death. He had gone to Matlock in apparently perfect health two or three days before he was laid up.

SUGAR REFINING IN CHINA.

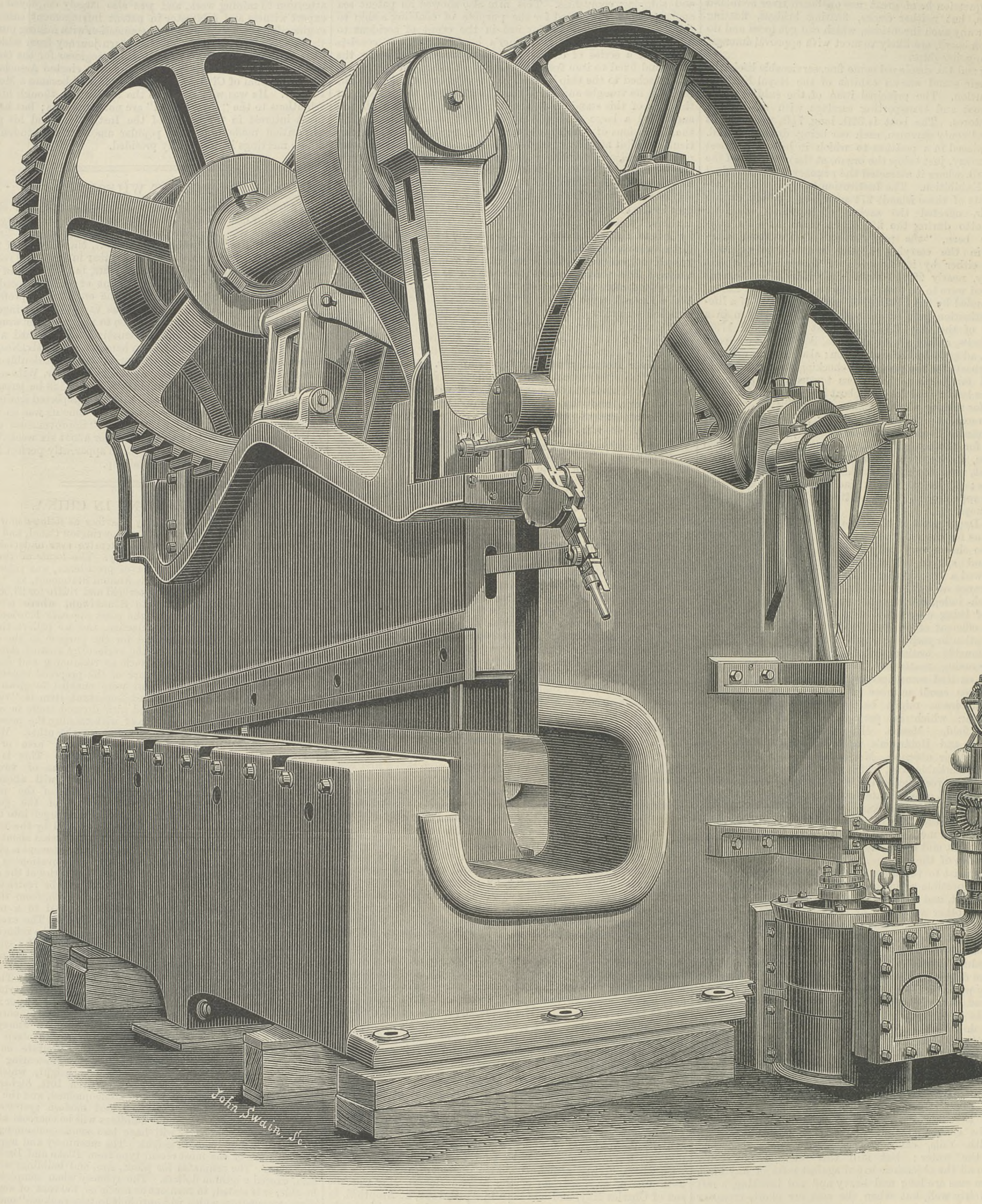
The *China Mail* of 25th of May describes as follows new sugar refineries at Quarry Bay and on the Bowrington Canal, and states that they are undoubtedly the most extensive ever undertaken by public or private agency in the colony. The *locale* of the first, which, from extent and cost, deserves precedence, was referred to by Sir John Pope Hennessy, in his Annual Statement, as "Inland lot No. 837," sold to Messrs. Butterfield and Swire for 24,500 dols. It is situate about half way to Shaukiwan, where a nullah debouches into a small indent of the coast opposite Kowloon Bay. There was hardly any room for selection, and we believe that this site was the only available ground for the purpose in the colony. Reducing the conformation of the surface by cutting down and filling in, with other measures, such as reclaiming and draining, will absorb no inconsiderable share of the proposed expenditure. From a cursory examination we were enabled to glean a few features of the scheme. The most important item is "reclamation" by means of a sea-wall faced with dressed stone in cement, of substantial dimensions, capable of withstanding the pressure of made earth on one side, and wave action on the other. We next come to the "filling in" of the reclaimed area or space between the new sea-wall and the road. This is being accomplished by the removal of the crowns of two hills on the East, the levelled tops of which will afford valuable building ground for the accommodation of the management and working staff. The drainage of the gorge is naturally received into a nullah and thence discharged into the sea. A portion of this water is intended to be utilised by the refinery, and to secure this object a dam has been constructed about a mile above the road, across the channel, which will intercept a plentiful supply of good fresh water at an advantageous elevation—a matter of great importance in the manufacturing industries of the class of that here intended. The surplus overflow will be restricted and regulated, particularly in the lowest or last reach, from the road bridge to the sea-wall, where it will be confined to a masonry drain. We may now proceed to the buildings. The excavation for the foundation of the principal block—that is, the refinery with charcoal cistern-house attached—is now in hand. The enormous weight of the proposed superstructure entails trouble and caution. Piling is imperative to a depth of 9ft., to be overlaid, we believe, by concrete and then stone an aggregate depth of 13ft. The great difficulty of water, which retards progress, is met by a ring-bund and a centrifugal pump and engine. The main building or refinery will be 90ft. by 48ft., and the charcoal cistern-house 60ft. by the same width. The former will have nine storeys, the tenth floor or roof supporting an iron tank 5ft. deep having a capacity of over 600 tons. This will necessitate enormous stability of structure, and the difficulty of securing equilibrium is considerably enhanced by the height, which is a total of 110ft.—in one place reaching even 10ft. higher. The walling throughout will be of brick, stone-quoined, and the roofing of iron, the design being after the best modern systems. The other necessary and contiguous buildings will be charcoal kiln and boiler houses. The latter will have two smoke-consuming chimneys, each about 150ft. in height. The machinery and appliances generally are of the most recent type from Blake and Barkley, of Greenock. The estimates for plant, site, and buildings will, it is said, exceed a million dollars. The refinery when completed will be able, it is stated, to turn out as much as 150 tons of sugar per diem, an out-turn which will entitle it to take rank as "one of the best sugar refineries in her Majesty's Colonial Empire."

The Bowrington sugar refinery is the result of Chinese capital and enterprise, and a favourable portent of the wealth and prosperity of the colony. The proprietary of this undertaking, which is in an advanced stage of progress, is vested in the well-known name of Lee Yeung. No better site could, in our opinion, have been obtained in Hong Kong. It is conveniently situated—alongside the main road, within a short distance of the Praya, and immediately on the right bank, of the deep portion between bridges, of the canal. The water supply so necessary to the success of these schemes will be obtained with comparatively little trouble from this last source; but will, however, need to be filtered before use. This scheme is, in its essential features, as regards buildings and machinery, very little different from those described or referred to in that at Quarry Bay—the exceptions being in size and in minor details. The same number of buildings for the same purposes will be here arranged more compactly within an area of 99ft. square. The foundations throughout of the refinery and other buildings, now being laid, will rest on piles—driven to a depth of 9½ft.—with about 12ft. of concrete and stone over them. The refinery itself will measure 48ft. by 41ft. It will have seven storeys, making up a height of 86ft. The water tank on top will be 3½ft. deep, having a content of about 180 tons. The chimneys—Livet's—will be 60ft. high. The machinery being estimated at half the working power of that at Quarry Bay, the estimated out-turn of sugar, may, therefore, be taken at over 50 tons per diem. It will be of the same pattern, but from a different firm, Houston of Greenock. The estimated cost of this scheme will not, it is expected, exceed 390,000 dols. Both the above works are being constructed from the designs and under the superintendence of Mr. Wm. Danby, M. Inst. C.E.

ELEVEN-FEET SHEARING MACHINE.

MESSRS. JOSHUA BUCKTON AND CO., LEEDS, ENGINEERS.

(*For description see page* 79.)



THE CRYSTAL PALACE INTERNATIONAL ELECTRIC EXHIBITION, 1882.

THE jurors have awarded prizes to the exhibitors at the recent Crystal Palace Exhibition. Diplomas of honour for the general excellence of their exhibits have been awarded to exhibitors not competing for trade motives, viz., her Majesty's Postmaster-General, the Secretary for War, the Anglo-American Telegraph Company, the Eastern Telegraph Company, the Telegraph Construction and Maintenance Company, the Submarine Telegraph Company, the South-Eastern Railway, the London, Brighton, and South Coast Railway, C. F. Varley, for his induction machine and condensers; R. H. Froude, for dynamometer.

Gold medals have been awarded to Messrs. J. R. Voss, for induction machine; Elkington and Co., for their deposition of gold alloys and general excellence; H. Wiggin and Co., improvements in electro deposition of nickel and cobalt; the Faure Electric Accumulator Company, for Faure battery; T. A. Edison, for complete system of lighting and other exhibits; British Electric Light Company, for Gramme dynamo machine and exhibit; R. E. Crompton, for Bürgin dynamo machine and Crompton arc lamp; Anglo-American Brush Company, for Brush dynamo machine and arc lamp; Swan's Electric Light Company, for incandescent lamp; Electric Light and Power Generator Company, for Weston and Maxim dynamo machines and lamps; White House Mills, for dynamo machine; Rowatt and Fyfe, for Pilsen arc and Joel semi-incandescent lamps; G. G. André, for arc lamp and regulator; Gerard and Co., for arc lamp; Davey, Paxman, and Co., for steam engines; Galloway and Sons, for steam engines; Marshall and Co., for steam engines; Robey and Co., for steam engines; Ransomes, Head, and Jefferies, for steam engines; Hornsby and Son, for steam engines; E. S. Hindley, for steam engines; Crossley Brothers, for Otto gas engine; Thomson, Sterne, and Co., for Clerk's gas engine; Roos and Ostrogovich, for their application of the automatic system to Hughes' type-printing apparatus; Johnson and Phillips, for the general excellence of their exhibits; Direct United States Cable Company, for the excellence of their exhibits; Edward B. Bright, for his fire alarm system; the Exchange Telegraph Company, for the general excellence of their exhibits; Prof. Dolbear, for his new electrostatic telephone.

Silver medals have been awarded to Messrs. Coxeter and Sons, Class X.; W. Elmore, Class XI.; United Asbestos Company, Class XII.; J. and H. Gwynne, for steam engines; Fyfe and Main, for arc lamp; National Electric Light Company, for dynamo machine and lamps; Gravier and Co., for arc lamp and exhibit; R. Hodson, for steam engines; Hammond Electric Light Company, for installation of Brush machines and lamps; A. Cance, for arc lamp; Domestic Electric Lighting Company, for the general exhibit; Electric Lighting Supply Company, Electric Lighting Engineering Company, Strode and Co., W. Ladd and Co., for the early historical dynamo machine; W. J. Hammer, for historical collection of incandescent lamps; W. T. Henley, for his cable core; W. R. Sykes, for his electric locking and blocking system of railway signals; the Consolidated Telephone Construction and Maintenance Company, for the general excellence of their exhibits; Saxby and Farmer, for their railway signals; R. Johnson and Nephew, for their iron wire exhibit; F. Smith and Co., for their iron wire exhibit; R. S. Newall and Co., for the general excellence of their exhibit; W. T. Glover and Co., for the general excellence of their exhibit; Phillips Brothers, for the general excellence of their exhibit; Professor Monnier, for his detector and analyser of fire-damp; J. W. Gray and Sons, for the excellence of their exhibit; Sanderson and Co., for the excellence of their exhibit. And bronze medals to Messrs. Binko and Co., for their improved agglomerate battery; E. Dent and Co., for their non-magnetising watches; E. Patterson, G. Skrivanoff, for his dry battery; R. Webster, for his non-magnetising watches; Roth, Schlaefli, and Co., for their electric self-winding clocks; J. F. Pratt, Class X.; H. Whiteside Cook, for his electric governor for screw marine engines; Arnold and Sons, Class X.; L. H. Borrell, for electric self-winding remontoire clock; T. R. Brailsford, for water-level indicator; J. Storer, for electrical table fountain; J. Willing, for electrical signs; B. Verity and Sons, for brass work; G. Hawkes and Co., Zanni and Co., E. Müller, E. Blouzon, C. R. Goodwin, Mignon and Co., J. E. Liardet, A. R. Sennett, J. H. Athole Macdonald, Philadelphia Dynamic Company, Alfred Apps, J. E. and S. Spencer, Julius Sax, W. Groves, Doulton and Co., Automatic Telegraph Company, J. Davis and Co., School of Submarine Telegraphy, Electric Railway Signal Company, G. C. Lewis and Son, and Waterlow and Sons.

Thomson, Sterne, and Co., of Glasgow, who, I understand, will lay out the works for engineering purposes, and it is reported will commence the manufacture of gas engines.

The proposed construction of a ship canal to Manchester is receiving strong support, not only in this city, but in the important towns along the route of the projected navigation, and there has been no difficulty in raising a guarantee fund for more than sufficient to cover the preliminary expenses connected with the survey which is now being made by the engineers with the view of preparing a report as to the practicability of the scheme. A guaranteed fund of £8000 has been raised for the purpose, and the work of the engineers is, I understand, being actively pushed forward, so that there may be no delay in presenting the report.

The extension of the Lancashire and Yorkshire Victoria station at Manchester is progressing rapidly. The main walls of the subways connecting the old and the new stations are now built, and a few of the permanent girders under the rails are in position. A heading is also being driven, to connect the line of rails to the adjoining Ducie Bridge station with the Victoria station extension. The new bridge, constructed of strong wrought iron plate girders, which carries York-street over the extension, is now sufficiently completed to enable the tram traffic to be carried over, and this now completes the various sections of tram lines running out of Manchester.

The Lancashire and Yorkshire Railway Company has this week given out contracts for the erection of an additional passenger station at Southport, to accommodate the district lying between Blowich and Southport stations. The new station will be on the island platform principle, and the building will be a somewhat ornate structure, with white brick facings and openings filled in with wooden mullions, and ridge and furrow overhanging roof constructed of iron. Extensive waiting and refreshment-room accommodation is being provided, and the platform, which will have a length of 133 yards, will be laid with blue Staffordshire tiles.

The coal trade continues without improvement. The better qualities of round coal for house fire purposes still move off very slowly, and the demand for other classes of fuel for iron-making and steam purposes remains much the same as of late. The reduction of 10d. per ton in the delivered rates for house fire coal, which has come into force this week in the Manchester district, but which does not affect the pit prices, has not been followed by any similar movement elsewhere. Supplies of coal are, however, so plentiful, notwithstanding the continuance of the St. Helen's strike, that to move away stocks prompt orders are taken at extremely low figures. The average prices at the pit mouth remain at 8s. to 8s. 6d. for best coals, 6s. to 6s. 6d. for seconds, 4s. 9d. to 5s. 6d. for common coal, 4s. 3d. to 4s. 9d. for burgy, 3s. 6d. up to 4s. for best slack, and 2s. 9d. to 3s. 3d. for common sorts.

The shipping trade continues to show a little more animation, and so far as the quantity of coal being moved away is concerned, there is a fair business being done. Prices, however, continue as low as ever, and delivered either at Garston Docks, or on the high-level, Liverpool, Lancashire steam coal is still being offered at 6s. 6d. to 7s. per ton, with good seconds house coal to be bought at 8s. 3d. to 8s. 6d. per ton.

A good demand is maintained for coke, and local makes at the ovens are firm at from 9s. for common up to 11s. and 12s. per ton for the best qualities.

There is no sign of any early termination of the colliers' strike in the St. Helen's district, both employers and men being very determined in the attitude they have taken, and as I anticipated the struggle is likely to be a protracted one.

Barrow.—Although last week's prices for hematite pig iron are still quoted in the market, I am in a position to know that a large amount of business has been done at 59s. 6d. and 60s. per ton for best qualities of Bessemer. In cases were makers are well sold forward, they demand and obtain the highest figure. No. 1 Bessemer is quoted at 58s. 6d.; No. 2, 57s. 6d.; No. 3, 56s. 6d. net, f.o.b. West Coast ports. A few second-hand parcels are offering at 57s. 6d., but there is not much of this in the market. The output is very heavy, but not large enough to meet the demand, although furnaces are being blown in at different places throughout the district. An increased demand from all quarters is the chief feature of the week, and this is particularly the case with regard to America. Exports continue on a very extensive scale, principally on account of shippers having held cargoes back as long as possible with a view to obtaining low freights. Steel rails are in large demand, and orders for a few heavy parcels have been booked. Other qualities are also in request. Prices are as last quoted. Iron ore has advanced in price, and is quoted at 14s. 6d. to 16s. 6d. per ton at the mines. The demand is heavy, and raisers are being well sold forward. Iron shipbuilders unchanged. Other industries are in full work and are well placed with orders. Coal and coke firm. Shipping active.

Owing to the increased demand which has set in for iron ore, raisers are extending their boring operations a good deal, with a view of meeting the demand. In South Cumberland, near Millom, several new bore holes have been sunk, and it is quite probable that some fine veins of ore will be discovered, as the indications are very encouraging.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THERE is, if anything, a slight change for the better in the iron trade. Prices are firmer, though not firm enough to justify any advance. In the coal trade there is no improvement to speak of. Messrs. Newton, Chambers, and Co., Limited, quote Mortomley coal as follows:—Mortomley best Silkstone, 12s. 1d. per ton; Mortomley thin seam, 10s. 10d.; Mortomley best nuts, 8s. 4d.; Mortomley brights, 8s. 9d. In manufacturing and similar fuel there has latterly been a fairly good business done; but the supply is so far in excess of the demand that no hope of any advance in prices can be entertained for some time.

Local steel manufacturers are expecting a very heavy contract to be put into the market early next month. It is for the new Forth Bridge, and it is calculated that if the current prices for steel bridge plate be paid, the cost of the steel needed for the bridge will be close upon half a million sterling. At the last competition for tenders for the bridge which was abandoned the Sheffield firms were successful in obtaining an important portion of the contracts, and though the work was not proceeded with, they did very well out of the affair.

Steel rails are now freely quoted at from £5 7s. 6d. to £5 15s. per ton at the works, £5 10s. is about the average. Messrs. Steel, Tozer, and Hampton, Phœnix Bessemer Works, Ickles, have just finished a contract for the Indian Government, and Messrs. Cammell and Co., in conjunction with the same firm, have completed delivery of an extensive order for 24,000 tons of steel rails, which they took between them. An order for the Midland Company, divided between these firms and S. Fox and Co., Deepcar, has also been executed.

The wagon companies are now issuing their reports. Generally, they have done very well during the half-year ended 30th June last. The North Central Wagon Company—Rotherham—announce a dividend at the rate of 8 per cent. per annum, add £300 to the reserve fund, and carry forward a balance of £19 15s. 8d. The directors express their regret at continuing to receive complaints of the unremunerative state of the coal trade; at the same time they observe that the exports of manufactured goods are still on the increase, which implies increased consumption of coal, and it is to be hoped a corresponding benefit to the various tenants of the company. The British Wagon Company, Limited, pay a dividend of 6 per cent. per annum, place £500 to the credit of the reserve fund, and carry forward a balance of £264. The Wakefield Rolling Stock Company, Limited, pay a dividend of 4 per cent. per annum. The British Company have 8200 wagons, and the Wakefield Company 1780.

At the annual meeting of the shareholders of the Tinsley Rolling Mills Company, Limited, on Tuesday, the directors' report and accounts were adopted, and a dividend of 12s. per share, being equal to 10 per cent. per annum, was declared.

The Sheffield Telephone Exchange makes rapid progress. The number of messages last week was 7658, being the highest weekly total since its establishment. On Wednesday from ten to eleven no fewer than 306 calls were recorded, the number during the day being 1346.

On Tuesday the Great Eastern Railway Company commenced running passenger trains through to Lincoln and Doncaster, over the new Great Eastern and Great Northern joint line from Spalding to Lincoln. The new line, which is a continuation of the Great Northern's March and Spalding Railway, has been carried out by the Great Eastern and Great Northern Joint Committee, who will work it together. By this extension the Great Eastern establish communication between South Lincoln and East London, which will at present be specially valuable to them for coal traffic to the metropolis. A direct service of passenger trains is to be established between Liverpool-street and Doncaster, but for the present the section will not be used in that way. The cost of the joint line between Spalding and Lincoln has been about £1,000,000.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE relapse of the Glasgow pig iron market had comparatively little effect upon its Cleveland rival at Middlesbrough on Tuesday last. Makers' prices for No. 3 g.m.b. ranged from 44s. 6d. to 45s. 4½d. f.o.b., according to the state of their books. Most of them seemed indifferent as to making sales, being able to wait for some time. Merchants, however, were not so careless as to the future, and were offering to sell at from 44s. to 44s. 6d. The demand from Scotland has lately increased, owing to the greater difference between the prices current in the two districts; but now that that difference is again diminished, the coasting trade will no doubt again receive a check. Warrants are at present the cheapest form in which pig iron may be bought, being obtainable at 44s. per ton, f.o.b.

The quantity of iron in Connal's Middlesbrough stores is 118,923 tons, or 640 tons less than a week ago.

The statistics of shipments from the port of Middlesbrough for the month of July have been issued. They show a total of 74,311 tons, against 87,595 for July, 1881, and 82,306 tons for July, 1880. This is a serious diminution, the reason for which is not clear. The decrease is spread pretty equally over all outlets, except Holland, where the trade is well maintained.

By the award of Sir J. W. Pease, M.P., an increase of 2½ per cent. in the wages of ironworkers commenced with Monday last, and a similar and further increase will take place in seven weeks time. The award terminates altogether on the 1st of October, when it is expected that a reduction will take place.

A petition has been sent by the Middlesbrough ironmasters to the War-office, referring to the retention under arms of the militiamen for double the ordinary period of time. It is represented that this produces great hardship to the families of the men, for whom provision is seldom made, and to employers of labour who need the services of the men.

A great sensation was produced on 'Change by the announcement that the Moor Ironworks, Stockton, lately in the occupation of Messrs. Johnson and Reay, had been purchased by Mr. A. J. Dorman, of the Britannia Works, Middlesbrough. The works in question have hitherto been owned by Messrs. J. Backhouse and Co., bankers, and were leased by them to Messrs. Johnson and Reay. This relationship was, however, not publicly known until the failure of the tenants a month or two since. Negotiations have been for some in progress for the purchase of the works by certain of the creditors, with a view to carrying them on for the benefit of all who would take part in the arrangement. Owing, however, to differences of opinion among these creditors, and to the delays consequent thereon, the offer made by the bankers lapsed. Immediately Mr. Dorman, backed up by another wealthy creditor, made an offer which was accepted, and the transaction was immediately made known on 'Change. The purchase price was £40,000, the amount advanced by the bank, and which gave the power of sale. Inasmuch as the works are capable of manufacturing from 900 to 1000 tons of plates per week, and contains three or four mills and other appliances to suit, and stands on a considerable acreage of valuable ground, it is believed Mr. Dorman has got a bargain. What he will do with it is probably not yet decided. It is thought, however, that he will sell it at once to a new limited company for a higher price, and thus realise an immediate and certain profit upon his purchase while he can.

The week after next the whole of the manufactured ironworks in the Cleveland district will be entirely laid off for Stockton races. The knowledge of this impending cessation is causing great pressure from consumers, and a corresponding stiffening of prices, especially for prompt delivery. Plates are now quoted at £6 15s. for deferred, and £7 per ton for prompt delivery. Angles and bars are to be had at £6 5s. to £6 10s. Old rails are offered at £3 12s. 6d. in the Tees, and purple ore at 18s. 6d. per ton delivered Middlesbrough.

There is a rumour that some large manufactured ironworks in the county of Durham, which have never been successful since they were restarted some time since, are about to discontinue operations altogether, the proprietors, some of whom are wealthy, being tired of working continuously at a loss.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

EARLY this week a severe reaction occurred in the Glasgow pig iron market in consequence, it was stated by brokers, of the critical state of affairs in the East. During the past few weeks very large speculative transactions have been taking place in this market between jobbers almost exclusively, the public taking little or no interest in the business. In consequence of these operations prices were forced up to a rather higher point than seemed to be warranted by the circumstances of the trade, and the result has been a reaction, which induced some of the larger holders to throw their warrants wholesale on the market. Prices were, in consequence, depressed on Tuesday from 2s. to 2s. 6d. below the highest point to which they had attained in the course of the past few weeks. While these speculative fluctuations have been occurring the demand for special brands of makers' iron has undoubtedly been good for consumption, and the foreign trade in pig iron has been maintained upon a larger scale than usual. With reference to the latter department, it has, however, been hinted that purchases have been made for some time forward, and also that ironmasters have been consigning iron to meet prospective wants abroad. The past week's shipments exceed 13,000 tons, as compared with 9000 in the corresponding week of last year. The stock in Messrs. Connal and Co.'s stores has been reduced about 700 tons since the date of last report.

Business was done in the warrant market on Friday forenoon at 51s. 6d. to 51s. 2d. cash, and 51s. 7½d. to 51s. 4d. one month, the quotations in the afternoon being 51s. 4d. to 51s. 3d. cash, and 51s. 5½d. to 51s. 4½d. one month. On Monday the market was flat, with transactions in the forenoon at from 51s. 3d. to 50s. 10d. one month, and 50s. 1d. to 50s. 7½d. cash; in the afternoon business was done from 50s. 10d. to 50s. 8d. one month, and 50s. 8½d. to 50s. 6d. cash. The market was also very weak on Tuesday, with business in the morning at 50s. 5d. to 50s. one month, and 50s. 3d. to 49s. 10½d. cash; the tone was a shade firmer in the afternoon, with business at 49s. 10d. to 50s. 1½d. cash, and 50s. to 50s. 3½d. one month. The tone was a shade firmer on Wednesday, when transactions took place up to 50s. 8d. cash, and 50s. 10d. one month. To-day—Thursday—business was done at 50s. 7½d. to 51s. cash, and 51s. 1½d. one month.

Makers' prices are rather weaker, but in reality not much changed from those of last week. The quotations are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton No. 1, 63s.; No. 3, 56s.; Coltness, 66s. and 56s.; Langloan, 64s. and 56s. 6d.; Summerlee, 62s. and 54s.; Calder, 62s. and 53s. 6d.; Carnbroe, 55s. and 52s.; Monkland, 52s. and 50s. 6d.; Quarter, 52s. and 50s. 6d.; Govan, at Broomielaw, 52s. and 50s. 6d.; Shotts, at Leith, 63s. and 56s.; Carron, at Grangemouth, 53s.—specially selected, 56s.—and 52s.; Kenneil, at Bo'ness, 52s. and 51s.; Glengarnock, at Ardrossan, 55s. 6d. and 52s.; Eglinton, 53s. and 52s. 6d.; Dalmellington, 53s. and 52s. 6d.

The week's arrivals of pig iron from Middlesbrough amounted to 4698 tons as compared with 5015 in the corresponding week of 1881. Up till date there is a decrease for the year on these imports of 34,693 tons, the total import so far being 139,511 tons.

The manufactured iron trade is brisk, and there are expectations of increased orders for shipping purposes. Founders continue busy, and makers of bars are well occupied. Manufacturers were unable to obtain an advance in prices equivalent to that in the pig iron market, and now that the latter has slackened and quotations have fallen, they are not likely to obtain higher contract terms at present.

It is all but finally arranged that the manufacture of steel on the Thomas-Gilchrist process plan will be commenced as early as possible at Coatbridge. The Glasgow Iron Company's furnaces are to be used, and they will have large shareholders in the concern.

Several extensive orders for war material have been placed by the Government in Glasgow. The Anderston Foundry Company has despatched by the Allan Line steamer Canadian a large portion of an order for combined iron rails and sleepers. In construction, the sleeper consists of a trough of malleable iron, the chair, the usual railway one, being fastened to the principal or convex side of the sleeper by screw, bolt, and nut. Messrs. P. and W. McLellan, of the Clutha Ironworks, are also executing considerable orders for war material, including a number of cranes, some of which they have ready for consignment.

The coal trade has been considerably more active in the past than in the preceding week. The shipments from the various ports amount to about 73,000 tons as compared with 56,000 in the corresponding week of last year. There has been some talk of making an effort to advance prices, but it is doubtful whether such a thing can be carried into effect owing to the extensive supplies of coals which are always to be had. The miners are working very industriously everywhere, and there is little difficulty in executing the largest possible orders. These remarks apply particularly to the West of Scotland. In Fifeshire the coalmasters have intimated an advance, which, for the most part, is merely returning to themselves a reduction previously made in prices, so that the increase on their part is not likely to have much effect in other districts of the country.

A proposal is made by the directors of the Clyde Coal Company, Limited, that its Spittalhill collieries be sold to a new company, in which the shareholders of the present company would have the opportunity of taking shares. It is believed that, by some such arrangement, the collieries could be worked in a profitable manner. The opinion of the shareholders will be taken on the subject.

The Burntisland Oilworks, which have been undergoing reconstruction during the past nine months, have been partially reopened this week. The shale mine in connection with the works has a daily output of 300 tons, which will yield 3,000,000 gallons of oil per annum. The company is erecting 100 dwelling-houses, to provide accommodation for its workpeople.

The death of Provost Weems, of Johnstone, at the comparatively early age of forty-six, has occasioned much regret in the West of Scotland. He was senior partner in the firm of J. and W. W. Weems, of the Perseverance Ironworks, and took a leading share in the public business of the town in which he resided, and of which he was appointed chief magistrate at the beginning of the present year, after a service of fourteen years in the Town Council.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

A GOOD sign of the improvement in the iron trade has been given by the launching of the De Bergue Works, Llandaff, as a tramway, locomotive, and marine engine works, limited. The company starts with a capital of £100,000 in shares of £10 each, and several leading men of Cardiff are in the movement. It has long been a mystery to me why such compact works so near the seaboard were left to rust and decay. The restart may be taken as a good augury.

Mr. Wm. Evans, late of Rhymney, is named as the new manager for Cyfarthfa. Mr. Wm. Evans is one of the numerous body of men who have been grounded in ironmaking at Dowlais; he has also had considerable practical experience at Rhymney Steel Works.

The Bute Dock Bill has virtually passed, only a few minor clauses remaining for discussion. The Bill was one of the most skilful and happiest achievements of the many gained by Mr. W. T. Lewis, and this notwithstanding the concessions made by the ironmasters in the course of carrying the Bill. One of these was to give the dock owner power to stop the "tip nursing" which has been so glaringly carried on. The freighters also are to be allowed to employ their own group of workmen, and thus supervise, as they so much wished, the loading of their own cargoes. The vital point of the Bill was remuneration henceforth for services hitherto rendered by the dock owner gratuitously, and this has been gained. The committee approve of the preamble of the Bill subject to certain conditions. One of these is that the dock shall be built in three instead of five years, that the time of demurrage should extend from forty-eight to seventy-two hours, and the license for boatmen, &c., be reduced from £1 to 5s. These were the most important of the few clauses that now only remain for discussion, and we cannot doubt of their being easily discussed and accepted. It is estimated that, taking the present average of coal output from Glamorgan as a basis, that by the time the dock is completed we shall have doubled it. Last week Cardiff shipped away foreign and coastwise 126,981 tons of coal, and the total, including all Wales, was a little over 189,000 tons.

There is a steady improvement in coal business to the North of France, and a very brisk character has also been imparted to the Mediterranean trade. Taking the three principal coal ports, Cardiff, Swansea, and Newport, the first and last seem of late to enjoy a greater share than Swansea. I hear little of the new dock, but there is a wise movement being quietly placed on foot to convert the Neath Canal into a railway and link the Rhondda by it and Swansea, as well as dovetail into the London and North-Western system. A considerable saving in distance to the North would be gained by it, and there are several other features which commend it. I shall note this more at length when it has been fully thought out. It is originated by one who has the most intimate acquaintance with the extent and capacity of the industries of Wales.

I am glad to note an increase in iron and steel shipments. Last week the following cargoes left Newport:—Baltimore, 1800 tons; Cape Town, 1600; Stockholm, 1080; Vera Cruz, 2020; Pomaron, 280; Figuema, 90.

Iron ore shipments to Wales continue steady, principally from Bilbao, though of late some consignments have been made from Ireland.

Tin-plate is moving up slowly. The price of ordinary coke plate at Llanelly is 16s. 3d., and at Swansea some parcels have been sold from 16s. 6d. These prices are regarded as suicidal ones, but in cases of pressure there is no alternative but to sell. An effort is being made at Swansea to start another dry dock movement.

The new railway from Llangammarch to Neath will open out a new district. I was in that quarter lately, and noted in the neighbourhood of the mineral wells all the indications, shale, &c., which accompany mineral deposits. There is evidently a future there for capital and enterprise.

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.

25th July, 1882.

3512. Bouyant Garments, F. W. Brewster, London.
3513. Telephones, S. Bidwell, London.
3514. Pipe Couplings, M. H. Simpson, Lancaster.
3515. Distributing Lights, A. P. Trotter, Cambridge.
3516. Splints, H. Hides.—(*E. Porteous, Antwerp.*)
3517. Safes, W. Corliss, Providence, U.S.
3518. Spring Slides, M. Millington, Nottingham, and R. Burton, London.
3519. Excavating, W. E. Gedge.—(*Messieurs Gabert frères, Bridet, and Dernad, Lyons.*)
3520. Electric Lamps, A. L. Lineff, London.
3521. Attaching Handles, H. J. Haddan.—(*A. Czepelka, Vienna.*)
3522. Metallic Alloys, C. J. L. Leffler, Sheffield.
3523. Gas Burners, D. and W. H. Thompson and J. Booer, Leeds.
3524. Packing, W. R. Lake.—(*E. Degrave, Paris.*)
3525. Penholders, J. A. Pickering, London.
3526. Rotary Engine, E. Brewer.—(*S. Marcus, Vienna.*)
3527. Coupling Clutches, E. J. Sterling, Brooklyn.
3528. Secondary Batteries, C. E. Buell, New Haven.
3529. Fire-escapes, F. Hoe, Burton-on-Trent.
3530. Self-binders, C. Q. Basevi, London.
3531. Railway Communication, F. Hoe, Burton-on-Trent.
3532. Secondary Batteries, C. L. Winch, London.
3533. Taps, W. Hunt, Scarborough.
3534. Electromotors, O. W. F. Hill, Gunnersbury.
3535. Needles, J. Hewitson and W. Napier. Liverpool.
3536. Pipe Couplings, W. H. Beck.—(*J. L. B. Bodel and J. L. F. Braur, Paris.*)
3537. Cutting Metal, W. P. Thompson.—(*E. Salomon and E. Armant, Montreal.*)
3538. Permanent Way, A. M. Clark.—(*J. Elmer, U.S.*)
3539. Fabrics, J. Jowitt and G. S. Page, London.

26th July, 1882.

3540. Thermo-dynamic Engines, J. Hargreaves, Widnes.
3541. Methylquinoline, J. Erskine.—(*Meister, Lucius, and Brüning, Germany.*)
3542. Washing Fabrics, B. Davies, Adlington, and J. Eckersley, Blackrod.
3543. Grinding Wheels, J. Robinson, Manchester.
3544. Electric Meter, W. Laing, London.
3545. Ingots, J. Gjers, Middlesbrough-on-Tees.
3546. Demonstrating Motion, H. J. Haddan.—(*G. Rudholzner, Germany.*)
3547. Cables, J. G. Lorrain.—(*J. André, Paris.*)
3548. Extinguishing Fire, A. M. Clark.—(*P. C. E. Tabourët, Paris.*)
3549. Throwing Projectiles, W. A. Barlow.—(*A. J. Krebs, Vienna.*)
3550. Fire Apparatus, C. S. Beauchamp, London.
3551. Pumps, W. R. Lake.—(*A. Burckhardt and F. J. Weiss, Basle.*)
3552. Separating Grain, W. Lake.—(*C. McNeal, U.S.*)
3553. Lubricating Bosses, W. R. Lake.—(*P. Decauville, Paris.*)
3554. Ventilators, J. L. Thomasson, Worcester.

27th July, 1882.

3555. Tell-tales, C. R. F. Schloesser.—(*Messieurs Kreutz and Bauer, Vienna.*)
3556. Lowering Boats, C. Grayson, Liverpool.
3557. Telephonic Appliances, J. Munro and B. Warwick, London.
3558. Velocipedes, J. S. Orton, Birmingham.
3559. Locking Devices, H. J. Haddan.—(*J. B. Fondu-Bloemendal, Belgium.*)
3560. Liquid Meters, H. Haddan.—(*T. Calkins, U.S.*)
3561. Drawing Tines, J. Imray.—(*P. E. Bird, U.S.*)
3562. Treating Sewage, J. Young, Kelly.
3563. Furnaces, A. Beard, Swansea.
3564. Furnaces, B. Finch, London.
3565. Adjusting Ventilators, H. Morris, Manchester.
3566. Looms, T. Singleton, Darwen.
3567. Pocket Cases, P. Everitt, London.
3568. Hoes, J. P. Goss and F. Savage, King's Lynn.
3569. Finishing Fabrics, W. W. Blackett, Leeds.
3570. Electric Lamps, F. M. Newton, Barton Grange.
3571. Breaking Stone, G. Dalton, Leeds.
3572. Clocks, W. R. Lake.—(*R. W. Willson, U.S.*)
3573. Ornamental Windows, A. L. Liberty, London.
3574. Governors, W. R. Lake.—(*J. Judson, U.S.*)
3575. Electric Lamps, J. G. Lorrain, London.
3576. Distributing Electricity, J. Hopkinson, London.
3577. Caustic Soda, A. Boult.—(*H. Herberts, Barmen.*)
3578. Impregnating Wood, W. P. Thompson.—(*L. L. de Paradis, Vienna.*)

28th July, 1882.

3579. Engines, J. B. Fell, Sparke Bridge.
3580. Spinning Machinery, J. Holmes, Allerton.
3581. Brakes, A. Fisher, Nottingham, and J. S. Walker, Wigan.
3582. Regulating Currents, L. Campbell, Glasgow.
3583. Electric Lamps, W. T. Henley, Plaistow.
3584. Pianofortes, W. A. Waddington, Stonegate.
3585. Facilitating References, A. Gerken, London.
3586. Toy Savings Banks, W. Lake.—(*J. Bowen, U.S.*)
3587. Head Coverings, J. F. Watson, Anerley.
3588. Safety Lamps, W. L. Wise.—(*La Compagnie Houillère de Bessèges, Nimes.*)
3589. Casks, S. Wright, Egremont.
3590. Roller Mills, A. Reddie.—(*H. Requier, Paris.*)
3591. Electric Power, J. Imray, London.
3592. Secondary Batteries, F. J. Bolton, London.
3593. Treating Grain, A. Reddie.—(*D. Requier, Paris.*)

29th July, 1882.

3594. Glass, W. S. Sutherland, Birmingham.
3595. Telegraph, J. H. Johnson.—(*E. Estienne, Paris.*)
3596. Hats, R. Wallwork, Manchester.
3597. Awnings, O. Seydel, Birmingham.
3598. Grabs, J. T. Jones and J. H. Wild, Leeds.
3599. Needles, J. Darling, Glasgow.
3600. Tricycles, J. P. Dalby, Leeds.
3601. Rinsing Apparatus, G. W. von Nawrocki.—(*Zeitzer Eisengiesserei and Maschinen-Aktien-Gesellschaft, Zeitz.*)
3602. Cleaning Wool, O. Imray.—(*La Société Harmel Frères, France.*)
3603. Buttons, C. Daggett, London.
3604. Roundabouts, A. Waddington and J. C. Rowbotham, Bradford.
3605. Driving Chains, W. Hartcliffe, Salford.
3606. Rolling Steel, W. T. Beesley, Sheffield.
3607. Producing Light, S. R. Smith, London.
3608. Obtaining Sulphur, D. Sidersky and H. Probst, Rositz, Germany.

31st July, 1882.

3610. Obtaining Products, J. Alexander and A. K. McKosh, Gartsherrie Ironworks.
3611. Supplying Gas, A. Haley & A. Savage, London.
3612. Haulage Clips, J. Walker, Derby.
3613. Stoves, A. Henderson.—(*Besson and Co., Paris.*)
3614. Illuminating Gratings, T. Hyatt, London.
3615. Looms, J. Hopkinson, Birstal.
3616. Electricity, J. R. Rogers, London.
3617. Dressing Flour, W. B. Dell.—(*G. T. Smith, U.S.*)
3618. Discharging Oil, J. Gordon, jun., Dundee.
3619. Electric Lighting, J. Verity, London.
3620. Horseshoes, F. Engel.—(*O. Lampe, Hamburg.*)
3621. Uniting Amber, W. Morgan-Brown.—(*B. Borowsky, Germany.*)
3622. Brakes, G. E. Vaughan.—(*J. Charlier, Nimes.*)
3623. Lamp Burners, H. W. Hayden, Waterbury.
3624. Sleeping Berths, E. Lawson, Birmingham, and E. de Russett, Anerley.
3625. Cartridges, C. S. Bailey, Waltham Abbey.
3626. Textile Fibres, W. J. S. Grawitz, France.
3627. Stop Motions, H. J. Haddan.—(*L. Knowles, U.S.*)
3628. Looms, H. J. Haddan.—(*L. J. Knowles, U.S.*)
3629. Stop Motion, H. J. Haddan.—(*L. Knowles, U.S.*)
3630. Motor, H. J. Haddan.—(*G. Rupalley, Paris,*)
3631. Amber Varnish, W. Morgan-Brown.—(*B. Borowsky, Germany.*)
3632. Steam Engines, D. Forbes & J. Hayes, London.
3633. Tachygraphical Apparatus, H. H. Lake.—(*V. A. de Celeda. Cadiz.*)
3634. Bobbin Frames, H. H. Lake.—(*R. Cookson, U.S.*)
3635. Flour, H. H. Lake.—(*R. S. Schmidt, Berlin.*)
3636. Separating Ores, T. S. G. Kirkpatrick, London.
3637. Operating Signals, A. C. Emery, Dalston.

Inventions Protected for Six Months on Deposit of Complete Specifications.

3489. Transforming Rum, H. A. Bonneville, London. —A communication from D. Cornilliac, Paris.—*22nd July*, 1882.
3519. Excavating Machinery, W. E. Gedge, London. —A communication from Messieurs Gabert frères, Bridet, and Dernad, Lyons.—*25th July*, 1882.
3574. Governors, W. R. Lake, London.—A communication from J. Judson, Rochester, U.S.—*27th July*, 1882.

Patents on which the Stamp Duty of £50 has been paid.

1010. Soles, F. B. Lecky and W. H. Smith, Glasgow. —*14th March*, 1879.
3025. Forge Hammers, H. Simon, Manchester.—*25th July*. 1879.
3035. Cable Holders, J. Mitchell and D. J. Cocks, Glasgow.—*25th July*, 1879.
3036. Paper Bags, H. Planche, Paris.—*25th July*, 1879.
3027. Velocipedes, W. Hillman, Coventry.—*25th July*, 1879.
3057. Regulating Water, W. White, London.—*26th July*, 1879.
3056. Washing Machines, R. D. Bennett, Manchester. —*26th July*, 1879.
3069. Enamelling Castings, C. Kesseler, Germany.— —*28th July*, 1879.
3113. Coupling Buffers, C. Turton, London.—*31st July*, 1879.
3060. Pyrometers, A. Budenberg, Manchester.—*28th July*, 1875.
3090. Perambulators, C. F. Owen, Manchester.—*30th July*, 1879.
3100. Teaching Music, W. E. Gedge, London.—*30th July*, 1879.
3138 Sharpening Machines, W. Clark, London.—*4th August*, 1879.
3150. Fence Wire, A. M. Clark, London.—*5th August*, 1879.
3154. Pencil Cases, J. Maclenahan, Belfast.—*5th August*, 1879.
3169. Cutting Veneers, A. M. Clark, London.—*6th August*, 1879.
3494. Sewing Machines, A. M. Clark, London.—*30th August*, 1879.
3075. Files, W. R. Lake, London.—*29th July*, 1879.
3078. Exhausting Apparatus, H. E. Newton, London. —*29th July*, 1879.
3089. Cleaning Lamps, W. Ackroyd, jun., and W. Best, Morley.—*30th July*, 1879.

Patents on which the Stamp Duty of £100 has been paid.

3132. Working Guns, A. Longsdon, London.—*7th September*, 1875.
3149. Railway Wheels, A. Longsdon, London.—*8th September*, 1875.
2674. Weaving, J. O. Evans, Manchester.—*28th July*, 1879.
2675. Treating Sewage, J. Hanson, Saville Town.— *28th June*, 1875.
2676. Chaff-cutting Machines, J. Whitaker, Rhuddlan.—*28th July*, 1875.
3677. Wagons, R. Hudson, Gildersome.—*28th July*, 1875.
2661. Measuring Cloth, W. R. Lake, London.—*27th July*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 18*th August*, 1882.

1379. Fire Buckets, J. M. B. Baker, London.—*22nd March*, 1882.
1385. Electric Thermometer, J. Formby, Formby.— *22nd March*, 1882.
1406. Corkscrews, W. J. Holroyde, Manchester.— *23rd March*, 1882.
1411. Spinning Flyers, R. C. Sykes, Cleckheaton.— *23rd March*, 1882.
1412. Electric Lighting, O. E. Woodhouse and F. L. Rawson, London.—*23rd March*, 1882.
1428. Steeping Tanks, R. Free, Mistley.—*24th March*, 1882.
1432. Flushing Tanks, W. Bartholomew, Lambeth.— *24th March*, 1882.
1442. Beater Bars, C. Green, Lincoln.—*25th March*, 1882.
1443. Measuring Appliances, J. Armstrong, New Swindon.—*25th March*, 1882.
1444. Electric Lighting, R. Werdermann, Surrey.— *25th March*, 1882.
1452. Chucks, J. M. Alling, London.—A communication from A. Y. Alling.—*25th March*, 1882.
1456. Tanning Hides, A. C. Henderson, London.—Com. from Casimir Bez and Sons.—*27th March*, 1882.
1474. Steam Engines, W. R. Lake, London.—Com. from E. D. Farcot.—*27th March*, 1882.
1547. Excavating Machinery, T. Abbott, Newark-on-Trent, and G. S. Moore, Sunderland.—*30th March*, 1882.
1577. Copper Tubes, S. Walker, Birmingham.—*31st March*, 1882.
1580. Electric Lamps, Sir D. Salomons, Broomhill.— *31st March*, 1882.
1626. Electric Light, J. Munro, West Croydon.—*4th April*, 1882.
1641. Measuring Liquids, J. M. Smales, Leavesden, and H. J. Rogers, Watford.—*5th April*, 1882.
1643. Buttons, G. W. von Nawrocki, Berlin.—A communication from C. Brandt.—*5th April*, 1882.
1661. Mills, W. R. Lake, London.—A communication from N. W. Holt and R. K. Noye.—*5th April*, 1882.
1683. Peroxides, &c., L. Mond, Northwich.—*6th April*, 1882.
1692. Dynamo-electric Machines, D. T. Piot, London. —*6th April*, 1882.
1701. Rotary Motors, W. J. Gurd, Sarnia.—*8th April*, 1882.
1702. Rotary Motors, W. J. Gurd, Sarnia.—*8th April*, 1882.
1775. Bleaching Hemp, A. C. Henderson, London.— Com. from A. Demeurs.—*14th April*, 1882.
1795. Nut Blanks, &c., A. M. Clarke, London.—Com. from A. Marland and T. Neely.—*14th April*, 1882.
1798. Boots and Shoes, J. Wetter, Surrey.—A communication from S. K. Hindley.—*15th April*, 1882.
1895. Electric Lighting, P. M. Justice, London.— Com. from A. Cruto.—*20th April*, 1882.
2082. Iron and Steel, T. Lishman, West Hartlepool.— *3rd May*, 1882.
2440. Rotary Engines, H. J. Haddan, London.—Communication from L. J. Wing.—*23rd May*, 1882.
2492. Cutting Machine, W. R. Lake, London.- Com- from R. D. Evans and R. M. Green.—*25th May*, 1882.
3047. Telephone Receivers, W. Spence, London.—A communication from M. Kotyra.—*28th June*, 1882.
3048. Insulating Wires, G. Macaulay-Cruikshank, Glasgow.—Com. from W. E. Banta.—*28th June*, 1882.
3101. Arc Electric Lamps, R. H. Courtenay, London. —*30th June*, 1882.
3157. Hydraulic Motor, G. W. von Nawrocki, Berlin. —A communication from F. K. Theis, A. Meckel, and L. A. Simons.—*4th July*, 1882.
3167. Railway Signalling, D. Knight, Cambridge.— *5th July*, 1882.
3489. Brandy, &c., H. A. Bonneville, London.—Com. from D. Cornilliac.—*22nd July*, 1882.

Last day for filing opposition, 22*nd August*, 1882.

1459. Field Forge, L. A. Groth, London.—A communication from A. F. Hammel.—*27th March*, 1882.
1460. Block Ice, C. D. Young, London.—*27th March*, 1882.
1469. Tube Beaders, J. A. Frieake and T. McCormick, London.—*27th March*, 1882.
1492. Folding Beds, J. Rycroft, Manchester.—A communication from E. S. Griffith.—*28th March*, 1882.
1498. Metallic Shingles, W. R. Lake, London.—Com. from C. Comstock.—*28th March*, 1882.
1519. Rail Chair, W. J. Boaler, London.—*29th March*, 1882.
1520. Looms for Weaving, J. C. Rouse, Halifax.—*29th March*, 1882.
1523. Looms for Weaving, R. Hindle and G. Greenwood, Blackburn.—*29th March*, 1882.
1532. Furnaces, A. J. Boult, London.—A communication from M. Gros-Desormeaux.—*29th March*, 1882.
1540. Clutch, F. W. T. C. Cordua, London.—A communication from C. M. E. Kortum.—*30th March*, 1882.
1549. Steelyards, A. J. Boult, London.—Com. from P. Arnaud and L. Gaytté.—*30th March*, 1882.
1551. Steadying Mechanism, J. S., T. A. and E. R. Walker, Wigan.—*30th March*, 1882.
1562. Registering Indicator, H. Lyon, London.— *31st March*, 1882.
1571. Screw Buttons, E. A. Brydges, Berlin.—Com. from B. Fischer.—*31st March*, 1882.
1575. Metallic Shingles, W. R. Lake, London.—Com. from R. Seaman.—*31st March*, 1882.
1578. Anæsthetics, W. R. Lake, London.—Com. from S. Cooper and E. Dennis.—*31st March*, 1882.
1584. Fireplaces, G. L. Shorland, Manchester.—*1st April*, 1882.
1600. Electrical Apparatus, G. W. von Nawrocki, Berlin.—Com. from F. Bahr.—*1st April*, 1882.
1606. Block Apparatus, H. J. Haddan, London.— Com. from A. Flamache.—*3rd April*, 1882.
1624. Driving Tunnels, C. D. Abel, London —Com. from F. Rziha and F. Reska.—*4th April*, 1882.
1647. Electric Lamps, St. G. L. Fox, London.—*5th April*, 1882.
1681. Brakes, &c., J. P. Davies, Chester.—*6th April*, 1882.
1740. Stove, A. Browne, London.—A communication from L. Bregha.—*12th April*, 1882.
2269. Harrows, R., J., and H. Wilder, Wallingford.— *15th May*, 1882.
2381. Hot Blast Stoves, E. A. Cowper, London.—*20th May*, 1882.
2887. Counting Apparatus, F. Peterson and J. H. R. Dinsmore, Liverpool.—*19th June*, 1882.
2953. Boots, P. Lehany, London.—*21st June*, 1882.
3094. Washing Wool, J. and F. W. Petrie, Rochdale. —*30th June*, 1882.
3159. Extracting Grease, G. W. von Nawrocki, Berlin.—Com. from J. Wellstein.—*4th July*, 1882.
3194. River Weirs, F. Wiswall and W. H. Collier, Manchester.—*6th July*, 1882.
3198. Walls of Houses, T. N. Sully, Wellington.—*6th July*, 1882.
3317. Railway Brakes, J. Imray, London.—A communication from A. Wenger.—*12th July*, 1882.
3411. Power Looms, R. J. Gülcher, London.—*18th July*, 1882.
3519. Excavating Machinery, W. E. Gedge, London. —A communication from Messrs. Gabert Brothers, Bridet, and Deruad.—*25th July*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 28th July*, 1882.)

469. Boilers, &c., J. Parkinson, Caton.—*31st January*, 1882.
491. Machine Guns, O. Jones, Philadelphia, U.S.—*31st January*, 1882.
497. Electro-magnets, G. Little, Passaic, U.S.—*1st February*, 1882.
499. Sizing Hanks, J. Conlong, Blackburn, and J. Robertshaw, Manchester.—*1st February*, 1882.
500. Brakes, W. B. Holbech, Huncote.—*1st February*, 1882.
503. Lamps for Bicycles, H. Salsbury, London.—*1st February*, 1882.
512. Steering Gear, T. Archer, jun., Dunston.—*2nd February*, 1882.
514. Blast Furnaces, J. Brown, London.—*2nd February*, 1882.
515. Silvering Glass, J. E. Pratt, Camberwell.—*2nd February*, 1882.
570. Purifying Gases, W. S. R. Jackson, Llansamlet. —*6th February*, 1882.
586. Lasts, J. L. Sharman, Northampton.—*7th February*, 1882.
587. Weighing Machines, T. Williams, jun., London. —*7th February*, 1882.
604. Decorticating Plants, A. Berthet, Paris.—*8th February*, 1882.
628. Twin-screw Ships, T. R. Oswald, Southampton. —*9th February*, 1882.
637. Shaft Couplings, W. R. Lake, London.—*9th February*, 1882.
672. Welding Metals, C. D. Abel, London.—*11th February*, 1882.
673. Air Refrigerating, T. B. Lightfoot, London.— *11th February*, 1882.
713. Valve Cock, W. R. Lake, London.—*14th February*, 1882.
720. Ovens, C. D. Abel, London.—*14th February*, 1882.
814. Colouring Matter, C. D. Abel, London.—*20th February*, 1882.
847. Sash Pulley, W. Meakin, London.—*21st February*, 1882.
886. Spinning Fibres, F. Ripley and T. H. Brigg, Bradford.—*23rd February*, 1882.
890. Testing Pressure, W. C. D. Wit, Amsterdam.— *23rd February*, 1882.
937. Corrugating Machines, V. B. Daelen, Berlin.— *27th February*, 1882.
950. Window Fastenings, W. P. Bonwick, London.— *27th February*, 1882.
1030. Colouring Matters, C. D. Abel, London.—*3rd March*, 1882.
1055. Sugar in Lumps, H. H. Lake, London.—*4th March*, 1882.
1477. Harvesting Machines, B. Samuelson and W. G. Manwaring, Banbury.—*27th March*, 1882.
1494. Treating Gases, P. Spence, Manchester.—*28th March*, 1882.
1650. Steam Engines, J. Penn, Greenwich.—*5th April*, 1882.
1672. Cigarettes, P. Everitt, London.—*6th April*, 1882.
1734. Cleaning Tram Rails, J. Remfry, Calcutta.— *12th April*, 1882.
2002. Excavating Machines, T. R. Crampton, London. —*27th April*, 1882.
2222. Treating Offal, &c., H. J. Haddan, London.— *11th May*, 1882.
2259. Transmission Apparatus, W. C. Barney, London.—*13th May*, 1882.
2294. Disintegrating, R. Prentice, Stowmarket.— *16th May*, 1882.
2296. Compound Funnels, F. Livet, London.—*16th May*, 1882.
2340. Dynamo-electric Machines, C. W. Vincent, London.—*18th May*, 1882.
2407. Explosive Compound, H. H. Lake, London.— *22nd May*, 1882.
2623. Coupling Devices, W. R. Lake, London.—*3rd June*, 1882.

(*List of Letters Patent which passed the Great Seal on the* 1*st August*, 1882.)

425. Damping Paper, A. Stierlin, Manchester.—*27th January*, 1882.
511. Turntables, W. Morris, Birmingham.—*2nd February*, 1882.
524. Valve Gear, J. Jensen, Birkenhead, and C. W. King, Liverpool.—*3rd February*, 1882.
527. Pressing Hay, &c., A. V. Wagner, London.—*3rd February*, 1882.
529. Clarification, S. C. Davidson, Belfast.—*3rd February*, 1882.
538. Accumulators, W. R. Lake, London.—*3rd February*, 1882.
541. Electric Motor, T. Morgan, London.—*3rd February*, 1882.
549. Bleaching Fibre, P. Thomas, Elberfeld.—*4th February*, 1882.
554. Concentrating Milk, F. Springmuhl, London.— *4th February*, 1882.
555. Grape Juice, F. Springmuhl, London.—*4th February*, 1882.
560. Boilers, J. S. Williams, Riverton, U.S.—*4th February*, 1882.
562. Velocipedes, E. R. Settle, Coventry.—*6th February*, 1882.
567. Blasting, E. S. Clark, Cefn-y-bebb.—*6th February*, 1882.
571. Milling Machinery, J. W. Crawford and W. Mellor, Leeds.—*6th February*, 1882.
572. Drying Wool, J. Shaw, Huddersfield.—*6th February*, 1882.
580. Furnaces, W. Morgan-Brown, London.—*7th February*, 1882.
593. Coal, T. Rowan, London.—*7th February*, 1882.
614. Gas Engines, W. H. Haigh and J. Nuttall, Oldham.—*8th February*, 1882.
626. Electric Lamps, A. A. Common, Ealing.—*9th February*, 1882.
731. White Lead, E. V. Gardner, London.—*15th February*, 1882.
734. Looms, W. H. Hacking and E. Grube, Bury.—*15th February*, 1882.
745. Regulating Device, H. H. Lake, London.—*15th February*, 1882.
786. Ventilators, J. M. Lamb, South Hampstead.— *18th February*, 1882.
793. Condensers, A. Craven, Bradford, and G. J. Warburton, Heckmondwike.—*18th February*, 1882.
794. Colouring Leather, W. A. Barlow, London.— *18th February*, 1882.
798. Recovering Soda, H. C. F. Störmer, Paris.—*18th February*, 1882.
1011. Rotary Engines, A. M. Clark, London.—*2nd March*, 1882.
1461. Explosive Compounds, E. Turpin, Paris.—*27th March*, 1882.
1490. Steam Engines, A. Morton, Glasgow.—*28th March*, 1882.
1569. Stoppers for Bottles, W. von Schlieffen, Schlieffenberg.—*31st March*, 1882.
1762. Wire, J. Westgarth, Warrington.—*13th April*, 1882.
1902. Ash Guards, W. Selley, Manchester.—*21st April*, 1882.
2278. Oxide of Lead, H. H. Lake, London.—*15th May*, 1882.
2302. Decorative Transparencies, J. Mitchell, Paris. —*16th May*, 1882.
2319. Fencing Wire, E. G. Rock, London.—*17th May*, 1882.
2526. Dynamo Machines, W. R. Lake, London.—*27th May*, 1882.
2570. Electric Lamps, W. R. Lake, London.—*31st May*, 1882.
2594. Ammunition Boxes, W. R. Lake, London.—*1st June*, 1882.
2596. Organ Pedals, W. C. Dyer, Weston-super-Mare. —*1st June*, 1882.
2632. Electric Lamps, W. R. Lake, London.—*5th June*, 1882.
2646. Car Brakes, S. Pitt, Sutton.—*6th June*, 1882.

List of Specifications published during the week ending July 29th, 1882.

5239, 4d.; 5286, 6d.; 5367, 6d.; 5433, 6d.; 5492, 6d.; 5577, 6d.; 5594, 6d.; 5601, 6d.; 5611, 6d.; 5613, 10d.; 5618, 6d.; 5619, 6d.; 5624, 2d.; 5626, 6d.; 5630, 6d.; 5633, 6d.; 5638, 6d.; 5639, 6d.; 5655, 4d.; 5656, 8d.; 5663, 6d.; 5665, 10d.; 5669, 6d.; 5671, 2d.; 5673, 2d.; 5675, 2d.; 5677, 6d.; 5678, 6d.; 5679, 2d.; 5681, 4d.; 5683, 2d.; 5684, 2d.; 5685, 6d.; 5686, 6d.; 5687, 8d.; 5689, 6d.; 5620, 2d.; 5693, 2d.; 5694, 2d.; 5696, 6d.; 5698, 2d.; 5700, 2d.; 5701, 2d.; 5703, 8d.; 5704, 6d.; 5705, 6d.; 5708, 6d.; 5709, 2d.; 5710, 6d.; 5711, 4d.; 5712, 2d.; 5713, 6d.; 5715, 6d.; 5719, 2d.; 5721, 6d.; 5724, 2d.; 5726, 6d.; 5727, 2d.; 5729, 4d.; 5730, 6d.; 5733, 6d.; 5735, 6d.; 5737, 8d.; 5738, 4d.; 5739, 2d.; 5740, 6d.; 5642, 6d.; 5744, 6d.; 5749, 4d.; 5751, 6d.; 1, 2d.; 3, 4d.; 5, 6d.; 9, 6d.; 13, 4d.; 25, 2d.; 27, 6d.; 28, 2d.; 38, 6d.; 92, 6d.; 109, 4d.; 143, 6d.; 451, 4d.; 1790, 4d.; 2035, 6d.; 2160, 4d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

ABSTRACTS OF SPECIFICATIONS.

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

5239. Haymaking Machine, *W. N. Nicholson and W. Mather, Newark-upon-Trent.*—*30th November*, 1881. 4*d.*

This relates to the methods of connecting the fork bars to their carriers, and to arrangements by which the forks are made to yield to any obstruction, which also allow the angle at which the forks are set to be adjusted.

5286. Improvements Relating to the Production of the Electric Light in Electric Lamps, in the Means for and Methods of Manufacture of the Carbons, &c., *A. R. Sennett, Worthing, Sussex.* —*3rd December*, 1881. 6*d.*

This relates to incandescent lamps. The inventor constructs his carbons of material containing a high percentage of cellulose, such as linen cuttings, &c These are mechanically reduced, and then deposited in layers in a special depositing apparatus connected with an air pump, so that layers of the material of uniform thickness are obtained. It is then inserted in dies and subjected to hydraulic pressure. The air is exhausted from the die before pressure is applied, and the pressure is increased very slowly. The material is then carbonised in a chamber from which the air is exhausted previous to the heat being applied; a stream of vapour of bisulphide of carbon is also caused to pass through this chamber. The carbon is then fixed on to the conductors, there being no material difference in sectional area between the carbon clamps and conductors at the point of junction. The other parts of this invention refer to the supporting of the carbon and attaching the conductor wires, and to exhausting the globe.

5367. Machine for Coating Insulated Electrical Conductors with Lead, *W. R. Lake, London.*— *8th December*, 1881.—(*A communication from H. S. Maxim, Brooklyn, U.S.*)—(*Not proceeded with.*) 6*d.*

Molten lead is pumped into an annular chamber and from thence flows out with the wires to be covered.

5433. LOCKS FOR RAILWAY AND OTHER CARRIAGE DOORS, &c., *W. H. S. Aubin, Bloxwich.—13th December*, 1881. 6d.

The improvements, so far as they relate to locks or fastenings for railway carriage doors, refer to the lock which is morticed into the door, and is opened by means of the usual handle.

5492. RANGE-FINDING, *T. Bolton, Calcutta.—15th December*, 1881. 6d.

This consists in the method of finding a range or distance, by the use of four mirrors, so arranged that their angles of reflection are those of the base of a right-angled triangle whose sides about the right angle are as 1 to 10, 20, or 40, 60, 80, or 120, &c.

5577. ELECTRIC TELEGRAPHS, *Sir J. Anderson and B. Smith, London.—20th December*, 1881. 6d.

The usual way is to have a complete set of instruments for each cable, in which case a message by one cable is received by one instrument and then sent on by another instrument. This apparatus is intended to avoid such retransmission, and to enable messages to be sent direct.

5594. KNITTING MACHINES OR LOOMS, *B. J. B. Mills, London.—21st December*, 1881.—(*A communication from N. W. Westcott, Providence, U.S.*) 6d.

This relates to looms resembling knitting machines of that class wherein a weft or filling is introduced into the warp formed by the knitted or looped fabric.

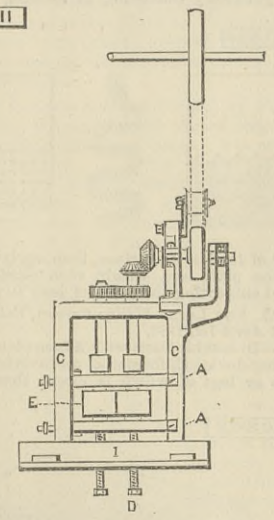
5601. IMPROVEMENTS IN ELECTRICAL BRUSHES AND COMBS, *J. N. Aronson, London.—21st December*, 1881. 6d.

This relates to the combination with a brush or comb of an induction coil and battery.

5611. ROLLING MILLS, *E. Edwards, London.—22nd December*, 1881.—(*A communication from G. Erkenzweig, Germany.*) 6d.

The vertical frame C containing the frames A A and the vertical rolls is capable of moving horizontally in the horizontal foundation plate I for a distance equal to the length of the horizontal rolls, and is also of sufficient height to allow the vertical rolls to be raised or lowered in it through a distance equal to their own

5611



length. The raising or lowering in this manner of the frames A A and the vertical rolls is effected by means of two or more screws D, and they are fixed in any desired position by means of screws E and by keys on the opposite side of the frames A A.

5613. FIRE-ARMS, &c., *B. J. B. Mills, London.—22nd December*, 1881.—(*A communication from J. H. McLean, St. Louis, U.S.*) 10d.

This relates to a fire-arm constructed with a many-chambered revolving cylinder, or with barrels loaded from an automatic magazine or feeder by means of a plunger, and having a shell extractor of novel construction, consisting of a hook or catch working in a circumferential groove in the rear of the revolving cylinder or barrels and retracted by gearing connecting it with the loading plunger.

5618. A NEW OR IMPROVED HOLDER FOR INCANDESCENT ELECTRIC LAMPS, *D. Graham, Glasgow.—22nd December*, 1881. 6d.

This relates to a holder for incandescent lamps. It consists of a block of insulating material, in one end of which a screw thread is cut for attaching the holder to gas brackets, &c. On this block is placed a spring socket for holding the tube of the glass globe, this socket being made in two parts, insulated from one another. Into each of these parts a pinching screw passes, which, when the lamp is in the socket, bears upon two metal tongues joined to the platinum wires of the carbon. These screws form connections between the conducting wires and the lamp. The holder may be provided with a switch for making and breaking contact.

5619. NET HAULING WINCHES AND MACHINES, *C. R. Mitchell, Aberdeen.—23rd December*, 1881. 6d.

This relates to the general combination of the parts of net hauling winches.

5624. APPARATUS FOR THE MANUFACTURE OF NAILS, *J. W. Summers, Stalybridge.—23rd December*, 1881.—(*Void.*) 2d.

This consists in causing the tube or barrel through which the clamp carrying the plate or strip of metal passes to have an intermittent rotary motion imparted to it by means of a star wheel and a train of gearing from a shaft beneath, which shaft is actuated in its turn from the main driving pulley of the machine.

5626. BLEACHING AND DYEING YARNS OF WOOL, SILK, &c., *J. Auchinvole, Glasgow.—23rd December*, 1881. 6d.

In carrying out this invention the yarns are in the cop form when being subjected to the dyeing process as well as when undergoing scouring, bleaching, mordanting, or other preparatory processes.

5630. REEDS FOR MUSICAL INSTRUMENTS, *J. B. Hamilton, Greenwich.—23rd December*, 1881. 6d.

The inventor claims in organs, harmoniums, and like instruments, combining a group of two, three, or more tongues in one reed, the said tongues being so connected together that they are both or all compelled to vibrate in unison, and mutually correct any discrepancy between the individual tongues.

5633. MACHINES FOR SPREADING SAND, SALT, OR OTHER MATERIALS ON STREETS, ROADWAYS, &c., *R. G. Garvie, Aberdeen.—23rd December*, 1881. 6d.

This consists in the combination of a containing hopper and delivering chains operated by gearing from the carrying wheels, the construction and application of regulating bars, and the arrangement of a reciprocating and distributing screen below the delivering chains.

5638. EXHIBITING MAGIC-LANTERN PICTURES, &c., *E. Webster and T. M. Williams, London.—23rd December*, 1881. 6d.

This apparatus consists of a disc or drum carrying magic-lantern slides, which under the control of a clock, is permitted to rotate step by step, and then brings up the slides into position to display the image of each in turn upon the magic-lantern screen.

5639. IMPROVEMENTS IN ELECTRICAL ALARM APPARATUS FOR RAILWAY TRAINS, &c., *D. S. Garau, Hatton Garden, London.—23rd December*, 1881. 6d.

This consists in providing each carriage with two insulated conducting wires, each carriage being connected to its neighbour by a suitable coupling. A battery and alarm bell is provided in the guard's van, and an alarm bell on the engine. In the carriages are a suitable number of contact makers, so that, when contact is made, the bells in the van and on the engine will ring, or should the coupling of a carriage break the same thing will occur. The inventor also provides a signal arm or other indicator in each carriage which will project when contact is made and an alarm given, so as to indicate the particular carriage.

5655. APPARATUS FOR HEATING WATER, *B. J. B. Mills, London.—24th December*, 1881.—(*A communication from L. J. Robin, Paris.—(Not proceeded with.)* 4d.

This consists of a portable apparatus capable of being applied at any desired place to a water supply pipe for instantly heating the water at any pressure, enabling this hot water to be distributed with the same cock or valve gear employed for distributing the cold water of the said pipes.

5656. IMPROVEMENTS IN APPARATUS FOR WORKING ELECTRIC CLOCKS, AND CERTAIN COMBINATIONS OF ELECTRIC CLOCK APPARATUS ON ONE AND THE SAME LINE, &c., *E. G. Brewer, Chancery-lane, London.—24th December*, 1881.—(*A communication from C. E. Buell, New Haven, U.S.A.*) 8d.

The object of the First part of this invention is to dispense with the use of local batteries at sub-stations on a line used for controlling electric clocks, and to substitute a combination of a relay in a constantly closed main circuit with a secondary battery in a derived circuit, together with a clock to be operated by the battery in such circuit, the whole being combined with an electro-magnetic switch controlled by the relay in the main circuit, so that in one position of the switch the secondary battery is charged by the current in the main line, whilst in the other position the derived current from the main line is broken, and the current of the secondary battery is closed locally through the controlling electro-magnet of the clock. The Second part refers to the transmission of fire alarm signals on the same circuit as the clock; and the Third to the transmission of telephonic signals on the same circuit.

5671. TEACHING MUSIC, *W. Wagner, Berlin.—27th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to the application to the keyboard of strips of metal or other suitable material marked with suitable inscriptions or signs.

5673. PUNCHING MACHINES, *G. Jones, West Hartlepool.—27th December*, 1881.—(*Not proceeded with.*) 2d.

The invention consists essentially in fitting the punch holder or rams of punching machines with two punches, one of which is so fitted that it can be made to punch the plate below it or give way by moving within the punch holder or ram when it moves downwards towards the plate.

5675. FLOATING ANCHORS, *W. M. Bullivant, London.—27th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to the employment of a raft and bags.

5677. OPENING AND CLOSING DOORS IN CONNECTION WITH HOISTS, *J. Barrett, Eastburn.—27th December*, 1881. 6d.

This relates to the mechanism for actuating the sliding door or doors turning on hinges communicating with the various floors from the well of a hoist.

5678 SPINNING MACHINERY, *M. Wright, Wibsey.—27th December*, 1881. 6d.

This consists in the securing of the spindle rail in such position that the spindles fixed therein are in

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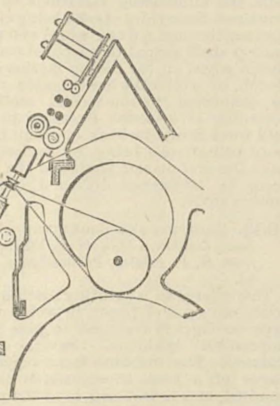

line with the nip of the rollers and carriers mounted upon the carriage plates fixed at a more acute angle.

5679. FIREPLACES AND STOVES, *J. Gillingham, Chard.—27th December*, 1881.—(*Not proceeded with.*) 2d.

The object is to prevent the formation of smoke, to economise the consumption of fuel, and to improve its economical application or utilisation.

5681. IMPROVEMENTS IN THE CONSTRUCTION AND ARRANGEMENT OF DYNAMO-ELECTRIC MACHINES, *J. Richardson, of the firm of Robey and Co., Lincoln.—27th December*, 1881. 4d.

This consists in the arrangement of a series of two armatures at right angles to each other, as shown in the accompanying figure, and so fitted in connection

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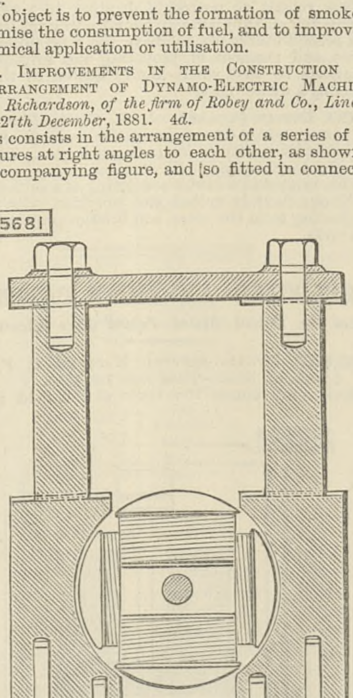

with the field magnets that one is at the point of maximum when the other is at the point of minimum intensity, and as one increases in intensity in the same ratio that the other diminishes, the sum of the two will produce a constant intensity of current.

5683. CONVERSION OF IRON, &c., INTO STEEL, *W. R. Lake, London.—27th December*, 1881.—(*A communication from J. Date, Montreal.*)—(*Not proceeded with.*) 2d.

This relates to a process whereby the bar, bloom, sheet, or shape of either cast iron after undergoing the annealing process, or wrought or forged iron is converted into solid steel by subjecting the bar, bloom, sheet, or shape in its natural state in a heated retort or oven to the action of gases or charcoal and petroleum, or other hydrocarbon, generated within or without the retort, said retort being of such construction that a pressure of gas shall not be maintained.

5684. THRASHING, AWNING, AND SEPARATING GRAIN FROM STRAW, *R. G. Morton, Perth.—27th December*, 1881.—(*Not proceeded with.*) 2d.

The object is the better thrashing and separating grain from straw, and awning such grain where necessary in combination with the comb drum.

5685. GORES, GUSSETS, AND SIMILAR PARTS OF WEARING APPAREL, *W. R. Lake, London.—27th December*, 1881.—(*A communication from S. Florsheim, Chicago.*) 6d.

This consists of an elastic gore, gusset, or section for wearing apparel, composed of a covering material having tubes, spiral metal springs enclosed by such tubes and not extending to the edges of the covering material, and stayed at their ends by such covering material, and in elastic margins outside of the said springs.

5686. OPERATING THE CUT-OFF VALVES OF STEAM ENGINES, *H. H. Lake, London.—27th December*, 1881.—(*A communication from S. A. Goodwin, Philadelphia.*) 6d.

According to this invention the cut-off valve is operated as well as controlled by the governor, and the governor is driven by chain gearing. To reduce the

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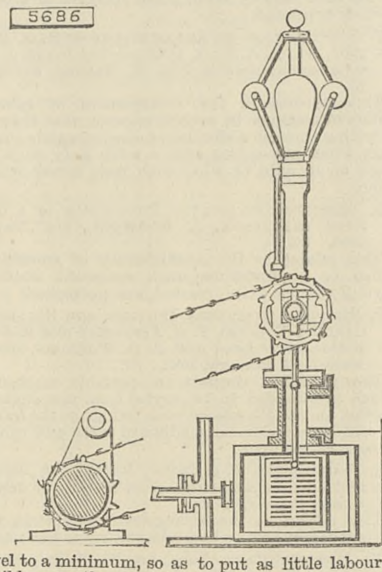

travel to a minimum, so as to put as little labour as possible upon the regulating elements of the governor, the cut-off valve is made to ride upon and with the main valve, so that in relation to the former the latter is at rest.

5687. CONTROLLING AND REGULATING THE PRODUCTION AND DISTRIBUTION OF ELECTRICITY, *C. A. Carus-Wilson, London.—27th December*, 1881. 8d.

The action of the engine governor is supplemented. A weight is made to bear on it, and this weight is under the influence of electro-magnets or solenoids. Another part of the invention is to use secondary batteries in a circuit between the main and earth, and charge them when too great an E M F is otherwise obtained.

5689. DEVICES FOR ATTACHING AND DETACHING THE TRAVELLING PAPER, &c., IN MECHANICAL MUSICAL INSTRUMENTS, *W. R. Lake, London.—27th December*, 1881.—(*A communication from the Automatic Music Paper Company, Boston, U.S.*) 6d.

This consists essentially of a music roll for mechanical musical instruments, composed of a paper or other perforated strip having at one end a tube piece, in combination with a roll body, which roll body and tube piece are so constructed as to interlock one with the other, the said roll body having head pieces, one permanently attached thereto, and the other arranged to be attached and detached.

5690. APPARATUS FOR HANGING CARCASES IN MARKETS, &c., *J. P. Milbourne, Manchester.—28th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to employment of auxiliary hooks or hangers in addition to the ordinary hooks or hangers.

5693. MANUFACTURE OF MATERIAL FOR COVERING BOILERS, &c., TO PREVENT WASTE OF HEAT, *F. Castelin, Marseilles.—28th December*, 1881.—(*Not proceeded with.*) 2d.

A layer of silk fibre in the condition of wadding is on its one side faced with a layer of ground glass or asbestos secured to it by silicates of potassa, and on the other side has cemented to it canvas or other closely woven fabric, which is coated on its outside with gutta-percha.

5694. GRATES FOR FURNACES, *J. Schofield, Littleborough.—28th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to the arrangement of the bars.

5696. RECORDING MUSICAL NOTES, *J. Wallis, London.—28th December*, 1881.—(*A communication from J. Föhr, Stuttgart.*) 6d.

The apparatus consists of the following principal parts, viz.:—The keyboard mechanism, the ruling and writing apparatus with its driving mechanism, a contact apparatus for marking intervals of time, an apparatus for preparing the strip of paper with a solution of chemicals, and a galvanic battery.

5698. PREPARING SOAP, *J. C. Mewburn, London.—28th December*, 1881.—(*A communication from J. J. Besson and C. L. Remy, Paris.*—(*Not proceeded with.*) 2d.

The invention consists in making up or preparing soap in the form of small lozenge-like pieces of special shape and of a size just sufficient to serve once.

5700. SCREW TAPS AND SCREW DIES, *F. de Camp, Germany.—28th December*, 1881.—(*Not proceeded with.*) 2d.

The screw tap combines an ordinary roughing tool and a finishing tool in one and the same appliance.

5701. OPERATING RAILWAY SIGNALS, *A. Gough, Buckingham.—28th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to means for automatically operating railway signals on the block system by the passage of the train itself.

5703. COOKING STOVES, &c., *F. Brown, Luton.—28th December*, 1881. 8d.

This relates partly to improvements in cooking and other stoves and fireplaces and furnaces, consisting in providing a fuel trough or receptacle and an upwardly inclining bottom, along which the fuel can be pushed and made to enter into the grate beneath the ignited fuel.

5704. EDGE SETTING AND BURNISHING MACHINERY, *W. R. Lake, London.—28th December*, 1881.—(*A communication from G. W. Copeland, Malden, Mass., U.S.*) 6d.

This relates to improvements in edge-setting and burnishing machines, and may be used with a jack for supporting the work during the burnishing or edge-setting operation, or without a jack.

5705. SHIPS' STERNPOSTS AND RUDDERS, *W. Cooke and D. Mylchreest, Liverpool.—29th December*, 1881. 6d.

The object is to provide stern-posts and rudders, so constructed that the said rudders may be easily shipped and unshipped without passing through the counter.

5708. MANUFACTURE OF ANCHORS, &c., *J. Nock, Turkey.—29th December*, 1881. 6d.

This consists in the manufacture of an anchor from a slab or ingot of metal by punching and cutting the slab or ingot, spreading the jaws of the cut, forging and swaging the shanks and limbs, and then rolling them to shape between horizontal and vertical rolls having their distances adjustable while they revolve.

5709. SKATES, *H. J. Haddan, London.—29th December*, 1881.—(*A communication from W. Tillmanns, Germany.*)—(*Not proceeded with.*) 2d.

This relates more particularly to the means of attaching skates to the boots of the skater.

5710. BATHING APPARATUS, *C. E. Winteros, Christiania.—29th December*, 1881. 6d.

This relates to portable bathing apparatus, and consists partly in the application of a diaphragm pump for lifting the water.

5711. WINDING TWO OR MORE YARNS ON TO ONE BOBBIN OR SPOOL, &c., *W. T. Stubbs and J. Corrigan, Manchester.—29th December*, 1881.—(*Not proceeded with.*) 2d.

This consists partly in an arrangement for arresting the motions of the bobbin when one or more of the yarns or threads that are being wound become or becomes broken or severed.

5712. SUPPLYING FEED-WATER TO STEAM BOILERS, *E. de Pass, London.—29th December*, 1881.—(*A communication from the Société Volpp Schwarz et Compagnie, Paris.*)—(*Not proceeded with.*) 2d.

This consists of a float and valve supply apparatus fixed on or in connection with the boiler, with which it is in communication by means of a steam and a water pipe.

5713. TREATMENT OF YARN AND OTHER COTTON GOODS, *C. W. Lightoller, Manchester, and J. Longshaw, Preston Brook.—29th December*, 1881. 6d.

This consists in passing cotton yarn or other goods, more especially threads, through a solution of chloride of zinc or sulphuric acid.

5715. COCKS OR TAPS FOR APPARATUS FOR COMPRESSING OR RAREFYING AIR, *W. R. Lake, London.—29th December*, 1881.—(*A communication from J. F. Aymonnet, Paris.*) 6d.

The cock or tap is provided with a single cylindro-conical passage, the conical portion being in the form

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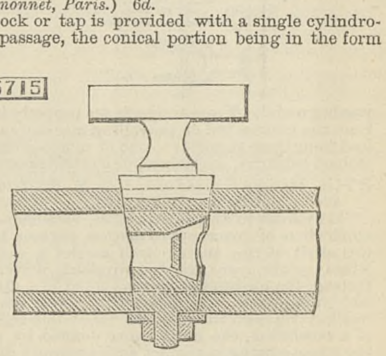

of the frustrum of a cone, whose smaller end may be in the centre or at one end of the passage.

5719. TREATING BOG-PEAT AND PEAT-MOSS, *S. D. Cox, New Charlton.—30th December*, 1881.—(*Not proceeded with.*) 2d.

The material is first dried in the air and is then broken to pieces in a machine and screened.

5721. HYDRAULIC LIFTS, *J. S. Stevens and C. G. Major, Battersea.—30th December*, 1881. 6d.

The lift is so constructed that when the ram and cage are to be lifted water under pressure is supplied to the cylinder from an accumulator, and when the cage has been raised to the required height the communication with the accumulator is closed, and the cage is thereby held in its elevated position. When the cage is to be lowered a communication is opened between the lift cylinder and a second hydraulic cylinder, which is shorter, but of larger diameter. The water in the lift cylinder can then as the lift ram descends pass into the second cylinder and raise the ram of that cylinder. Above the top of the ram of the second cylinder there is another ram, rigidly fixed to it, and working in a third cylinder of less capacity and inverted.

5724. CANDLE SHADES, *E. Wylam, Bermondsey.—30th December*, 1881.—(*Not proceeded with.*) 2d.

The shade is made of glass.

5726. WINDING MACHINES, *R. and F. Speight, Bradford.—30th December*, 1881. 6d.

This consists in the construction and employment of a self-acting closing and opening circular plate fitted to ordinary winding machines or apparatus whereby the wooden bobbins heretofore employed are dispensed with.

5727. MILLS, *F. Wirth, Frankfort.—30th December*, 1881.—(*A communication from W. Harmann, Germany.*)—(*Not proceeded with.*) 2d.

This relates to the preparation of the grinding surfaces.

5729. SAFETY VALVES, *C. W. Collins, Manchester.—30th December*, 1881.—(*Not proceeded with.*) 4d.

This consists in various modes of counteracting or counterpoising the gradually increasing power of the springs when acted upon by the rising of the valves.

5730. MANUFACTURE OF BRUSHES, *G. J. Beissbarth, London.—30th December*, 1881.—(*A communication from J. M. Beissbarth, Nuremburg.*) 6d.

This relates to the use of a thick ferule or metal ring constituting a metallic binding for firmly securing the brush head to the handle, the said ferule or ring being forcibly and uniformly crushed into and around the materials forming the head and handle, and the bristles, hairs, feathers, or other material forming the brush head being held so securely compressed by the uniformly indented and unyielding metallic binding as to obviate the necessity for using cement or a binding of wire or string.

5733. WIND MUSICAL INSTRUMENTS, *W. P. Thompson, Liverpool.—31st December*, 1881.—(*A communication from M. Harris, New York.*) 6d.

This consists partly in a wind musical instrument containing sound-producing devices, such as reeds, of the combination with the wind chest enclosing the valves which regulate the passage of air over or through said devices of pneumatic keys located within said wind chest.

5735. HOT-WATER HEATING APPARATUS, *T. Drake, Huddersfield.—31st December*, 1881. 4d.

This relates to the combination of a coil with a cone-shaped boiler connected together and supplied with water.

5737. ORNAMENTAL, DECORATIVE, AND OTHER GLASS OR GLASS WARE, *J. Hewitt, London.—31st December*, 1881.—(*A communication from R. W. Harris, Calais.*)—(*Complete.*) 4d.

This relates to the manufacture of ornamental or decorative glass ware, by applying to ordinary white or coloured glass metallic pieces or particles, enamels, or calcareous substances, either singly or two or more together, in combination with salt or alkalies.

5738. ELECTRIC LAMPS, *G. J. G. Lorrain, Westminster.—31st December*, 1881. 4d.

This invention consists in silvering or coating a portion of the globe with a reflecting material.

5739. TREATMENT AND PREPARATION OF MAIZE FOR USE IN BREWING, *T. B. Kinder, Anerley.—31st December*, 1881. 2d.

The maize is roasted and ground and mixed with the malt and mashed.

5740. Hoists and Brakes, *J. and J. T. Pickering, Stockton-on-Tees.*—*31st December*, 1881. 6d.

This relates to patent No. 7, dated 1st January, 1879, and consists in simplifying the mechanism described in the specification, and for automatically suspending the load, and also for lowering the same with an improved brake.

5742. Heating and Rolling or Shaping Metals, *J. S. Williams, New Jersey, U.S.*—*31st December*, 1881. 6d.

This relates to a method of manufacture in which electricity is utilised for heating metal during its passage through or between rolls, draw-plates, dies, or other apparatus for imparting to such metal the form or shape desired, and thus producing rods, bars, plates, wires, rails, or the like. Between each of the sets of rolls C one or more supports D are arranged for the

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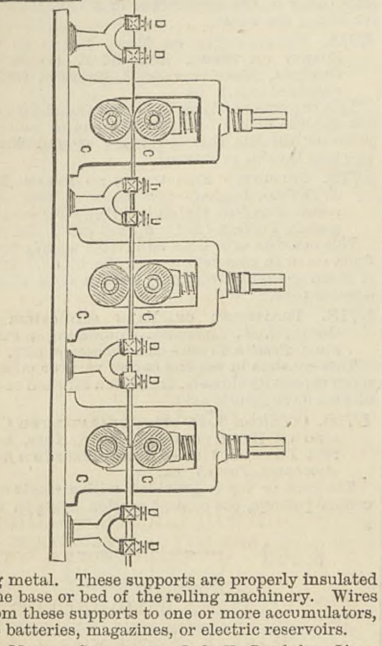

passing metal. These supports are properly insulated from the base or bed of the rolling machinery. Wires lead from these supports to one or more accumulators, storage batteries, magazines, or electric reservoirs.

5744. Marine Governors, *J. G. H. Batchelor, Liverpool.*—*31st December*, 1881. 6d.

This relates to the construction, arrangement, and application of governors to marine engines in which the shaft of the engine itself carries a momentum wheel or its mechanical equivalent, driven round through the medium of springs fixed to a disc keyed fast on the shaft, the momentum wheel itself being free to revolve on the shaft for about one-eighth part of a revolution, the limit being defined by stops on the wheel coming in contact with stops on a disc keyed or otherwise secured to the shaft, and in which arrangement the fluctuations or irregularities in the revolutions of the shaft are caused to operate on the throttle valve, through the medium of links, a sliding collar, a strap or ring, and rods.

5749. Alloying, Uniting, and Covering Metals with other Metals, *P. de Villiers, St. Leonards-on-Sea.*—*31st December*, 1881. 4d.

This consists partly in the production or formation of metallic alloys by the decomposition of the salts in the presence of oxides or in the presence of other salts and the re-composition of the same.

5751. Improvements in and Relating to Apparatus for Operating or Controlling Railway Brakes by Electricity, *W. R. Lake, London.*—*31st December*, 1881.—(*A communication from A. L. Duwelius, L. W. Goss, Paget Biggs, F. R. Merrell, H. D. Peck, and H. Walker, America.*) 6d.

This consists in the provision of the rotary engine, dynamo and storage battery on the locomotive, with a switch, so that the battery may be charged, or the current applied to the brake mechanism at will. The locomotive and the carriages are all connected by suitable conducting wires, with branches leading to the brakes. The construction of part of the brake is shown in the figure, J being a rotating electro-magnet

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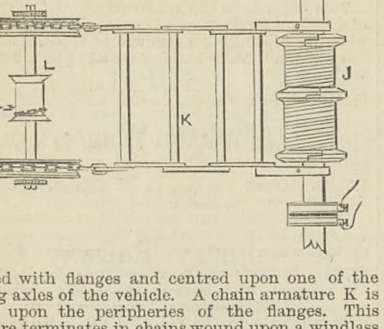

provided with flanges and centred upon one of the rotating axles of the vehicle. A chain armature K is wound upon the peripheries of the flanges. This armature terminates in chains wound upon a windlass to which the ordinary brake chain is attached. Normally the armature chain is out of contact with the peripheries of the flanges of the magnet, but when a current passes the armature chain is attracted and adheres, the rotation of the magnet drawing the succeeding bars of the armature upon its flanges.

1. Table Cutlery, &c., *E. A. Lynde, Sheffield.*—*2nd January*, 1882.—(*Not proceeded with.*) 2d.

This relates to the mode of securing the handle to the tang by means of a spring.

3. Preserving Timber, &c., *H. Aitken, Falkirk.*—*2nd January*, 1882. 4d.

This relates to the treatment of timber, stone, &c., with naphthaline, or chrysene, or pyrene, or mixtures thereof.

5. Mashing Malt, &c., *L. A. Groth, London.*—*2nd January*, 1882.—(*A communication from M. C. Seitz, New York.*) 6d.

The inventor claims as an improvement in apparatus for mashing malt or malt substitutes the combination of a steam jacketted saccharification vessel, having an interior stirring mechanism, an auxiliary mash tun arranged above the level of the vessel also provided with a stirring mechanism, a settling and draining-off tun arranged below the level of the saccharification vessel and provided with a perforated false bottom and pipes connecting the vessel and mash tun and vessel and settling tun. An improved process is also claimed.

13. Composition for Coating Ships' Bottoms, &c., *N. G. Little, Doncaster, and N. Nickels, London.*—*2nd January*, 1882. 4d.

Acridine obtained from heavy tar oils is employed, and products resulting from the distillations of coal tar, either solid or in a concentrated form, or in admixture with its associated oils or such portions of tar oils that may be rich in acridine.

25. Manufacturing Soap, *G. Payne, Millwall.*—*3rd January*, 1882. 2d.

The inventor claims the process or method of manufacturing soap, wherein lime soap is treated with a solution of hydrate or carbonate of soda or of potash.

9. Tube Expanders, *G. Allix, Poplar.*—*2nd January*, 1882. 6d.

The invention consists partly in the construction of the body A of a tube expander solid—not built up of

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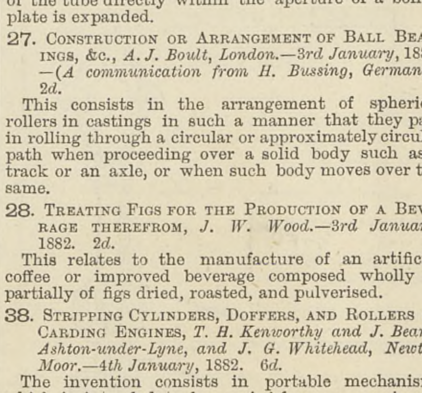


rings screwed together—in which body parallel surfaced rollers or tools move freely, so that the part only of the tube directly within the aperture of a boiler-plate is expanded.

27. Construction or Arrangement of Ball Bearings, &c., *A. J. Boult, London.*—*3rd January*, 1882.—(*A communication from H. Bussing, Germany.*) 2d.

This consists in the arrangement of spherical rollers in castings in such a manner that they pass in rolling through a circular or approximately circular path when proceeding over a solid body such as a track or an axle, or when such body moves over the same.

28. Treating Figs for the Production of a Beverage therefrom, *J. W. Wood.*—*3rd January*, 1882. 2d.

This relates to the manufacture of an artificial coffee or improved beverage composed wholly or partially of figs dried, roasted, and pulverised.

38. Stripping Cylinders, Doffers, and Rollers of Carding Engines, *T. H. Kenworthy and J. Beard, Ashton-under-Lyne, and J. G. Whitehead, Newton Moor.*—*4th January*, 1882. 6d.

The invention consists in portable mechanism, which is intended to be carried from one engine to another and readily placed upon fixings on the framing by which the apparatus is adjusted to the said cylinder to be operated upon.

92. Pianofortes, *F. C. Glaser, Berlin.*—*7th January*, 1882—(*A communication from the firm of Gebrüder Knake, Germany.*) 6d.

This relates to the arrangement of certain novel parts whereby soft and certain playing is produced.

109. Manufacture of Soda, &c., *W. Weldon, Burstow.*—*9th January*, 1882.—(*A communication from Dr. M. Schaffner and W. Helbig, Austria.*) 4d.

The inventors claim the combination of the Leblanc process with the ammonia process.

148. Locomotive, *R. H. Brandon, Paris.*—*11th January*, 1882.—(*A communication from A. Cotrau, Naples.*) 6d.

The invention consists in adding externally or internally to the motor axles (and if necessary, also to the non-motor axles) of the engine a second pair of wheels which may be of smaller or larger diameter.

451. Manufacture of Colouring Matters for Dyeing and Printing, *J. A. Dixon, Glasgow.*—*30th January*, 1882.—(*A communication from C. Rumpff, Germany.*) 4d.

The invention consists in the production, by means of a reaction or combination effected in neutral or very slightly or weakly acid solutions, of colouring matters or dyestuffs which may in chemical language be denominated the sulpho-acids of amido-azo derivatives of the naphthylamines.

649. Spring and Block Tip Wagons, &c., *J. Watling and E. Chaston, Lambeth.*—*10th February*, 1882. 6d.

This relates partly to the application of a two or four-wheeled van, wagon, or cart, to act as a tip van, wagon, or cart upon springs or blocks with ladders and cam and friction rollers.

660. Manufacture of a Dry Antiseptic Non-hygroscopic Powder from a Liquid Extract of Saponin, &c., *N. Bradley, Manchester.*—*11th February*, 1882. 4d.

This consists in a process by which a liquid extract of saponin from any vegetable product containing saponin is converted into a dry powder, which will keep dry on exposure to the atmosphere, thus rendering it more easy of transit, and more convenient to store, to sell, and to use in the scouring of silks, and for giving head finish and soundness to flat beverages. The extract is evaporated to the consistency of a syrup, when the heat is lowered, and so kept till the extract is thoroughly dry, in which state it is combined with a mixture of carbonate of magnesia, lime salts, and dry tartaric acid or other vegetable acids, and the antiseptics bi-borate of soda and sulphite of soda.

711. Lamps, *W. J. J. Robinson, Limerick.*—*14th February*, 1882. 2d.

This relates to the method of diminishing or destroying the noise caused by the supply of air through passages in lamps, by fluting or grooving the air passages of said lamps.

902. Asbestos Fabrics, *H. J. Haddan, Kensington.*—*24th February*, 1882.—(*A communication from T. Trivier, Belgium.*)—(*Complete.*) 4d.

This consists in forming an asbestos yarn composed of a metal wire completely surrounded by asbestos fibres, so as to enclose it on all sides, and from this covered thread various kinds of fabrics are made by weaving, knitting, or plaiting.

912. Washing, Lighting, or other Gases, *H. A. Bonneville, Paris.*—*25th February*, 1882.—(*A communication from L. A. Chevalet, France.*)—(*Complete.*) 6d.

This consists essentially in causing the gases to pass through perforated plates either immersed in water and arranged in arched chambers, or over which water is caused to flow in a stream.

1063. Processes for Extracting Metals from their Ores, &c., *H. H. Lake, London.*—*4th March*, 1882.—(*A communication from N. F. Evans, Philadelphia.*) 6d.

This relates to the process of chlorinating ores, wherein the ore is charged with chlorine under a pressure greater than that of the atmosphere, such pressure being produced by the evolution of chlorine gas within a closed chamber containing the ore, or otherwise produced.

1264. Heating Zinc Furnaces, *W. R. Lake, London.*—*15th March*, 1882.—(*A communication from La Société Oeschger Mesdach and Cie., Paris.*)—(*Complete.*) 6d.

This relates to heating furnaces employed for the reduction of zinc ores, and consists chiefly in the distribution of the combustion of the gas which is produced in a gas generator separated from the furnace and burnt successively at several places in combustion chambers of special construction, for the purpose of obtaining the greatest possible uniformity of temperature in all parts of the furnace, and the degree of temperature most suitable for the reduction of the zinc. For this purpose the quantity of air introduced into each combustion chamber to assist the combustion of the gas, and also the temperature of such air is regulated so as to produce the desired effect.

1293. Machine for Cutting and Boring Earth for Mining Purposes, *H. A. Bonneville, Paris.*—*17th March*, 1882.—(*A communication from G. Dubois and J. François, Belgium.*) 4d.

This relates to bringing down coal in mines and boring galleries in rock without blasting, and consists in a machine by which grooves may be made to any depth, and holes of large diameter drilled to the same depth, the machine being easily modified so that the cutting and drilling apparatus may be transformed into a mechanical hammer for striking wedges, consists of three parts, viz., two fish plates, and the wedge introduced into the holes drilled, so as to bring down the mass of earth.

1343. Dust Collectors for Flour Mills, *L. Varicas, London.*—*20th March*, 1882.—(*A communication from S. L. Bean, Washington.*)—(*Complete.*) 6d.

This relates to balloons for collecting and grading flour dust in mills.

1708. Lacing Studs or Hooks for Boots, &c., *W. R. Lake, London.*—*11th April*, 1882—(*A communication from M. Bray, Massachusetts.*)—(*Complete.*) 4d.

This relates to a process of forming lacing studs from wire equal to the diameter of the shank, and it consists in cutting from the wire a cylinder blank, which is submitted to the action of dies to bend one portion thereof at right angles to the other portion and emboss or swage the same, so as to form a shoulder round the shank, and give shape to the neck and outer head projecting radially from one side of the shank, bending the neck to bring the outer head over the shank, and then drilling out the centre of the shank to form a tube.

1738. Dining-room, Billiard, and Bagatelle Tables, *W. R. Lake, London.*—*12th April*, 1882.—(*A communication from H. U. Alcock, Melbourne.*)—(*Complete.*) 6d.

This relates mainly to dining-room tables, which, on removing the leaves, disclose a billiard or bagatelle table, and consists, First, in means for raising and lowering the latter; and, Secondly, in making such tables with sliding extensions. The raising and lowering is effected by means of excentrics or cams acting as lifters, which are operated by screws and nuts.

1790. Locomotives, *W. R. Lake, London.*—*14th April*, 1882.—(*A communication from Messieurs Debarnot and Jacquot, Paris.*)—(*Complete.*) 4d.

The invention consists chiefly in arranging the axles of the wheels above the boiler.

1840. Self-opening Umbrellas, *W. Grant, New York.*—*18th April*, 1882.—(*A communication from J. W. Watson, New York.*)—(*Complete.*) 6d.

A runner is provided which travels along the stick in the usual manner, and is fitted with stretchers extending to the ribs. A second runner is also provided, and has other stretchers also extending to the ribs. Springs are combined with the runners, so that the action of closing the umbrella compresses the same, and when the usual runner is released the force of the springs carries it to the opposite end of the stick, and thereby spreads the stretchers and automatically opens the umbrella.

1844. Rolling Mills, &c., *W. Deighton, Workington.*—*18th April*, 1882.—(*Complete.*) 8d.

This consists in improvements in rolling mills and in driving apparatus thereof, by the construction of a double reversing mill in which two pairs of rolls are employed to act on the material at the same time, the front pair of rolls being driven at a less speed than the back pair of rolls, and when reversed the back pair of rolls being driven at a less speed than the front pair of rolls, the alternating variations in the speed of the front and back pairs of rolls being obtained in a simple manner through a fixed wheel and pinion on the first motion shaft geared to a loose clutch pinion and loose clutch wheel on the second motion shaft with sliding clutch, by which the loose pinion or loose wheel can be connected to the second motion shaft at will, according as material is being passed through the mill from front to back or from back to front, the front pair of rolls being by preference driven direct from the first motion shaft and the back pair of rolls being by preference driven direct from the second motion shaft.

1865. Printing and Bookbinding Machinery, *W. R. Lake, London.*—*18th April*, 1881.—(*A communication from H. P. Feister, Philadelphia, U.S.*)—(*Complete.*) 6d.

This relates to a printing machine to print from a continuous roll of paper, in which an endless chain of type carriages is arranged to pass before inking and impression cylinders. Several improvements are claimed. The machine is arranged to print all the pages of a book in succession and without being handled, and to fold and bind the printed sheets into books.

2035. Apparatus and Appliances for Producing Intense White Light, *J. Imray, London.*—*29th April*, 1882.—(*A communication from C. Clamond, Paris.*)—(*Complete.*) 6d.

This relates to means of heating to a very high degree the air supplying an illuminating jet by means of a second heater placed above the true illuminating flame, and methods of preparing and arranging the magnesia so that when highly heated by the jet it radiates a white light.

2160. Bottle Cleaner, *A. M. Clark, London.*—*8th May*, 1882.—(*A communication from W. S. Wood, New York, and L. H. Livingstone, jun., Rhinebeck, U.S.*)—(*Complete.*) 4d.

This relates to a device consisting of a series of balls or blocks flexibly united and provided with bristles projecting from the sides, and bristles projecting from the ends.

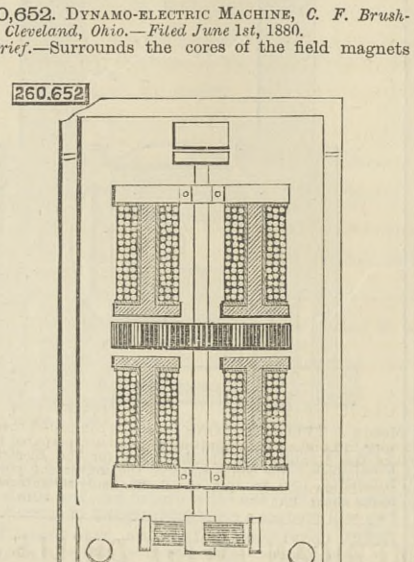
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette

260,652. Dynamo-electric Machine, *C. F. Brush, Cleveland, Ohio.*—*Filed June 1st*, 1880.

Brief.—Surrounds the cores of the field magnets

260.652

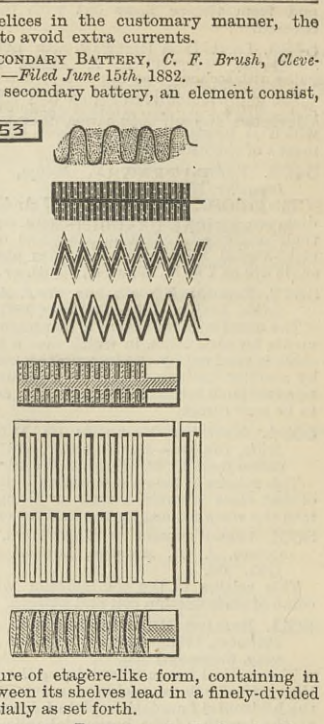


with a continuous band of sheet copper or other suitable conductor. Over these bands are coiled the magnetising-helices in the customary manner, the purpose being to avoid extra currents.

260,653. Secondary Battery, *C. F. Brush, Cleveland, Ohio.*—*Filed June 15th*, 1882.

Claim.—In a secondary battery, an element consist,

260.653



ing of a structure of etagère-like form, containing in the spaces between its shelves lead in a finely-divided state, substantially as set forth.

260,654. Secondary Battery, *C. F. Brush, Cleveland, Ohio.*—*Filed June 15th*, 1882.

Claim.—The method of forming the plates of a secondary battery consisting in forming receptacles

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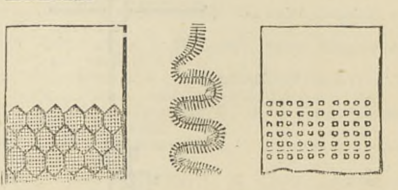
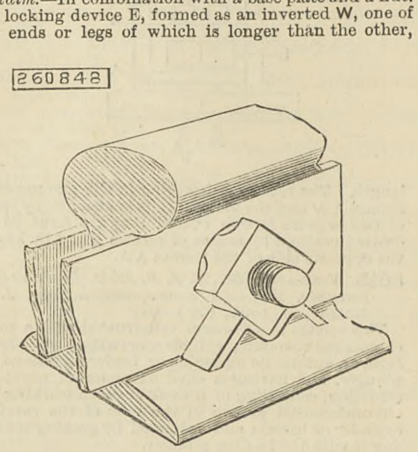


for oxide of lead in its surface, then applying oxide of lead to the plate and within such receptacles, and afterward subjecting the oxide of lead to pressure.

260,848. Nut Lock, *Phillip Curran, Caliente, Cal.*—*Filed April 1st*, 1882.

Claim.—In combination with a base plate and a nut, the locking device E, formed as an inverted W, one of the ends or legs of which is longer than the other,

260848



said locking device operating in connection with the nuts, and constructed substantially as herein described.

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The Engineer, August 4th, 1882.