THE IRON AND STEEL INSTITUTE.

THE annual metropolitan meeting of the Iron and Steel Institute began on Tuesday at 10.30, and terminates to-day. The meetings are held, as usual, in the Hall of the Institution of Civil Engineers, 25, Great George-street. The meeting extends over three days; but, unlike the Institution of Naval Architects, the Iron and Steel Institute sits only during the day time, on which fact it is very much to be congratulated. The proceedings began on Tuesday with purely formal business; and it is satisfactory to learn that the Institute advances apace in prosperity and importance. The Bessemer medal for the year was presented to Mr. Menelaus, the manager of the Dowlais Works, and it could not have been better bestowed. Mr. Smith, manager of the Barrow Steel Works, president elect for the ensuing year, was inducted into the chair which has been so ably filled, by Mr. Williams, the retiring president, to whom a vote of thanks for his past services was warmly accorded. Mr. Smith then delivered his

PRESIDENT'S ADDRESS.

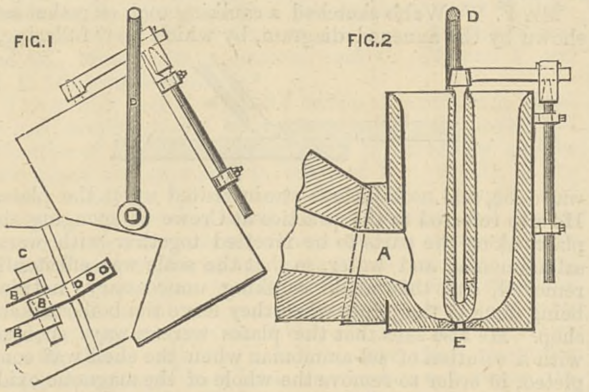
This occupied more than an hour in the reading, and was a very masterly exposition of the present position and prospects of the iron and steel trade. We have seldom, if ever, found statistics put together in so readable and attractive a form; of scientific interest, however, the address possessed hardly a trace, Mr. Smith being almost entirely silent concerning such questions as the dephosphorisation of steel, which is perhaps no matter for wonder, seeing that the good folks of Barrow are by no means too anxious to see a process succeed which would render the Cleveland district a most formidable rival to the hematite country. Mr. Smith, after referring gracefully and in well-chosen language to the honour conferred on him by the Institution, and having pointed out that it began twelve years ago with only 100 members, while it has now 1100, invited the attention of his hearers to a retrospect of the progress of the iron and steel trades during that period. He complained that the returns of the Mining Record-office, as well as those of the Board of Trade, were issued so late that they lost their practical value; but on the other hand the British Iron Trade Association gave the figures required in a reasonable time. Thus it supplied statistics of the iron and steel trade of 1880 in two and a-half months after the expiry of that year, and he would venture to say that the report referred to must go far to induce many who have not hitherto seen their way to join the Association to reconsider their decision, and thus assist in bringing to a more prominent and successful position a most important organisation, and one which has really grown out of the Iron and Steel Institute.

Twelve years ago the importation of ores into the United Kingdom reached 114,000 tons. In 1880 it was 2,600,000, while about 17,500,000 tons of British ore were raised. Our enormous import of ores was mainly of the class required to make pig iron suitable for Bessemer and open-hearth steel; and over 2,000,000 tons of this quantity came from Bilbao. Having given in detail figures further illustrating the growth of the manufacture, he made the curious statement that in Prussia, Austria, and Sweden the quantity of ore raised per man reached 130 to 140 tons, while in Luxembourg it reached 600 tons. He did not say how much each man raised in Great Britain, but he held that there was foundation for the assertion which had been made that pig iron cost less in the Grand Duchy of Luxembourg than in any other country. He then proceeded to deal with coal statistics, showing that we had enough at the present rateof use to last 900 years; and that the improvements which had been effected in making iron and steel have kept down consumption by about 10,000,000 tons per annum. In 1871 each ton of pig iron represented 3 tons of coal; in 1881 it represents 2 tons 4 cwt. A ton of iron rails formerly represented 5 tons of coal; a ton of steel rails can be made for 2 tons 15 cwt. Last year we made 800,000 tons of steel rails. Turning to blast furnaces, after complimenting the Cleveland ironmasters on their enterprise, he went on to deal with the yield. On the west coast a make of 500 to 600 tons per week is the rule with ores containing from 53 per cent. to 57 per cent. of metallic iron. On the east coast one furnace at Consett, supplied with Bilbao ore, has averaged 750 tons per week for some months past, the pig obtained in both cases being of the quality called Bessemer. In the month of April, 1862, 1279 tons of iron were made in one fortnight at the Barrow Works, with a furnace 45ft. high and 16ft. bosh; and during the last four days of this period the make was 460 tons, the quality of the iron being grey forge, and the ore soft hematite of 55 to 56 per cent. richness. The experiment showed that to produce 500 tons per week regularly with a minimum consumption of coke required an increase of height and diameter. As to American practice, one of the Edgar-Thomson furnaces is said to have produced over 1200 tons in a single week. It would be interesting to know in twelve months from now whether an annual make of 60,000 tons with one furnace can be maintained; and if so, whether the consumption of fuel has not been larger than in furnaces which, with the same raw materials, produce more moderate quantities. To those whose efforts are devoted to making Bessemer iron, it is well known that blast furnaces when new are more trustworthy and economical in their working than those which have been in operation three or four years. He thought that in view of the large results we now know can be obtained with furnaces capable of receiving large quantities of blast heated to a high temperature, and bearing in mind that the wear takes place almost entirely in the lower part, that an arrangement by which the hearth and a few feet of the bosh could be bodily removed, and replaced by a new equivalent portion already built and dried, was worth consideration, as thereby a rapid destruction of the furnace to attain great results as to the quantity of iron produced might be advantageously combated by a method calculated to facilitate its renewal in a short space of time, and not subject it to the serious drawback of being out of blast so frequently and occupying so long a time for repairs. It might be said, indeed, that the old system of repairs which is still practised is the last inheritance from our forefathers in blast furnace management that they still enjoyed. Mr. Smith by no means believes in the total extinction of the iron trade. On the contrary, he produced figures to show that, between 1869 and 1879, the six iron-making countries of the world increased their production by about one-third. There are no accurate returns available for the United Kingdom, but there is reason to believe that about 175,000 tons of manufactured iron were exported in 1880 in excess of the quantity exported in 1879; and there must be still in operation over 5000 puddling furnaces. About 45 per cent. of the total pig iron production of the world is still converted into iron. In 1869 Great Britain produced 160,000 tons of Bessemer ingots, while in 1880 the make was 1,044,000 tons, the latter figure being an increase of 210,000 tons on the make of 1879. In 1880 our production of Bessemer steel rails reached 740,000 tons, equal to laying 7500 miles of railway with rails of 65 lb. weight per yard. In the appliances and machinery used for this new and important trade, very important changes have taken place; to such an extent, indeed, that while within the last seven or eight years 50s. per ton was roughly deemed the difference in value between iron and steel rails, manufacturers of steel rails have during the last two years had to compete with iron rail-makers on equal terms, and in one case a railway company bought 60,000 tons of steel rails at a price that left less than 90s. per ton at the works. Twelve years ago a pair of Bessemer converters did not average more than five charges every twelve hours; now the average will probably be nearer fifteen. At the first-named period, rolling mills upon strengthened patterns of the old iron mills could roll 500 to 600 tons per week of such rails as are used on British railways, whereas now they can much exceed 2000 tons per week. As we have said, Mr. Smith supplied no information concerning the Thomas-Gilchrist process, which he just glanced at, and he skimmed pleasantly over a great many other subjects of interest, such as the conversion of ores directly into steel, Messrs. Parry and Tucker's spectroscopic analysis, and the application of steel and iron to shipbuilding. If he said nothing new on such matters, he at least spoke pleasantly, and made his figures attractive. He closed with an eloquent peroration, in which he paid a high compliment to the services rendered to the metallurgical arts by the Institution, and resumed his seat amid well-deserved applause. Mr. Smith possesses natural advantages which fit him for the post which he fills. He has an excellent delivery, a good voice, courtesy, and above all, method.

Sir Henry Bessemer briefly and in well chosen language proposed a vote of thanks, which was passed unanimously.

Mr. Jeans then read a letter concerning Casperssen's converter ladle, described in a paper taken as read at Dusseldorf. The accompanying cut illustrates this ladle, the invention of Mr. Casperssen, of the Westanfors Bessemer Works, Sweden. This ladle is provided with the arrangement common in Bessemer ladles for casting through the bottom, and has at a limited height from the bottom a side opening A, fitted to the mouth of the converter by means of fire-clay luting, and the cotters C, one on each side of the mouth of the converter, driven through the eyes B. When a Bessemer blow is finished, and the converter has been partly tilted, the converter ladle is brought by a crane and the sling D to the converter mouth, and fastened. To give the luting time to dry, the converter remains about five minutes in the position shown in Fig. 1, the blast of the converter entering during

FIG. 1 FIG. 2

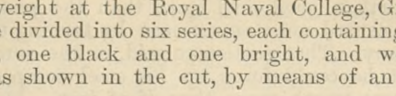


the running out of the metal. The converter is then tilted, as shown by Fig. 2, and the casting begins through the tap-hole E. The advantages attained by the converter ladle are thus stated:—The formation of sculls is avoided, and a greater percentage of ingots thus obtained; the ingots are denser and sounder both externally and in their upper ends; the ingots produced from the same charge are of more uniform quality; less work has to be expended on the ingots in cleaning or removing the scrap, and the ingots, when hammered or rolled, yield less metal which has to be rejected as unserviceable cuttings. The letter confirmed the statements in favour of the invention made in the paper in question. The ingots produced were increased in density and the work was reduced. He then read a letter from Messrs. Parry and Tucker, who stated that they had obtained a grant of £100. They had worked on a powerful arc, and obtained better spectra, and they could now say that it was possible to read the composition of a steel or iron by the spectroscope, even quantitatively, because the larger the quantity of an impurity present the more common were its lines in the spectrum.

Mr. Parker, of Lloyd's Registry, then read his paper on

THE RELATIVE CORROSION OF IRON AND STEEL.

This was in all respects a very able contribution to a much discussed subject. We must content ourselves with giving the main facts. Twelve discs, 4½in. diameter, were obtained from each of eleven steel and iron-making firms. Six of the discs from each maker were turned bright, to remove all scale, and the other six were turned round the edge only. Each disc was carefully weighed to $\frac{1}{50,000}$th part of its own weight at the Royal Naval College, Greenwich. They were divided into six series, each containing twenty-two discs, one black and one bright, and were fixed together, as shown in the cut, by means of an iron rod



which had been covered by a glass tube, the plates being separated from each other by means of glass ferules about ⅝in. long and 1in. diameter, thus so far as possible insulating each disc, and preventing galvanic action being set up between them. These sets of discs were then exposed to corrosive influences of various kinds. Some were put in the boilers of steamers, in different trades; one was fixed under the pier at Brighton; another on the roof of a house in London. They were exposed for various periods, some for nearly a year and a-half. The general result was that the steel did not corrode faster than iron; but while the bright plates appeared to corrode equally all over, those with the scale on pitted, which is a much more serious matter; all the corrosion, or nearly all, being seemingly concentrated on a limited area. In some cases the glass ferrules corroded quicker than the iron or steel. As will be seen further on, this pitting seems to be due to galvanic action between the black oxide and the iron. Mr. Parker gave tables setting forth all the results obtained, but he warned his hearers too much importance should not be attached to small scale experiments. He could say, however, that they had 1100 marine steel boilers running, and that the most careful inspection by Lloyd's surveyors showed no difference between their behaviour and that of iron boilers under the same circumstances.

After an adjournment for luncheon, the proceedings recommenced at 2 p.m., when Mr. Denny, of Dumbarton, read his paper on

THE ECONOMICAL ADVANTAGES OF STEEL SHIPBUILDING.

This paper dealt almost exclusively with the saving in weight to be effected by using steel instead of iron in building ships, and this was for all classes of ships with great uniformity as nearly as possible 13 per cent. The more important figures in Mr. Denny's paper are set forth in the following tables:—

Cost of Iron required in a Spar-decked Steamer of 4000 *Tons Gross.*

	Tons.		£	£
Plates, angles, and bulbs	2,098	at	6·0	12,588
Slip iron	52	,,	5·5	286
Round and bead iron...	31	,,	6·5	202
Forgings	41	,,	25·6	1,050
Rivets	111	,,	10·0	1,110
	2,333			15,236
Less 9 per cent. scrap	210	,,	3·5	735
	2,123			14,501

Cost per ton of invoiced weight $\frac{£14,501}{2,333} = £6·25$

Cost of Iron and Steel required in same Steamer built of Steel.

	Tons.		£	£
Iron plates and angles	244	at	6·0	1,464
Slip iron...	49	,,	5·5	270
Round and bead iron	31	,,	6·5	202
Rivets	16	,,	11·0	176
	340			2,112
Steel plates, angles, and bulbs...	1,569	,,	9·25	14,513
Forgings...	41	,,	25·6	1,050
Rivets	80	,,	13·0	1,040
	2,030			18,715
Scrap, 9 per cent....	183	,,	3·5	640
	1,847			18,075

Cost per ton invoiced ... ... $\frac{£18,075}{2,030} = £8·9$

Mr. Denny complained that the iron makers charged as extras any size the least out of the common. Thus owing to the plates in the iron steamer in the preceding tables being 16ft. long, 610 tons of them exceed the limits allowed by ironmakers in size and weight, and on this an extra payment of £650 would be required. The true cost of the iron would therefore be £15,151 instead of £14,501. The limits allowed by the steelmakers would entail no extras on this vessel. As concerned labour, the cost of rivetting with steel was 5 per cent. greater than with iron rivets. He advocated in the strongest terms the reduction of the cost of steel, and advised steel makers to use every effort to bring it down to the price of iron. Concerning corrosion he had little to say, save that according to his experience there was no cause for alarm, steel behaving like iron.

This paper and Mr. Parker's were taken together for discussion, and we regard it as a curious fact that although there were several eminent chemists present not one of them, save Mr. Snelus, opened his lips. Indeed, at first it seemed as if there was to be no discussion; a solemn silence pervaded the assembly, and it was not until Mr. Smith had vainly tried in several directions to get some one to speak that Mr. Snelus rose. He cited twenty-five steel boilers which had been under his observation for eight or nine years, and they were just as good now as when they began work, with the exception of a very little pitting. He then advanced the theory that pitting is due to the irregular diffusion of manganese through the plates, this theory being founded on the fact that it was only some soft old Bolton steel plates with a lot of manganese in them which had pitted. He was now experimenting, he said, with a view to find out whether he was right or not. Mr. Parker's experiments were very good, while those made by the Government Boiler Committee were extremely bad. Turning to Mr. Denny's very natural wish to have cheap steel, Mr. Snelus explained that it was very difficult to make it cheaper than it was while scrap could not be profitably utilised. Thus a ship plate began with an ingot worth £5 a ton, about 32 cwt. of that ingot was required to make a ton of finished plate. The difference mainly appeared as scrap, which was only worth £3 a ton. But when they dealt with iron, the scrap from the plate was really No. 2 iron, and was worth a good deal more than the puddled bar. Mr. Snelus caused some amusement by turning the tables on Mr. Denny. That gentleman said, in the course of his paper, that he could forge up his steel scrap, and the forgings were worth more than if of iron. Mr. Snelus now urged the shipbuilders to buy scrap and pay a good price for it, because Mr. Denny admitted it was worth it.

Mr. Richards said he had had experience with sixty steel boilers, and had no trouble from corrosion, save when some water spoiled by pyrites was used, and that was caused by putting zinc plates in the boilers.

Mr. White, of the Admiralty, spoke of Mr. Barnaby's experiments on corrosion made in Portsmouth Harbour, the result of which was that if the least scrap of black oxide was left on the plate, it would cause pitting, which was a serious matter, while diffused corrosion was so slow in its action that it was of no consequence. In the Government ship yards the plates were cleaned by pickling, but he hoped that experiments now being made would be successful, and that they would be able to clean the plates when in place. The steel was dearer than iron principally because people insisted on having a steel which was much better than the iron they were previously quite satisfied with. Mr. Walker and Mr. Martell added little to what had gone before, but they agreed in condemning a paper on the comparative endurance of iron and mild steel when exposed to corrosive influences, read before the Institution of Civil Engineers on the 29th of March, by Mr. David Philips. Sir Henry Bessemer followed the same line, and said that he made a few calculations, and if the statements made in that paper were true, then nothing would be left in $8\frac{1}{2}$ years of boilers made of $\frac{3}{8}$in. plates but the coat of paint on the outside. As a matter of fact, boilers did not exist as ghosts, and such assertions as those he called in question were refuted by the fact that he could name six boilers, each 30ft. long, made of $\frac{5}{16}$in. steel plates, which were good now after twenty-two years' service. Mr. Williams, the past president of the Institution, warmly and vigorously defended the steel-makers from Mr. Denny's imputations. They did all they could do, he asserted, to make steel cheap. If shipbuilders would be content with steel as good as iron they could have it cheap. To make good steel plates it must be well worked, and there was a great practical difficulty about this. He explained that in an 80 lb. steel rail there are about 8 square inches of cross section. Such a rail is rolled from a 15in. ingot, with a section 28 times that of the rail. But to keep this proportion in an ordinary ship plate the ingot must be 35in. by 20in., and for 1in. steel boiler-plates the ingot would have to be 40in. by 38in. "Why," cried Mr. Williams, "to roll such a thing would be like rolling the end of a house. I once saw them rolling a plate in Sheffield 25ft. long, 60in. wide, and 5in. or 6in. thick, and they rolled it in double lengths to save crop ends." This sally was received with shouts of laughter. "People who could do that sort of rolling could roll anything," added the speaker. He went on to add that at present enormous rolling apparatus was quite out of the question, and they were compelled to use costly hammering which made steel dear. Mr. Williams created further amusement by his description of one of Sir Henry Bessemer's earlier proposals. "He was to have," said Mr. Williams, "a couple of rolls, I don't know how large, 40ft. or 50ft. in diameter, and fluid steel was to be poured on them in a continuous stream, and they would turn out steel plates in any length just like cartridge paper." Testing steel added to its cost, and he could assure the steel users that anything that reduced the worry of steel makers would be well repaid. Mr. Riley made a most vigorous speech in defence of the steel makers. He warmed with the subject, and spoke quite to the point. He was especially severe on those "who were always ready to put the steel maker in the pillory. "They hunt out," he said, "every little flaw or defect. They stick up the bad plate before the world, and they crucify us with diagrams." On one point he was quite determined, namely, that no matter what the outcry for cheap steel, he would not be a party to the wasting of hard-earned reputations by risking quality. Tests were of the greatest value, costly or not, and must not be given up.

In replying on the discussion Mr. Parker detailed the circumstances of the failure of the Livadia's boiler plates, and called attention to the fact that, whereas iron plates will not fail when they are let alone, steel plates crack when there is no one meddling with them. He showed specimens taken from the Livadia's plates. Mr. Denny in his reply dealt principally with Mr. Snelus, and explained that he had scrap enough of his own to work up without taking that of steelmakers off their hands. He very energetically assured the steelmakers that if they thought any lenience would be shown by him to steel they were much mistaken. He would treat it just as he treated iron, no better and no worse, with one exception, he would not let steel be worked at a black heat. It was quite true that iron was good enough for ships while they kept at sea, but it was not as good as steel when they went ashore, and steel was so superior, he argued, for ships on rocks and sandbanks, and other places where they ought not to be, that the cost of insurance was reduced. As to the cost of steel, in a comparatively short time it had fallen from double the price of iron to 50 per cent. dearer than iron, and he was quite certain that in about a year and a-half it would be no dearer than iron. A vote of thanks was passed to both Mr. Parker and Mr. Denny.

It was now long past three o'clock, but the president advised the reading, by the secretary, of a paper by Mr. Sirgius Kirn,

On the Manufacture of Steel and Steel Plates in Russia.

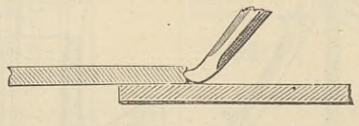
This was a description of the process as carried out at the Obouchoff Works, near St. Petersburg. The plant at these works consists of two 10-ton Siemens-Martin furnaces, without muffles or auxiliary furnaces for the previous heating of the scrap, the top-ends of ingots, &c., of which the charge is composed. The gas-producers are arranged so that one part of them may be fired by wood and another by coal. The ladle turntable is controlled by hand, and the moulds are placed on a semicircular elevation. The ingots which are cast at present are used for the rolling of tires and plates, mostly for shipbuilding. The charge is introduced into the furnace in a cold state at once, and very often pieces of steel—top-ends of ingots—weighing about 2 tons are introduced, with other scrap and waste ingot-ends. The average weight of the total charge is from 8 to 9 tons. The charging of the furnace is completed in 1 to $1\frac{1}{4}$ hours, and a full supply of gas melts the steel, if all is going on well, in $3\frac{1}{2}$ to 4 hours, when about 1 to $1\frac{1}{2}$ cwt. of ferro-manganese is added. After this a sample is taken, and the usual forging and tempering tests are made. In case the metal has not attained the desired degree of softness, after some 20 to 25 minutes another test is taken; but, in most cases, it is found better to add at once a certain quantity of good iron ore—magnetic or brown—in the form of a powder. The reaction which then takes place soon brings the molten metal to the desired degree of softness. Before casting a certain quantity of ferro-manganese is again added—usually about $\frac{3}{4}$ to $1\frac{1}{2}$ cwt. The loss in the process varies from 7 to 9 per cent. The whole process of making open-hearth steel, reckoning from the commencement of the charging till the tapping, occupies from 5 to 6 hours for medium steel—tires—and about 7 to $7\frac{1}{2}$ hours for soft steel—plates. In 1 to $1\frac{1}{4}$ hours after the casting is over, the furnace is ready for another charge.

Not a dozen members remained to hear this paper read, and when it was concluded the meeting adjourned without discussion until the next day, Thursday. We reserve our report of the proceedings of yesterday until next week.

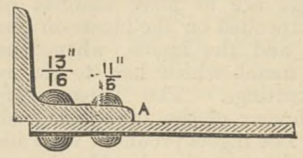
THE INSTITUTION OF MECHANICAL ENGINEERS.

In our last impression we brought down our report of the proceedings of the Institution of Mechanical Engineers to the evening of Thursday, the 28th of April. Two papers were read; one on rivetting, by Baron Clauzel, and the other on rivetted joints, by Professor Kennedy. We were compelled by want of room to hold over our report of the discussion which followed, and which we now give. It was opened by Mr. R. H. Tweddell, who first referred to a table—page 325—giving the practice, as regards pitch and diameter of rivets for plates of given thickness and form of joints, of a large number of the leading boiler-making and engineering firms in England. Mr. Tweddell considered that these tables showed that the general practice of English engineers conformed to and was confirmed by the results of Professor Kennedy's experiments and the deductions therefrom. He then referred to the diagram—Fig. 1—illustrating the incipient set which takes place with steel tested by Professor Kennedy, saying that he feared that that curve indicated that some value less than the ordinarily assumed value of the elastic limit must be taken in apportioning the necessary sectional areas of parts of structures. He next referred to the influence on the pitch ordinarily adopted by engineers of the known effect of heavy caulking, and remarked that few boiler-makers now caulked with anything but the light hand-hammer and a light set tool formed so that caulking in the ordinary sense of the term was not performed, but only a gentle swelling of the edge of the plate, commencing at the centre of the edge, and from which there was practically no strain on either the plate or the rivetting.

Mr. F. W. Webb sketched a caulking tool, or rather set, shown by the annexed diagram, by which no "fullering,"



was done, and no injurious strain visited upon the plates. He also referred to the practice at Crewe of sponging the plates along the parts to be rivetted together with warm sal-ammoniac and water, so that the scale was effectually removed, and this made caulking unnecessary, nothing being done to the joints when they leave the boilermaker's shop. He also said that the plates were always sponged with a solution of sal-ammoniac when the shell was completed, in order to remove the whole of the magnetic oxide scale, as this prevented corrosion, the plates being afterwards washed and coated with glycerine to prevent rust if the boiler was not at once put to work. In order to prevent the grooving of the plate, which at one time generally occurred at the edge of the angle-iron or steel at the smoke-box end of boilers, he had adopted the following plan. The angle bar was made to oversail the plate a



little, and rivets of larger diameter at the root of the angle than at the edge were used. The strain was thus spread over the whole of that part of the plate joined to the angle, and the cause of grooving at A was removed. He said that 100,000 practical tests of steel plates had been made at Crewe, and only two plates had ever had to be rejected after being worked up into a boiler. He considered it wholly unnecessary to heat boiler plates to bend them, and annealing was unnecessary and injurious when badly done, or done by simply heating a number of plates and then allowing them to cool. All the plates at Crewe were punched, and with a bolster about $\frac{1}{16}$in. larger than the punch, and no injurious effects on the plates were noticeable, though about two boilers were turned out every three days at Crewe, all working at 140 lb. per square inch. It had been remarked that the corrosion in ships was almost all exterior corrosion, but Mr. Webb said that in the vessels of the London and North-Western Company corrosion took place more in the inside, partly due to the excreta of the cattle carried, and which found its way into the bilges.

Mr. Boyd referred to Professor Kennedy's curve, Fig. 1, and seemed to have some fear that it indicated the necessity of attaching a lower value to the limit of elasticity.

Mr. Cowper (president) remarked that he had on a previous occasion described an instrument which he called an extensometer, which showed that very small permanent sets took place before the ordinary elastic limit or point of "breaking down" of the material was reached.

Mr. W. Traill remarked that though the results of Professor Kennedy's experiments with strips of plate $1\frac{3}{8}$in. and 4in. gave tensile resistance practically the same, other experiments had indicated that the strength of plates of different widths was not the same, the narrow strips exhibiting greater resistance. He considered that there was no cause for alarm in the fact that iron and steel plates showed slight permanent set before the ordinary elastic limit was reached.

Mr. Longridge considered that the high proportional strength of rivetted joint obtained by Professor Kennedy was due to the larger diameter of rivet used, and with respect to the greater tensile resistance of the part of a strip which remained after punching, he remarked that this was not exhibited in any case in experiments on iron with which he was acquainted, though it had been found to be the case with iron strips in which a hole had been drilled.

Mr. Schönheyder referred to the experiments on the shearing resistance of rivet steel, and said that he should expect that the friction of the cutting pieces in Professor Kennedy's apparatus somewhat increased the result.

Mr. Hall said that the tables of Mr. Tweddell, to which we have already referred, showed that the ordinary practice agreed with Professor Kennedy's results as to pitch of rivets, but not as to diameter of rivets. It was necessary, he considered, in assigning the thickness of plates for a boiler, to make a sufficient allowance in all cases for the corrosion of plates.

Mr. Jeremiah Head said he considered that the practice of bending plates after they were punched was probably a frequent cause of fracture along the rivetted joints, for that part which was punched was bent much more in passing through the bending rolls than the other parts of the plate, and that no doubt incipient cracks were produced in this way. He also referred to the bad effect of using bolsters much larger than the punch, and sketched the annexed in illustration of his remarks.

FIG. 1

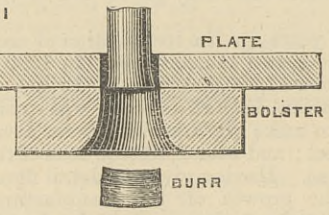
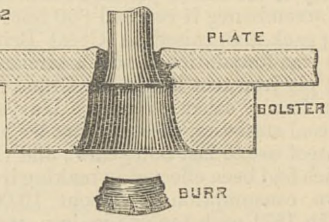
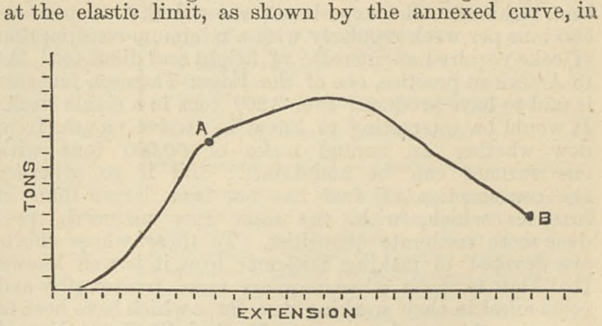


FIG. 2



Mr. John referred to Professor Kennedy's substitute for the usual modulus of elasticity, and said he had a long time urged that this modulus should be expressed as a function of the load. On the effects of punching he remarked that this was small in thin plates, such as those tested by Professor Kennedy, but the case seemed to be very different with thick plates, the loss of strength on punching was very great as compared with the author's results. He also considered that Professor Kennedy's widest plates were not sufficiently wide to show the difference between the strength of narrow strips as tested in a testing machine, and whole plates as built into a structure.

The discussion was then adjourned, and on its resumption on Friday evening Mr. Druit Halpin described the results of some experiments on the tensile strength and elastic limit of some pieces of steel, which showed that the ultimate strength was less than the strength exhibited at the elastic limit, as shown by the annexed curve, in



which A represents the point at which destructive extension commenced, and B the point at which rupture took place.

Mr. Paget made some remarks upon this, saying that if Mr. Halpin was right in saying that the ultimate resistance was less than that at the elastic limit, he could only say that his breath was taken away. Mr. Paget certainly seemed excited at what he understood as an alarming statement, Mr. Halpin the while standing at the black board with a smile of surprise, in which there was also something comic; but he re-explained that at the point A, destructive extension had commenced, though the ultimate resistance went up to as high as shown by the upper part of the curve. Here extension so increased that the sectional area rapidly decreased, and the load the specimen could carry decreased with it. This is in fact just what Professor Kennedy's experiments, and many hundreds before his show, and it really looked as though Mr. Halpin threw out his remark and drew his curve to frighten Mr. Paget.

Mr. L. Fletcher said that he had little information to supply that was new, but what he had was at the disposal of the members of the Institution of Mechanical Engineers. He had recently carried out a number of tests of the strength of rivetted joints in boilers, making these tests not as though the materials were in a machine, but under actual working conditions. He had these tests made in comparison with kindred tests made by Mr. Kircaldy. The boiler tested by hydraulic pressure was 7ft. in diameter, with 2ft. 9in. tubes, and built up of seven belts 3ft. wide. The general result was that rivetted seams in the boiler were much stronger than in the testing machine. In the machine the single rivetted joint had but 53·84 per cent. of the strength of the solid plate, while in the boiler it had

TABLE COMPILED BY MR. R. H. TWEDDELL, SHOWING THE ENGLISH PRACTICE IN RIVETTING.

Single-rivetted Lap Joints.

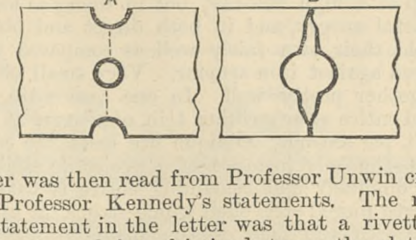
	Thickness of plate.	Diameter of rivet.	Diameter / Thickness	Pitch.	Pitch / Diameter.
B	5/16	5/8	2·00	1¾	2·80
C	,,	5/8	2·00	1⅝	2·60
D	,,	5/8	2·00	1⅝	2·60
F	,,	5/8	2·00	1⅝	2·60
A	3/8	5/8	1·66	1¾	2·80
B	,,	3/4	2·00	2	2·66
C	,,	3/4	2·00	2	2·66
F	,,	3/4	2·00	1⅞	2·50
H	,,	5/8	1·66	1¾	2·80
B	7/16	7/8	2·00	2¼	2·57
C	,,	7/8	2·00	2⅛	2·42
D	,,	3/4	1·71	1⅞	2·50
F	,,	7/8	2·00	2⅛	2·42
A	½	3/4	1·50	2	2·66
E	,,	13/16	1·62	2	2·46
F	,,	1	2	2⅜	2·37
D	9/16	7/8	1·55	2⅛	2·42
E	,,	13/16	1·44	2	2·46
A	5/8	7/8	1·4	2¼	2·57
H	,,	3/4	1·2	2	2·66
I	,,	7/8	1·4	2¼	2·57
H	11/16	1⅛	1·63	2⅝	2·33
A	¾	1	1·33	2½	2·5
D	,,	1	1·33	2¼	2·25
G	,,	1⅛	1·5	2½	2·22
H	13/16	1¼	1·53	2⅞	2·3
H	7/8	1	1·14	2½	2·5
I	,,	1⅜	1·56	3	2·18
D	15/16	1⅛	1·2	2½	2·22
C	1	1	1·0	2¼	2·25
D	,,	1⅛	1·12	2½	2·22
C	1⅛	1⅛	1·00	2⅜	2·11

Double-rivetted Lap Joints.

	Thickness of plate.	Diameter of rivet.	Diameter / thickness.	Pitch.	Pitch / dia.	Spacing	Pitch / spacing.
B	5/16	5/8	2·00	2¼	3·60	1¾	1·28
C	,,	5/8	2·00	2½	4·00	1⅝	1·53
D	,,	5/8	2·00	2¼	3·60	1¼	1·80
F	,,	5/8	2·00	2⅞	4·60	1¼	2·30
A	3/8	5/8	1·66	2⅛	3·40	—	—
B	,,	3/4	2·00	2½	3·33	2	1·25
C	,,	3/4	2·00	2½	3·33	1⅝	1·53
F	,,	3/4	2·00	3⅜	4·50	1½	2·25
H	,,	5/8	1·66	2¼	3·60	—	—
I	,,	11/16	1·83	2 11/16	3·9	1 1/16	2·58
J	,,	3/4	2·00	2⅝	3·50	1⅛	2·33
B	7/16	7/8	2·00	2¾	3·14	2¼	1·22
D	,,	3/4	1·71	2½	3·33	1½	1·66
F	,,	7/8	2·00	3⅞	4·42	1¾	2·21
A	½	3/4	1·50	2½	3·33	—	—
E	,,	13/16	1·62	2	2·46	1¼	1·60
F	,,	1	2·00	4⅜	4·37	2	2·18
H	,,	3/4	1·50	2½	3·33	—	—
D	9/16	7/8	1·55	2¾	3·14	1¾	1·56
E	,,	13/16	1·44	2	2·46	1¼	1·60
A	5/8	7/8	1·40	2¾	3·14	—	—
H	,,	7/8	1·40	3	3·42	—	—
A	¾	1	1·33	3	3·00	—	—
D	,,	1	1·33	3¼	3·25	2	1·62
G	,,	1⅛	1·50	3⅝	3·22	—	—
A	7/8	1⅛	1·28	3¼	2·88	—	—
H	,,	1⅛	1·28	3⅝	3·22	—	—
D	15/16	1⅛	1·20	3½	3·11	2¼	1·55
H	,,	1	1·06	3½	3·50	—	—
I	,,	1¼	1·33	3½	2·80	—	—
A	1	1¼	1·25	3½	2·80	—	—
D	,,	1⅛	1·12	3½	3·11	2¼	1·55
H	,,	1⅜	1·37	3½	2·54	—	—
K	1 1/16	1 5/16	1·23	4⅛	3·14	2½	1·65
A	1⅛	1⅜	1·22	3¾	2·72	—	—

56 per cent. The cause was no doubt that the crossing of the seams and the way in which the plates were put together kept the strain more direct than it would otherwise be. There was no doubt as regarded punching, that *pro rata* it made iron stronger. He called attention to a defect due to the flat in all boiler plates left when they are bent between three rolls only. A strip at each end of the plate is obviously left unbent, and at the junction of this flat with the circle fine hair-like cracks show themselves, which may ultimately lead to the most disastrous results. He had recently met with three dangerous examples of this kind of cracking in locomotive boilers, built of Lowmoor iron. A desultory conversation ensued between Mr. Fletcher and the president, which elicited little or nothing which was not contained in Professor Kennedy's paper.

Mr. J. Head again called attention to the effect produced on metal by the proportion borne by the bolster to the punch. When the punch was sharp and nearly filled the holes, the metal was not torn, but when the punch was too small, then ragged holes were made, and the punch really tended to split the metal. Mr. Cowper, jun., and two or three other speakers then commented at some length on the influence of form on the specimen—plates treated as in diagram A breaking as shown by the dotted line, while those treated as in B broke in a different way, as shown.



A letter was then read from Professor Unwin criticising some of Professor Kennedy's statements. The most important statement in the letter was that a rivetted seam derived no strength from friction between the plates; what was attributed to this being in fact due to the *pro rata* augmentation of strength of the plate due to punching or drilling—in fact to form.

A letter was then read from Professor Kennedy, who unfortunately could not be present, replying on the discussion of the night before. On the whole, his experiments did not confirm the table prepared by Mr. Tweddell, because he dealt with steel and Mr. Tweddell with iron. Steel rivets were made too small, and did not possess the strength usually attributed to them, and they ought to be increased in dimensions; to get the best possible results out of them, much more rivet area was wanted. As to permanent set from the first, that was so small to begin with as to be of no consequence. The first extensions were quite uniform, and the modulus of steel was constant up to 14 tons on the inch.

The president, after complimenting Professor Kennedy and defending the accuracy of his experiments, proposed a vote of thanks, which was accorded with applause. The next paper read was by Mr. W. Worby Beaumont,

ON THRASHING MACHINES.

IN this paper the author dealt only with modern machinery, illustrative of the best English practice, and after referring to the great difficulties which had been met with and overcome in arriving at the modern finishing machine, by forty years of experiment in almost all parts of the world with many and various kinds of grain, grown, harvested, and thrashed under varying conditions and circumstances, he said the primary operations performed in thrashing are:—(1) Separation of the grain from the ear and straw; (2) separation of the grain from short broken straw and pieces of broken ear—cavings and chobs, and from the chaff; (3) separation of the grain from dirt and seeds; (4) separation of the grain into different qualities. In most countries these involve—(1) thrashing the whole crop, with greater or less length of straw, by passing it between a fixed and a rapidly revolving ribbed surface; (2) shaking the straw, to remove any grain, seeds, chobs, and chaff that may be carried by it; (3) passing the whole of the products of thrashing, except the straw, over rapidly reciprocating riddles and sieves, in presence of the blast from one or more fans; (4) passing the grain through a cylinder provided with revolving beaters or arms, to remove any firmly adhering chaff, awns, or beard, followed by final sifting on secondary sieves; (5) passing the grain through a revolving screen. The parts by which these operations are performed, and their arrangement were then described by reference to diagrams illustrating the 4ft. 6in. machines of Messrs. Ransomes, Head, and Jeffries, Messrs. Clayton and Shuttleworth, Messrs. Richard Garrett and Sons, Messrs. Robey and Co., Messrs. Davy Paxman and Co., Messrs. P. and H. P. Gibbons, and others.*

The author then described a series of coefficients which he had developed, and by means of which the areas and velocities of the chief moving parts of thrashers may be determined and expressed in terms of the velocity of the drum, or of the product of its velocity, length and diameter. These were based on the velocities and dimensions employed by nine manufacturers, the mean velocities of the drum peripheries being 6000ft. per minute. As all parts of the machine receive their motion from the drum spindle, and as all the material received by these parts must first pass through the drum, and depends in quantity upon the drum capacity, it will be seen that, except for special cases, there must be a direct relation between the product of the circumferential velocity, length, and diameter of the drum, and the simple area or the product of the velocity and area of the other moving parts. These relations may be expressed as constants, which will be applicable in all but special cases. All the shakers shown in the diagrams were of the reciprocating form, receiving their motion from one or from two cranks. The employment of one crank and rocking bearers, or of two cranks and no rockers, seems to be entirely a matter of individual preference. When two cranks are employed, the vertical range of movement of each shaker section is the same throughout its length; but when one crank only is used a greater range of vertical movement is given to the free end of each section, while that at the end attached to the rockers, or vibrating arms, is very small. The mean range of vertical movement for the whole length of any shaker section, whether with one or two cranks, is thus about the same. Generally speaking the number of feet moved through vertically in a given time by that part of the shaker section which is immediately over the crank, is somewhat greater with double-crank shakers than with single-crank shakers, but the mean total movement is as great in the single-crank shakers as in the other; depending as it does upon the distance at which the crank is placed from the middle of the shaker sections, as well as upon the length of stroke and the number of revolutions of the crank. The width of shakers is usually very nearly the same as the length of the drum, their length being about double the length of the drum. A considerable stroke is necessary for a shaker crank, in order that the shaking of the straw may be sufficiently violent; a very short stroke, even with a high velocity, not being as efficient as a similar total motion per unit of time with a longer stroke. In comparing the velocity of movement of the shakers with that of the drum periphery, it is therefore not sufficient to take the total mean vertical movement—or feet moved through per unit of time—by the shaker sections, but it is necessary to assume a minimum vertical range. The throw of the crank is thus to a certain extent fixed, and especially is it so with the two-crank shaker. Comparing a number of two-crank machines, the mean throw is found to be 4·6in., with a mean of 348·4 strokes per minute, giving a speed of 133·54ft. per minute, or 0·0222 of the drum-surface speed. Although with single-crank shakers the range of movement of the shaker sections may be greater than the throw of the crank, there is not much difference in the throw of the cranks used. An average throw is 4·25in. with 345 strokes per minute, giving a speed at the crank of 122·13ft. per minute, or 0·0203 of drum periphery speed. The Brinsmead's shakers now employed by Messrs. E. R. and F. Turner are designed to secure greater range of motion of the shaker sections with one crank. This is effected by making each section in two parts jointed at the crank, the longitudinal frame-pieces of each section being four instead of two, and the movement being like that of a pair of scissors, placed, with one handle and one blade nearly level, upon cross pieces suspended by hangers, and pivotted upon a crank pin. A somewhat lower crank speed may be possible with this shaker, but the crank must have a throw fully equal to those already referred to. With a given throw of crank it may thus be taken that the total mean vertical speed of any shaker section will be given, according to the best English practice, by multiplying the drum-surface speed by the coefficient 0·0213. The product is, of course, that of the crank stroke by the number of strokes per minute. It is very important in machines for all countries that a sufficient area of riddle surface should be given. Too large an area is not likely to be given, as the length is often one principal element in the determination of the length of a machine, and it is desirable to keep down the weight of the upper shoe, which is always a heavy reciprocating part. The necessary area may be determined by reference to the developed surface of the drum, the usual meaning of the term developed being here employed to express the product of the circumference, length, and circumferential velocity in feet per minute. "Developed surface" is also the term used to express the product of the simple area of sieves, and the feet moved through per minute. In the case of the machine described the mean developed surface of the caving riddle is 2446·6ft., and the coefficient of area in terms of the developed surface of the drum is 0·09374. But as a large area of riddle with a short stroke is more likely to be efficient than a small area with long stroke, the best coefficient of riddle area will, perhaps, be that which expresses the actual or simple area in terms of the developed drum surface. The coefficient expressing this is 0·000802, the mean simple area of the riddles being 21·467 square feet. The effective area will, of course, be dependent upon the pitch of the holes. This ranges from 1in. to 1½in. transversely, and from 1½in. to 1⅞in. longitudinally, the holes being in almost all cases in zigzag transverse lines. The mean speed of reciprocation of the riddles of eight machines is 114·54ft. per minute, and the corresponding coefficient, expressing the ratio of riddle speed to drum-surface speed, is 0·01909. Omitting two machines in which the velocity is considerably less, and one machine in which the velocity is much higher than the others, the coefficient becomes 0·018869.

The necessary area of each of these sieves may again be taken as a function of the developed drum surface, and the velocity of their reciprocation as a function of the drum surface velocity. The mean area of these lower shoe sieves, in eight machines, is 6·091 square feet, the developed area being 722·55 square feet, while the mean velocity of reciprocation is 115·70ft. per minute. There is considerable variation in these areas and speeds, but the above means coincide closely with the dimensions of two of the largest makers. The coefficient for the actual area of the sieves, in terms of the developed drum surface, is 0·000262; while the coefficient for developed sieve area (which includes the relation between sieve velocity and drum velocity as well as developed drum surface, as before expressed) is 0·02647. The relation between the velocity of reciprocation of the sieves and the drum velocity is expressed by the coefficient 0·019285. The average area in seven machines is 2·867 square feet; but in two of these the area is considerably larger, while the developed area is also larger. In these cases the first-dressing sieve area is also large; but the large area of the second-dressing sieve is probably due to the use of only two instead of three or four first-dressing sieves. It may however be noted that the sieve area is by a few makers made sufficient to suit a wide range of requirements; while other makers modify the sieve areas according to the known requirements of the district in which the machine is to be used. The few makers referred to send the same machine to most countries from which they have orders; but this can only be done by making some parts much larger than is necessary for some purchasers. Expressing the second-dressing sieve areas in the same terms as before, the coefficient for the actual area is 0·0001065, while that for the developed area is 0·01063. The mean velocity of reciprocation is 100·09ft. per minute; and the relation between this and the mean drum speed is thus given by the constant 0·01668. The mean width of the first-blast fan in seven machines, is 35·8in.; the mean diameter 21·5in., and mean number of revolutions per minute 582·5. The quantity of air delivered by these and by the second-blast fan may be expressed in terms of the developed surface of the drum. The mean width of these fans is 7·707in., and the mean diameter 17·33in.; in each leaving

* As most of the diagrams were the same or nearly similar to those recently given in THE ENGINEER, we need not reproduce them. See THE ENGINEER for 4th July, 1879, 1st August, 1879, 8th August, 1879, 23rd July, 1879.

out of account one unexplained exceptional size. The mean number of revolutions per minute is 695·33. Most of the screens employed are of Penney's design, and all are adjustable. The mean diameter employed is 16·72in., and the revolutions per minute 39. The largest diameter is 18in., running at 40 to 50 revolutions per minute. The 4ft. 6in. machines under trial at the Cardiff meeting of the Royal Agricultural Society in 1872 required on an average about 11-horse power to work them, when thrashing one ton of wheat in the sheaf in from fifteen to twenty minutes. The power required to work the machine empty ranged from 52 to 77 per cent. of that necessary to work the machine full. The heavy reciprocating parts, hanging upon non-synchronous pendulum rods, consumed a great quantity of power. It has been estimated that of the whole power consumed the drum takes 40 per cent., the shakers and caving riddle, with the other parts of the upper sieve, 40 per cent., and the other parts of the machine 20 per cent.

In the discussion which followed this paper, Mr. Jeremiah Head referred to the blast or fan corn elevator, which was at one time employed as a substitute for the cup elevator; but this, the author said, was disused because of the quantity of grain which was broken by it when it was very dry. Mr. Head also suggested the further use of steel or iron in the construction of thrashing machines; but it was stated in reply, that though thin buckled plates might be used in some machine sides, and iron or steel used, as it is already by one maker, for the frames, iron could not be used in many of the parts where wood was now used, because surface was necessary, which could not be obtained with lightness in iron. Iron would, moreover, cost much more for the parts than wood, and could not be used for the caving riddles, as much of the short straw would pass through them. Again, iron frames and principal parts were not so easily or cheaply repaired as when of wood. Mr. W. E. Riche referred to the trials of machines at Cardiff, in 1872, and to the large number of units of work expended in thrashing and cleaning a given quantity of corn, as shown by the elaborate dynamometrical trials there made, and fully recorded in the Royal Agricultural Society's *Journal*. Another speaker referred to the loss of power which results from the use of long hangers for the first and second dressing shoes, while for the high speed at which these reciprocate the corresponding pendulum would only be 3in. or 4in. in length; and he described a method of mounting such shoes on short curved surfaces resting upon small rollers, the curvature of the carrying surface being that which would give the same rise and fall as a synchronous pendulum. This terminated the proceedings.

THE PRESENT CONDITION OF OUR ARMOURED DEFENCES.

SOME months since Colonel Inglis, R.E., read a paper at the Royal Artillery Institution on our armoured defences, which is now printed and deserves special notice, Colonel Inglis being probably the best authority on the subject in this or any other country—his time having been devoted to the subject from the first introduction of armour. We propose to review the position of our forts as depicted by him in connection with the present state of progress of artillery.

After briefly describing the introduction and development of armour through its earlier stages, Colonel Inglis notices the trial of iron shields fixed in masonry at Shoeburyness in 1865, when masonry 14ft. thick and armour in layers and solid plate 13½in. thick were fired at by Rodman guns and 10in. and smaller Woolwich guns. The masonry was destroyed much more completely than the iron, and this, he says, led to the adoption of two principles, (1) that our most advanced and important sea forts should be protected wholly by iron, and (2) that for other coast batteries masonry might be used, but that every gun casemate should have a shield affording protection against fire equal at least to that of its own gun.

Colonel Inglis is strongly in favour of plate-upon-plate armour as compared with solid, on account of the quality of thinner plates being more certain, while the joints can be broken in the successive layers. The best interval between the layers is 5in. filled up either by wood, bricks set in asphalte or Portland cement, or better still, iron concrete. The support given by one plate to another is much more complete when there is not sufficient space between the layers to admit of the shot point clearing the corners of plate it bends back before it meets the next layer, while on the other hand the plates are liable to fracture if the interval is so small as to render the structure rigid. It may be seen from the stress that is laid by Colonel Inglis on a certain measure of elasticity afforded by the intermediate layers, that the resistance is not of quite the same character as that of a solid plate—more bending occurs, we think, as illustrated in the case of No. 41 target under the blows of the shot of the 80-ton gun. We question if a solid plate could have bent at all to the same extent. Next, passing over the matter of bolts, air spacing, &c., we come at once to Colonel Inglis's summary as to the present power of guns. Old type Woolwich guns with fresh charges of slow-burning powder may penetrate armour, he considers, about equal to one and a-half their own calibre at close quarters—that is, the 10in. gun would penetrate a plate 15in. thick, and so on. Roughly speaking, a well-proportioned shot will pierce solid iron equal to its own calibre in thickness with a velocity of from 1050ft. to 1150ft. per second; one and a-half times its calibre with a velocity of from 1500ft. to 1650ft.; and twice its calibre with a velocity of from 2000ft. to 2200ft. —a velocity which has been obtained with certain new type guns. Colonel Inglis does not commit himself to any law, but it will be seen that these figures agree fairly with the rough rule of which we gave the mathematical proof in THE ENGINEER of January 14th last. After noticing recent experiments, both English and foreign, Colonel Inglis gives the estimate that compound steel and iron plates are better than those of wrought iron in proportion of 4 to 3, against a moderately severe trial; that is to say, a 9in. compound plate is as good as a 12in. iron one for ordinary direct fire, while the former has the advantage of deflecting and breaking up shot of all kinds to a much greater extent.

With regard to the work of the Committee on Plates and Projectiles—of which Colonel Inglis is president—we learn that against wrought iron, chilled projectiles always break up at a high velocity, but in doing so lose little of their useful energy, and in both direct and oblique fire they hold their own fairly well as compared with steel when fired against iron armour. Very small chilled shot hold together pretty well. In one case a 3in. projectile remained entire after striking 4½in. of armour at a velocity of 1699ft. per second. Oblique fire tests the shot more severely—the only instance of a projectile striking thick armour obliquely and remaining entire is that of a 9in. Whitworth forged steel shell which struck at an angle of 60 deg. with the face of the plate at a velocity of 1500ft. per second. The same description of shell went three times through a 12in. plate of wrought iron, and another from the 8in. gun remained entire and but little set up in a 16½in. plate after impact at 2200ft. per second. The great value of projectiles remaining intact is that in their doing so lies the only hope of carrying a bursting charge of gun-cotton into the interior of an enemy's ship or fort. Steel-faced armour defeats this method of attack when the fire is oblique, and completely baffles chilled cast iron projectiles. Sharp pointed heads have proved best for direct fire, but a 2 diameter head is the longest that is suitable for oblique impact. This we may observe has been the head adopted on the Continent for some time past. Krupp, for example, employed it in his Meppen trials in 1879. Colonel Inglis condemns flat heads altogether. We do not ourselves believe in flat heads, and have never recommended them; but we think there is one function that belongs to them that may be borne in mind, namely, that they may probably have an advantage in not readily breaking up in direct fire against hard armour. As Colonel Inglis points out, we have no experience with chilled armour in this country, but we may easily have to do with it. We cannot ignore the fact that this class of armour is now used on land almost universally abroad; while thick steel plates are carried on the Duilio, and perhaps the Dandolo and other heavily clad ships. This kind of armour must be destroyed by racking, and the shot that best holds together probably racks most. Fairbairn found that flat-ended shot took more than double the force to crush it than was required for a hemispherical-headed shot, the sides of the latter yielding outwards on the same principle as the supports of an arch. We therefore are disposed to think that whenever trials take place against thick steel or chilled iron in this country, it will be worth while to try the effect of flat-headed projectiles, although it may require many rounds to enable a comparison to be made, for this last class of armour suffers without exhibiting outward signs of disintegration for some time. We cannot leave this subject without expressing our conviction of the great desirability of making a trial of chilled armour in this country. Looking back at the trials even of chilled armour erected with a view of proving its *inefficiency* by Krupp at Meppen, and considering its behaviour in the light of German reports on chilled armour which we have since seen, we are inclined to think that it has much greater resisting power than we gave it credit for. Krupp, we think, was disappointed in the effect of his chilled shell against the chilled shield, and soon took to firing steel. Deep cracks were then produced, but we are inclined to believe that this class of shield would be tenable long after it was "pretty well cracked up," for the fragments are too large and irregular to become detached, and there is no langridge in the interior. Moreover, we question whether it would generally be feasible to fire a shell carrying a bursting charge through it. It has been suggested, however, that in the case of impact by a shot quite overmatching it, chilled armour might be shattered in a ruinous way, while wrought iron would only be completely perforated in a single clean hole. Colonel Inglis then discussed the interesting question of manufacture of armour, which we regret to have to omit at this time in order to pass on at once to what we regard as the specially interesting part of his most valuable paper, namely, the description of some of England's armoured coast defences. We have in all 434 guns ranging from the 80-ton to the 7-ton gun, provided for armoured forts on the coast of England, and ninety-one guns between the 38 and 12-ton guns mounted behind armour abroad. This, it will be seen, by no means represents the power of the batteries that would be shortly encountered by armour-clad vessels attacking us. For example, the four 100-ton guns to be mounted at Malta and Gibraltar are not included. The armoured defences take four forms—(1) Shields built in masonry; (2) shields in masonry with guns on turntables; (3) iron batteries; (4) turret.

Fig. 1 gives a section of Picklecombe and Garrison Point Forts, as a specimen of two-tier shield, fixed in masonry, showing, however, a weak point. At Garrison Point, Sheerness, the 38-ton guns have three 10in. plates in front of them, instead of three 5in. Speaking generally, the shields are built into the masonry as follows:—A strong frame of ¾in. plate and 6in. by 6in. angle irons, is constructed in the masonry, being built in, and attached by bolts, dovetailed pieces, &c. On this is built the armour, generally on the plate-upon-plate system. In the figure is shown the method of lifting a plate to be attached, as indicated. The drawing generally explains itself. The plate is hoisted up to the position shown in figure, and then run in by means of a traveller A, worked by a screw with handle at B.

Fig. 2 shows a specimen of turntable battery (Class 2), such as that at St. Helen's Fort, Portsmouth, Malta, and Gibraltar. Each gun has two ports, and moves to either by means of the turntables. Here, again, strong as the structure is made by intermediate layers at the ports, and heavy, iron-cased concrete supports between the ports, we show the weakest class of armour—three 6in. or two 9in. plates being used in some places. Colonel Inglis adds that it is proposed to use turntables for reversing and loading muzzle-loading guns. Of this, however, more hereafter.

Omitting Plymouth Breakwater, which is a stronger but perhaps less interesting structure, we pass on to the Class (3) Iron Batteries, of which the two great forts at Spithead—"Horse Sand" and "No Man's Land"—are good specimens, *vide* Fig. 3. Here again will be seen the plate-upon-plate armour, coupled with the principle of keeping the armour separate from the floor structure, so that any contortion of the armour may not affect the racers or structural parts on which the working of the guns vitally depends. There are armour-bar supports, about 10in. by 5in. or 4in., the greatest section being placed normally or radially to the wall about 4in. apart, extending from the lower floor to the roof. The pier casings are filled with Portland cement concrete. The safe load of the upper gun floor and of the roof is equal to a mass of concrete laid 10ft. thick over it, or half a ton on every square foot. The middle plates of the armour stand on end, being 22ft. 6in. long, extending from base to roof. Concrete is used between the plates, except at the port frames, where wood is employed. It will be seen that here again it would be easy to add outside rings of armour and masonry to correspond, for which express provision is made. The weight of ironwork on these forts is as follows:—Skeleton per gun, 50 tons—total, 2450 tons; armour wall per gun, 75 tons—total, 3764 tons; total weight, 6214 tons. Each sea fort at Spithead, Spitbank, and Plymouth is prepared for the addition hereafter of a turret on its roof, each to carry two of the heaviest ordnance. The Spithead forts can carry five turrets each; the others two each. Rope mantlets soaked in chloride of calcium to render them uninflammable are supplied to all these works.

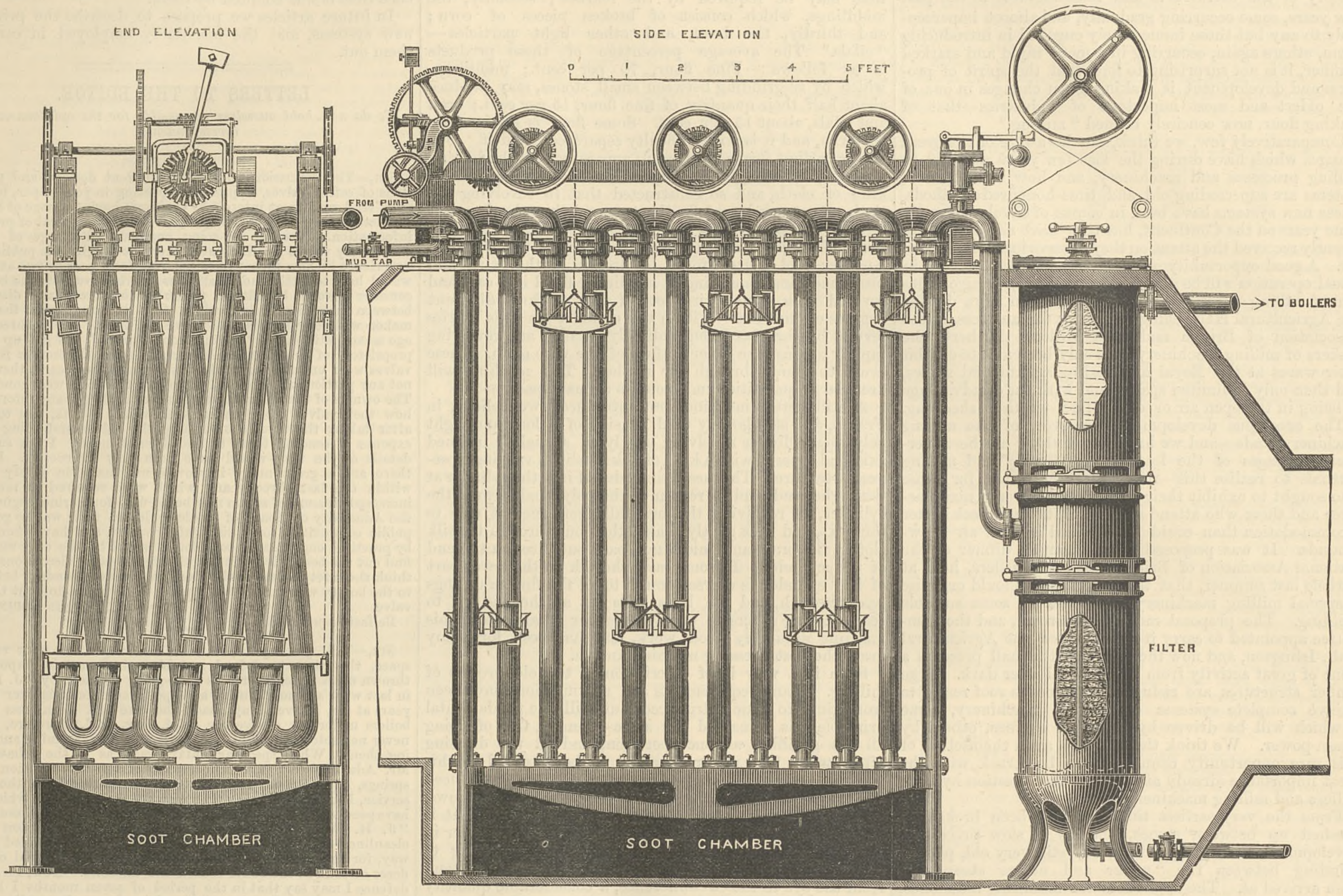
Class 4 — turret — is only employed on Dover Admiralty Pier. This is a tremendous structure. The foundations are laid 7 fathoms below low-water mark, and the guns are 33ft. above high-water mark. The entire structure is therefore about 95ft. high. The turret consists of a live ring and rollers of steel running on a path of steel laid on a massive cylinder of masonry. On this live ring runs the iron framework—Fig. 4—weighing 240 tons, containing the gun chamber. The armour consists of three 7in. and two intermediate 2in. plates, making in all a weight of 460 tons; the guns, carriages, and slides make up the total of the running weight to 895 tons. This throws on each of the thirty-two rollers of the live ring a pressure of about 28 tons. The entire diameter of the turret is 37ft., the interior 32ft. The interior height of the gun chamber is 8ft. 8in., the height of the turret armour is 9ft. There is a massive central casting holding on to the masonry, and a thick cylinder of hammered Bessemer steel inside this surrounds the wrought iron built-up cylinder, which forms the centre of the turret framework. The unabsorbed portion of the blows of impact may be transmitted to this part, which is made specially strong. Practically we should not expect this strain to be much. The pieces are 80-ton guns got in and out through the roof, of which parts are removable for this purpose. Provision is made for the escape of smoke through the turret top. The gun ports admit of 7 deg. elevation and 2 deg. depression. The glacis round the turret is plated with 5in. and 3in. plates. The guns are depressed and loaded from under the glacis.

Colonel Inglis concluded his paper by calling attention to the necessity throughout all the work of construction, of making provision for constant change taking the shape of continual increase in the scale, and that in a rapidly increasing ratio. This has made the work of the engineers difficult indeed, and that the works should have the completeness and yet the power of augmentation they possess reflects the greatest credit on the designers.

We have a few observations to make on this last point, and on the question generally. If we wish to consider the strength of the armour roughly as it now stands, we may reduce three layers to their equivalent in solid single plate by multiplying by 9 and dividing by 10. Thus the 17in. of armour in Fig. 3 becomes equivalent to 15·3in. solid; 5in. or 6in., however, must be added for the armour bars. This would have been considered a very heavy defence a few years since. The Glatton turret, for example, at its strongest part is only 14in. Nevertheless, the development of length in guns, in conjunction with slow burning powder, has made it possible to pierce such armour with a really powerful gun. At Meppen in 1879 the Krupp 24 centimetre (9·45in.) gun drove two steel projectiles through a target consisting of one 12in. and one 8in. plate (20in. in all) of rather indifferent iron. The projectiles went on whole and almost entirely uninjured for some 3000 metres. The Armstrong 100-ton gun drove a Whitworth forged steel projectile through a steel plate 27·56in. (70 centimetres) thick without suffering more than a moderate amount of setting up. This indicates the possibility of driving a shell containing a gun-cotton bursting charge into even a very heavily plated fort, and through steel or chilled iron shields, if the most powerful guns afloat are brought against it. This reminds us of how rapidly the powers of the guns have developed latterly; but at the same time we may certainly congratulate ourselves on the particular form of armour which we have adopted. We have said above that chilled armour has not, to our knowledge, ever been so utterly wrecked as to be untenable, although hammered and cracked through and through. Chilled armour, however, is certainly not calculated to meet the question of a rapidly increasing power of artillery, for two reasons—first, the blow of a shot enormously out-matching it, might wreck the structure in a wholesale manner, and secondly, as its resistance depends on the rigid transmission of a shock through the mass we are unable to see in what way it could be gradually increased in thickness to meet the attack of guns much heavier than those whose fire it was intended to repel. The comparatively elastic structure of plate-upon-plate armour depending on its toughness for strength is admirably suited to receive additions to its strength in the shape of steel or compound plates on the exterior. The necessary operation would be easily performed.

ECONOMISER AND LIME DEPOSITOR.

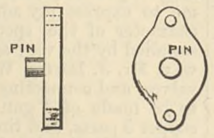
THE ECLIPSE ECONOMISER COMPANY, MANCHESTER, ENGINEERS.



At most it would be only necessary to remove the outside ring of armour. In some cases, however, the engineers have even rendered this operation unnecessary by drilling the holes required in the outer plates and inserting nuts in the recess on the reverse or inner side with wooden pegs which might be removed easily from the outside. As far then as the nature of things permits, our forts are not only well protected, but also adapted to grow, as it were, so as to meet the constant development of artillery power—a power which, it may be observed, owes much of its formidable character to the circumstance that powerful breech-loaders might be got into positions where there would be no room to work a muzzle-loader, a fact that we might surely take advantage of in preference to resorting to turntables to reverse the guns. A gun that will work in a small space becomes of more advantage every year, and if we are successful in reducing recoil to any great extent, breech-loaders must come in rapidly.

ECONOMISER AND LIME DEPOSITOR.

THE accompanying engraving illustrates a feed-water heater and lime depositor, manufactured by the Eclipse Economiser Company, Tib-lane, Manchester. The lime is deposited on the well-known principle of providing a depositing place and heating the water before it enters the boilers. The pipes of the Eclipse Economiser are cast in the form of a U, with a 2in. hole through the bottom, and a flange with two bolt holes of this form. The object in having this hole through the bottom of the pipe is, first, to support the core; and secondly, for cleaning out the pipes, if necessary, by removing the flange. The loose flange has a pin cast on it, which drops into a footstep cast on the carrying bars, and is thereby kept in its place while it is free to be lifted out of the flue, and replaced without having occasion to go into the flue. The angling of the pipes alternately from side to side forms one of the features in the patent. It will be seen from this that the scrapers must necessarily have a double motion, namely, vertical and horizontal. The horizontal motion is given by the friction on the pipes first on one side in their ascent, and then on the other in their descent. By the arrangement of the pipes, in the event of a pipe giving way, it can be removed and replaced in the course of half an hour, at most; at the same time a pipe may be left in the flue and the circulation carried past it, if inconvenient to remove it for the time being; the bends at the top being of two different lengths. The whole construction is entirely supported upon its own framework, and the covering-in plates can be removed, and the machine examined without the necessity of going into the flues.



GRIFFIN'S METHOD OF REMOVING CAN LIDS.

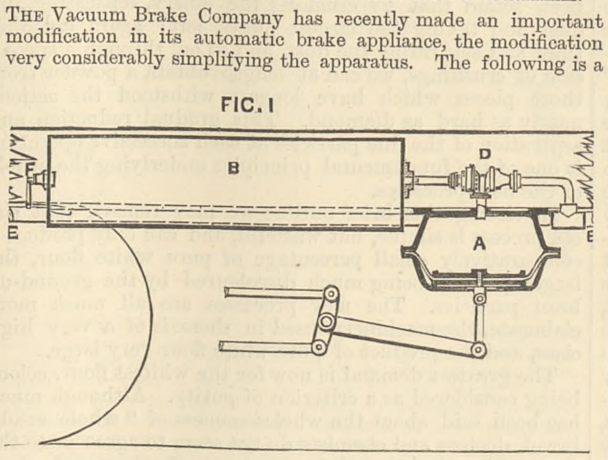
THE accompanying engravings illustrate an exceedingly simple invention, which promises to be of very great value. Many millions of tins are used now for packing meat, milk, fish, fruit, and almost every known eatable commodity; all these must be soldered air-tight, and we all know by unhappy experience how difficult it is to get these tins open, in spite of the many "tin-openers" in the market. Mr. Featherstone Griffin, of 156, Upper Thames-street, London, has patented in every country where a patent can be got the admirable device which we illustrate. The top of each tin is made slightly conical; the cone is exaggerated for the sake of clearness in our sketch. The lid when put on is not pressed home, as is the usual custom, but is just stuck on, and then soldered all round. When the tin is to be opened, it is only necessary to drive the lid on further by a few taps of a hammer or anything handy, a poker or a stone will do, if nothing else is to be had. The solder is readily broken. The cone top of the tin, wedges out the lid a little, and it can then be lifted off whole, and is available if wanted to put on again and keep the dust out of the tin.

The device is applicable in tins of all shapes. It is one of the simplest and most elegant inventions ever made, and cannot fail to augment the trade already done in preserved meat, fruit, milk, &c. How is it that no one thought of this invention before? The two smaller engravings show refinements on the original idea. In one the lid is doubled in the rim to make it stronger; in the other a small groove is used to keep the melted solder from running up too far.

SMITH'S AUTOMATIC CONTINUOUS BRAKE.

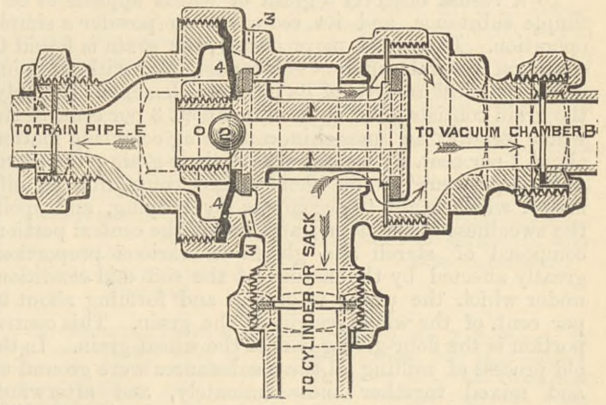
THE Vacuum Brake Company has recently made an important modification in its automatic brake appliance, the modification very considerably simplifying the apparatus. The following is a

FIG. I



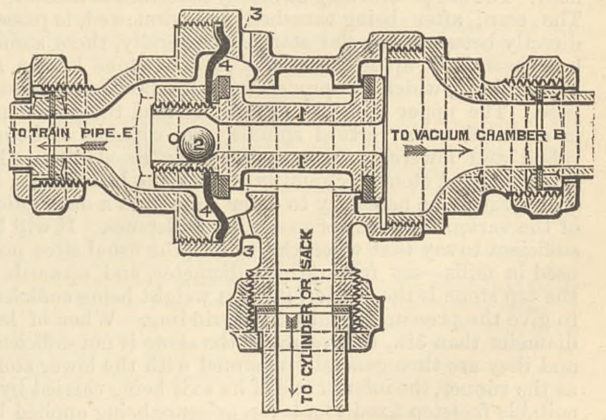
description of the apparatus as now made:—By means of a small ejector placed upon the engine the air is drawn out of the train pipe E, and also from the vacuum chamber B through the automatic valve D, so that in running a vacuum of 20in. to 24in.—or 10 lb. to 12 lb. per square inch—is maintained in both of these Fig. 1 shows the general arrangement. Fig. 2 shows the position of the automatic valve when the brakes are on. Fig. 3 shows the position when the brakes are off. The action of the automatic valve is as follows:—A vacuum being created in the train pipe E —Fig. 2—the valve 1 moves into the position shown in Fig. 3 by the pressure of the atmosphere which enters through the holes 3 and acts on the diaphragm 4, at the same time the ball valve 2

FIG. 2



falls from its seat and a free communication is thus opened between the train pipe E and the vacuum chamber B through the hollow stem of the valve 1. In this position all communication is shut off between the vacuum chamber and the cylinder, the latter being open to the atmosphere through the holes 3 in the valve casing. To apply the brakes, air is admitted to the train pipe which presses the ball valve 2 on to its seat and acts upon the whole area of valve and diaphragm, moving it into the position shown by Fig. 2. The air in the cylinder then escapes into the vacuum chamber, and the brakes are applied by the atmospheric pressure acting on the bottom side of the piston or diaphragm. To release the brakes when the engine is detached from the train the small release valve F is opened by means of a lever placed in a convenient position on either side of the carriage which admits air to the vacuum chamber and top side of piston or diaphragm, and the brakes fall off by gravity.

FIG. 3



THE MILLING EXHIBITION.

No. I.

So many changes and improvements have marked the history of the useful arts and manufactures in the past few years, some occurring gradually, and almost imperceptibly to any but those immediately engaged in introducing them, others again, occurring in a more rapid and marked manner, it is not surprising to find that the spirit of progress and development is making great changes in one of the oldest and most important of industries—that of making flour, now concisely termed "milling."

Comparatively few, we think, can be aware of the great changes which have during the last few years occurred in milling processes and machinery, and how fast the new systems are superseding old and time-honoured methods. These new systems have been in course of development for some years on the Continent, but they have not until quite recently received the attention they deserve in our own country. A good opportunity of witnessing the new process in actual operation will be afforded by the forthcoming exhibition of milling machinery about to be held in a few days at the Agricultural Hall, Islington, under the auspices of the Association of British and Irish Millers. Hitherto the makers of milling machinery have only been able to exhibit their wares at the Royal and leading agricultural shows, and then only in limited spaces, and with the disadvantage of being in the open air or under fine weather shedding.

The enormous development, however, of the milling machinery trade—and we have only to look at the advertisement pages of the leading engineering and milling journals to realise this—rendered it necessary for those who sought to exhibit their special systems and manufactures and those who attend such exhibitions, to seek better accommodation than could be obtained in open air show-grounds. It was proposed at the annual dinner of the National Association of British and Irish Millers, held at Carlisle last summer, that the Association should organise a special milling machinery exhibition in some suitable building. The proposal met with approval, and the committee appointed to carry it out obtained the Agricultural Hall, Islington, and now the inside of this hall presents a scene of great activity from daylight till after dark. Large timber structures are rising almost to the roof ready to receive complete systems of milling machinery, some of which will be driven by large gas engines, others by steam-power. We think that all who avail themselves of this rare opportunity cannot fail to be struck with the great importance already attached to this question by both millers and milling machinery makers.

From the very earliest times corn has been broken or crushed up between stones, and by a slow process of development the more modern, but still very old, plan of grinding between the "upper and nether stone" has been arrived at. The appliances for mounting millstones, so that one stone could be made to revolve upon the other, are amongst the oldest mechanical contrivances of which we have record; but now the millstone bids fair to be completely superseded by other and more refined means of pulverising the grain, and producing from it that most necessary article of food—flour. Before entering into a description of the new systems and their machinery, it will be as well to make a brief sketch of the old process, pointing out some of its prominent features.

To a casual observer a grain of wheat appears to be a simple substance, and its reduction to powder a simple operation. Examined more closely, the grain is found to consist of several different substances, even without going into a chemical analysis of its ultimate elements. Roughly, the grain consists of an outer skin, about 3 per cent. of the whole weight; an inner skin, containing colouring matter, about 2 per cent. by weight of the whole grain; the germ, about 5 per cent. of the whole weight, containing an oily matter which is apt to decompose by keeping, and spoils the sweetness of the flour; and, lastly, the central portion, composed of starch and gluten in various proportions greatly affected by the nature of the soil and conditions under which the wheat is grown, and forming about 90 per cent. of the whole weight of the grain. This central portion is the flour-giving part of the wheat grain. In the old process of milling all these substances were ground up and mixed together indiscriminately, and afterwards separated into three products—fine flour, middlings, and offals—no attempt being made to effect a separation of the bran and other less valuable portions before they were ground up and incorporated with the central portions of the grain containing the starch and gluten.

In the new processes the leading feature is the complete separation of all these outer portions and the gum from the central portion before the latter is pulverised into flour. The old process may be briefly described as follows:—The corn, after being thrashed and winnowed, is passed directly between two flat stones. Generally, these stones have been built up of pieces of a kind of stone known as French burr, which has proved to be the best for this purpose. The upper stone, technically termed the "runner," is mounted on a vertical spindle, and capable of being raised and lowered so as to approach or recede from the lower or fixed stone, technically termed the bed stone. It will scarcely be necessary to enter here into a description of the various methods of mounting millstones. It will be sufficient to say that when they are of the usual sizes now used in mills—say from 3ft. in diameter, and upwards—the top stone is the runner, its own weight being sufficient to give the pressure required for grinding. When of less diameter than 3ft., the weight of the stone is not sufficient, and they are then generally mounted with the lower stone as the runner, the inferior end of its axis being carried by a suitable footstep fixed to a lever, pressure being applied by raising one end of the lever, the other end being the fulcrum. These small stones are rarely used in regular mills, except latterly, for grinding middlings, but they are largely used for grinding barley, beans, peas, &c., for farm purposes. After passing between the stones, the meal, as it is then called, consists of all the substances contained in the wheat grain—bran, germ, and flour, in various degrees of fineness, and thoroughly mixed together. The meal is then dressed, to effect a separation of the flour from the bran and middlings. The three products resulting from this separation may be thus described:—First, the flour, which is afterwards separated into the different qualities that may be required by the market; secondly, the middlings, which consist of broken pieces of corn; and thirdly, the bran, and other light particles—"offals." The average percentage of these products is as follows:—Fine flour, 70 per cent.; middlings, which by re-grinding between small stones, may produce about half their quantity of fine flour, 15 per cent.; bran and offals, about 15 per cent. Some flour is retained by the bran, and it is with difficulty separated from it. One of the earliest forms of dressing apparatus was the bolting machine, consisting of a cylinder covered with a peculiar kind of cloth, and so constructed that in revolving the cloth was struck by wooden beaters, and thus the flour was forcibly shaken through the meshes of the cloth, the bran and middlings passing through the end of the machine. Another and better form of dresser is the wire and brush machine, consisting of a cylinder fixed in a case and covered with woven wire cloth of two or three different degrees of fineness. Within the cylinder an axis carries several brushes fixed longitudinally on arms and revolving rapidly against the inner surface of the wire cloth. These brush the flour through the meshes. This machine will dress large quantities and occupies a small space.

A still better machine, first introduced, we believe, in France, and still largely used, consists of a long and light polygonal cylinder revolving slowly on a slightly inclined axis, and covered with a kind of silk muslin of varying closeness of texture. The meal is introduced into the cylinder at the higher end, and by reason of the polygonal form of the cylinder, in revolving the meal falls from one flat side to the next, and thus gently shakes the flour through the silk cloth; the bran and middlings pass out through the end of the cylinder. In some cases the silk on the lower part of the cylinder is coarse enough to let the fine middlings pass through, and the bran falls out at the end on to reciprocating sifters to effect a further separation. This machine does very good work, and has been for many years the best dressing machine known.

Such is a very brief description of the old process of milling. Many requirements and modifications have been from time to time introduced, but still the fundamental principle has remained the same—namely, that of doing all the grinding at one operation, and all the dressing afterwards. The points specially to be observed in this method are as follows:—First, the corn is introduced whole into the eye of the stones, passes into the furrows, and is rubbed to powder between the flat faces. It is obvious that as the stones must be very close together in order to produce fine flour, the action of reducing to powder is sudden and severe; also, as the furrows extend from the eye to the circumference, a considerable quantity of the corn is only broken, not powdered, and passes out in a more or less direct manner, about which millers are much at variance. No doubt the heavier portions pass out by centrifugal force, the lighter by the currents of air formed by the rapid revolutions of the runner stone. But in whatever manner and by whatever agents these particles make their exit, it is certain that considerable quantities of broken pieces of corn escape without being converted into flour. Part of the bran is ground up with the flour, and gives to it a brown tint. Much ingenuity has been exercised in removing the finely adhering particles of flour from the larger pieces of bran, but without marked success. Latterly the middlings have been subjected to re-grinding between small stones very truly faced, and by this means will yield 50 per cent. of good flour. In suddenly reducing the grain to meal at one operation great waste of power occurs, also great unevenness in the size of the particles produced.

It may be mentioned as bearing on this fact that practical experience in grinding mineral substances, such as phosphates for artificial manure making, shows that gradual reduction to powder by successive operations is far more economical than reduction at one operation, and produces a much more equal sample. We have personally noticed this, and in examining two samples—one produced by gradual reduction, and the other by one operation—it is easy to both see and feel the difference; the former gives a soft and neatly impalpable powder, the latter a mixture of coarse grains and fine powder.

Again, by gradual reduction and separation of the fine particles from the coarse at each operation we effect a separation of the different materials, which go to form a mass of any substance not of a homogeneous nature, it being obvious that the hardest and toughest portions would withstand the grinding longer than the softer and more pliable portions. Here again an illustration in support of this may be taken from mineral substances. It has been found that by crushing the emery, separating the dust and taking the largest pieces left; again crushing these and separating the dust, and so on, through a succession of crushings, we can at length obtain a powder from those pieces which have longest withstood the action; nearly as hard as diamond. This gradual reduction and separation of the fine particles at each successive operation is one of the fundamental principles underlying the whole of the new processes.

In closing this brief outline we may remark that the old process is simple, but wasteful, and can only produce a comparatively small percentage of pure white flour, the larger portion being much discoloured by the ground-up bran particles. The new processes are all much more elaborate, the machinery used in them is of a very high class, and the product of pure white flour very large.

The greatest demand is now for the whitest flour, colour being considered as a criterion of purity. Although much has been said about the wholesomeness of "whole meal" bread, doctors and chemists do not seem to agree as to the desirability of using all the products of wheat as food, or only the starch and gluten. The steady increase in the demand for pure white bread has been going on for years past, and has even tempted bakers to adulterate the lower qualities of flour with alum and other substances to produce the much desired whiteness. It was remarked by a writer on this subject as early as 1849, that "the preference of the public for white bread is not likely to be an absurd prejudice, seeing that it was not till after years of experience that it was adopted by them."

In future articles we propose to describe the principal new systems, and the machinery employed in carrying them out.

LETTERS TO THE EDITOR.

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

SAFETY VALVES.

SIR,—The discussion relating to different designs and proportions of safety valves, at present appearing in your paper, is, I am sure, read with great interest by engineers having charge of boilers. The letter, signed "Chief Engineer," gives a great deal of practical information. If other sea-going engineers in charge of boilers with safety valves by different makers would give the public their experience of how their valves behaved for a year or two at sea, it would help to settle the question as to which valve is the best. I consider it would benefit the public much more than a discussion between makers of safety valves, as it is but natural that each maker will consider his own valve the best. About three years ago a competition for "spring safety valves" was got up by the proprietors of the *Nautical Magazine;* some thirteen or fourteen valves were entered for trial. As far as I can learn, there were not any particulars published as to how the trials were conducted. The owners of the different valves never could get any information how their valves acted under trial, which, I think, was too bad, after taking the trouble of making the valves and going to the expense of sending them to and from London. I am sure the details of the trial would have been very instructive. I know there are a great many improvements made in safety valves within the last three years, which were required to meet the increased pressure of steam now being used for marine engines. If the Admiralty or Board of Trade could see their way to get up a public competition for spring safety valves, and have them tried by practical engineers, I consider it would be the only means to find out the best valve. It would save all paper discussions, and I think the safety valve, as the most important appendage belonging to the boiler, would merit the trouble of trying to find out the best valve. JOHN ROBINSON.

Belfast, April 29th.

SIR,—Will you again allow me to trespass on your valuable space, this time to defend myself against certain imputations thrown upon my character as a sea-going engineer by "J. H. W." in last week's issue. During an experience extending over several years at sea, I have always made the care and cleanliness of the boilers under my charge my chief duty, and, therefore, I have never neglected the slightest opportunity for examining and cleaning them. When speaking unfavourably as to the behaviour of Mr. Adam's safety valve, on account of the deterioration of the springs, I particularly referred to a steamer which, in the Greek service, has been very recently under my charge, and in which, as I have previously stated, I suffered no end of trouble with these valves. "J. H. W." suggests that had I paid more attention to the cleanliness of my boilers I should not have been troubled in any way, for he seems to consider that an overdose of mud or overdoses of mud in the boiler caused the mischief. Now, Sir, in my defence I may say that in the period of seven months I had my boiler opened, brushed down by hand brushes, and most thoroughly washed with a hose in every part of its interior no less than six times, and that after each washing I myself went into it and examined every part of it. In addition to this, I may add, that I have always discouraged an excess of lubrication in the cylinders, using not more than half-a-pint of the purest Gallipoli oil for this purpose in the twenty-four hours. I used this oil advisedly, because I find it to be much superior, infinitely cleaner, and altogether a better cylinder lubricant than any of the various preparations for the purpose so much puffed just now. Another argument in my favour, and against the chance of my having dirty boilers when in Greece, is to be found in the fact that there is a uniformity of sea level, there being no tides, consequently the water, being undisturbed, is always clean, and we seldom, if ever, came into such shallow water as to disturb the bottom. Any sea-going engineers who have ever spent any time amongst the Greek islands, can answer for the purity of the water there to be had. But, Sir, even were I to grant everything which "J. H. W." says as to my boiler's dirt, there is still no case made out in his letter for Adam's valve, for I cannot conceive that such a thing has a right to the title of "safety" valve, if it can be altogether disorganised and rendered useless by a little priming. Mr. Adam's valve is not one bit superior to half-a-dozen which are in the field, and most emphatically must it be inferior if it is disastrously affected by a little or, indeed, by any amount of priming.

London, May 4th. CHIEF ENGINEER.

LOCOMOTIVE ENGINE BRASSES.

SIR,—Kindly grant me your permission to make a few practical remarks concerning slide valves, axle bearings, and brass casting generally required for the Lancashire and Yorkshire goods engines you have recently illustrated. But before proceeding, allow me to express my admiration of the very full and comprehensive character of the specification, both generally and in detail, as supplied by the very able locomotive superintendent of that railway, Mr. J. Barton Wright. I read that engine axle-boxes, slide valves, and connecting rod brasses—both large and small ends—are to be made of "gun metal." That metal is defined to consist of copper 5 parts, and tin 1 part.

Now, Sir, having had more than twenty years' experience in locomotive work, and also ample opportunities for trying any alloy which might to me appear worthy of trial, likewise every chance of watching and inquiring into the working and results of every engine for which I have had to provide, of all of which I have endeavoured to take the fullest advantage, I therefore always feel great interest in the question of alloys for bearings, &c., of locomotive engines, and hence my desire for a few words concerning the specification for these engines. I think that it will be admitted by mechanical engineers generally, if not unanimously, that the locomotive, by reason of its high speed, great weight, and necessarily narrow bearings, is the most destructive in fair wear and tear upon its journals of any engine yet invented, and therefore the question of brasses becomes not only interesting, but of considerable moment to engineers and others.

It must ever be remembered that in brasses, two inevitable evils have to be contended with, viz., breakage and friction. The more tin is used in proportion to a given quantity of copper, the harder the casting will be when produced, which, as is well known, gives to it the necessary quality to resist friction. But the conditions of working may be such as to render it absolutely useless, for, in consequence of its great hardness, it has become brittle, and will be sure to fail when subject to the thrust of the connecting rod, side rod, or because of the general knocking or vibration of the engine when in motion.

During the whole time of my connection with railways, I have not met with more than one or two locomotive superintendents and engineers who have taken any really apparent interest in the question of alloys for castings. The interest which I have generally seen evinced has been a desire to get at the minimum cost per pound at which castings could be produced, either as regards material or labour, but generally both, and attaching the most vital importance to the difference of a penny per pound in the cost of production, and seldom, if ever, considering the great advantage derived from castings of the higher cost by longer wear.

Such I could in some measure understand with firms that make for sale, but am really at a loss to understand why railway companies, who build and repair for themselves only, should be so positively blind to their own reputation and interest. Far be it from me any desire to speak disparagingly of the profession, for I do assure you that I entertain for it the highest respect. I simply refer to it for the purpose of pointing out what to me is a self-evident error, in the hope that it may give rise to investigation which will lead to its removal for ever.

To the question. The proportions of copper and tin given by Mr. Wright are, in my experience and observation, the maximum quantity of the latter to the former, with a due regard to safety, for any of the purposes named, and in some I have no doubt whatever that it is exceeded. It may be urged that in consequence of the comparatively equal distribution of weight upon the several axles, the alloy which will suit for a leading and trailing box will answer equally for a driving one. My reply is, No. I contend that what is the maximum in the two former is an excess in the latter, owing to the continuous heavy thrusts of the connecting-rod upon the crank axle. But in these engines there exists one very palpable reason why the alloy used for axle-boxes should be kept considerably within the boundary of maximum hardness, viz., the fact of the bearing surface having to be lined with white metal. Thus, without any sacrifice, would the risk of breakage be reduced and renewal avoided, which is of no trifling character, when the cost of stopping the engine, lifting, re-casting, and re-fitting a box or boxes is properly considered. I could easily enumerate other cases of a like nature and equal importance; but enough for the present. FOUNDRYMAN.

April 25th.

ENGINEERS BY ACT OF PARLIAMENT.

SIR,—In your issue of the 25th ult. I observe an article entitled, "Engineers by Act of Parliament," having reference to a Bill recently introduced into the Legislature of the province of Ontario at its session held in Toronto last winter. I enclose you a copy of a letter written by myself, with the consent and approval of eight out of the fourteen names contained in the Bill, and who fully endorse my views regarding it. Of the remaining five, one is that of a very able and well-known railway engineer, whose failing health, for the last few years, entirely prevented him from taking part in public matters, and who would be the last man to lend his countenance to such a scheme as proposed by the Bill in question. Two I have not had an opportunity of conversing with since my letter was published, but one of them at least I believe to be quite in accord with us; whilst of the other two, who are supposed to have inspired the Bill, neither are civil engineers in the ordinary and practical acceptation of the term, one of them being a land surveyor and the other an architect. In justice to the profession in Canada, I trust that you will give publicity to this letter and its enclosure. J. SHANLY,

Chief Engineer I.C. Railway.

Intercolonial Railway (Chief Engineer's Office),
Ottawa, April 13th.

[COPY.]

Intercolonial Railway, Chief Engineer's Office,
Ottawa, 28th February, 1881.

(*To the Editor the Globe, Toronto.*)

SIR,—My attention was called a few days ago to a Bill introduced into the Legislative Assembly having reference to an organisation of the Profession of Civil Engineer, in which are inserted the names of some fourteen gentlemen who shall at once become legalised practitioners under the Act when passed.

As one of these so named, I wish to protest, through your columns, against such unauthorised use of names, as I am aware of at least eight besides myself who have never been consulted in the matter, or indeed, who had even ever heard of the Bill until it was printed and made public.

Should the Bill become law, it will have the effect of shutting out very many well-tried, experienced, practical engineers, whose services the country can ill spare, and of introducing any boy, fresh from school, without experience and that real professional knowledge required in the management and construction of public works—qualifications which, I need hardly say to you, cannot be acquired from the reading of any number of books, or the passing of any kind of examination.

I should not have troubled you with this letter, only an impression seems to have gone abroad that most of the names contained in the Bill are those of its promoters, whereas the fact is that not more than two or three have inspired it.

The whole Bill is so absurd in its provision that its passing into law by an intelligent body, such as the Ontario Legislature, can hardly be supposed possible. I am, Sir,

Your obedient Servant,

F. SHANLY.

MEMO.—The above letter was published both in the *Globe* and the *Mail*, Toronto, about 1st March, 1881.

THE STRENGTH OF STEEL.

SIR,—As one of those who were privileged to hear at the meeting of the Institution of Mechanical Engineers Prof. Kennedy's most interesting and valuable paper, but not having the right of speaking at the meeting, I will esteem it a favour if you will allow me space to remark upon one of the points discussed, in which I take much interest, namely, the greater strength of drilled than un-drilled plates. Prof. Kennedy concludes from the forms ultimately taken by originally straight lines scribed on the plate that in plain test strips without holes in them the stress at the centre is much greater than at the edges, while in drilled test-plates the tension is uniformly distributed over the fractured section between the holes. It must be remembered that the forms assumed by these lines correspond to the ultimate stressed condition, *i.e.*, after the metal has "flowed" to the greatest possible extent; and that this flow, which is of the nature of permanent set, is that part of the strain which is unelastic and is much less nearly proportional to the stress than is the elastic part of the strain—in fact, it probably depends quite as much on the time to which the material has been exposed to stress as upon the intensity of the stress. While, therefore, agreeing with Professor Kennedy that the undrilled strips have probably a somewhat less stress on their edges than at the centre, and that this condition is neutralised—I would rather say reversed altogether, and that the stress at the edges is now very considerably greater than at the centre—in drilled plates, I doubt whether his remark that "the increase of strength due to localisation of fracture at a section of the material not probably the weakest, can go for very little indeed, with a material so uniform as that here examined." The material used was, undoubtedly, of comparatively very uniform quality; but even in so uniform a material an inspection of Prof. Kennedy's table of results shows that the probable deviation from the average strength, of any untried specimen taken at random, would not be much less than one ton per square inch. Now, the holes were 1in. diameter, and the contracted length may be taken as about half the diameter or ½in. The length of the strips tested for the "natural tenacity" is not given, but they were not probably less than 10in., that is, twenty times as long as the contracted length in the plates. Now, Prof. W. S. Chaplin, in a recent paper in Van Nostrand's "Engineering Magazine," calculates that on the above account, set aside by Prof. Kennedy as insufficient to explain the phenomenon, the difference in the strengths of long and short lengths of this ratio should be 2·7 times the probable deviation from the average strength of the short pieces. If the ratio were 15, the number would be 2·5; and if 25, it would be 2·85. The difference shown by Prof. Kennedy's tabulated results is just about 3 tons. The theory which Prof. Chaplin has developed, therefore, does account for nearly the whole difference, if we estimate the probable deviation as above at about 1 ton per square inch—it is not possible to calculate it accurately, because the experiments made under precisely similar conditions are not numerous enough to admit of that being done. I myself do not believe in the complete sufficiency of the reasons advocated by Prof. Chaplin and deprecated by Prof. Kennedy; but the above is certainly a most remarkable confirmation of their great importance. Prof. Chaplin's theory is also borne out by the very much smaller variation of Prof. Kennedy's results with the long inch-wide strips than of those with the plates with the holes in them.

Battersea Ironworks, S.W., ROBERT H. SMITH.
April 25th.

SCREW PROPULSION.

SIR,—Some observations made by Mr. R. E. Froude during the discussion of my paper on Screw Propulsion, at the Naval Architects' meeting, on the 8th inst., have, I am sorry to find, caused you to take a view of the matter which Mr. Froude did not contemplate, and I fear that the result may be in some measure to defeat the object with which I was induced by Mr. Denny to publish the results of my experiments, so far as they had gone. This reason was, that others might perhaps be thus persuaded to join with me in the effort I am making to clear up the difficulties and uncertainties that still environ the subject of screw propeller designing.

Mr. Froude expressed to me, after the meeting had terminated, his regret that he had spoken as he did, because he feared that his words might be misconstrued. His intention was, not to throw discredit on the model experiments *per se*, but to point out the fact that considerable corrections are still requisite when comparing their results with those of actual ships.

The very valuable Greyhound trials, conducted by Mr. Froude's late father, defined with considerable clearness the extent by which the resistance of a model exceeds that of the ship herself, and, as I pointed out in my paper, I found a similar excess in the expenditure of power, when compared with the actual ship, at proportional rates of speed. The results of the models may, in fact, be regarded as analogous to those of the actual ship when driven against a head wind.

The length of the Greyhound being only about six times her beam, it is evident that the observations made with her cannot safely be applied to ships of nine or ten beams, and as it is not an easy matter to repeat Mr. Froude's towing experiment with a ship of 4000 or 5000 tons displacement, I think the next best thing to do is to compare speed curves from accurately made models—of which the various progressive powers have been carefully measured—with speed and power curves from the actual ships taken during their progressive trials. This is what I am endeavouring to do, and at the same time by tabulating the results of a very large number of propellers of various proportions I am collecting a mass of information which I have already found useful, and which only needs a key such as that supplied by the late Mr. Froude in the case of the Greyhound to render it available as a practically reliable guide.

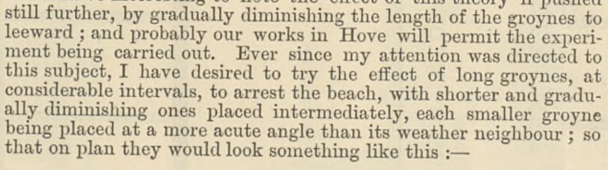
I should be very sorry if anyone possessing the necessary experience should be deterred by Mr. Froude's remarks from taking up this line of investigation, and he, I am sure, would be equally sorry. The subject is one whose importance cannot be denied, as was shown in the case of H.M.S. Iris, and as is felt daily by those who are engaged in designing screw propellers, to whom the want of exact knowledge is a constant source of difficulty and uncertainty. I am of opinion that the subject can be better investigated by large shipowners than by shipbuilders, because the latter seldom see or know much of their ships after they leave their hands, whereas the former are, or should be, constantly watching results, and it is naturally a matter of paramount importance to them that their ships should have the very best propellers to be procured. If I can assist any who are disposed to take up the subject in the way I have indicated, and who possess the necessary opportunities for watching actual results side by side with those of their models, I shall be glad to do so in the interests of what I believe to be a most important investigation.

CHARLES HALL, A.M.I.C.E. and M.I.N.A.
122, Leadenhall-street, London, E.C., April 23rd.

BRIGHTON BEACH.

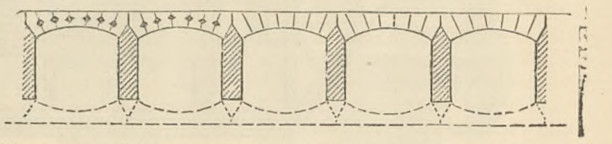
SIR,—Your courtesy on a former occasion, in allowing me to explain the course adopted by the Hove Commissioners to preserve the coast-line in front of their town, assures me you will once more permit me to offer some corrections and explanations in reference to the articles which you have subsequently published, more particularly to the careful and able leader in your issue of the 29th ult. I wish to discuss the question of legislative interference apart from the design of the new groynes, as it is altogether a separate question, at least, in my judgment.

You advocate the shortening of the two easternmost groynes now being erected, saying, that by so doing "it would sacrifice no interest. Agreeing with you in your opinion, formed, no doubt, on a careful and impartial examination of the circumstances, that it is well nigh impossible to prevent scour on the lee side of a groyne, these structures have been designed to reduce such scour to a minimum, if not to altogether obviate it. In regard to length, they have been carried to sea as short a distance as is consistent with the certainty of arresting the travelling beach on the weather face. Long experience has demonstrated that to ensure this groynes must be carried out a certain distance seawards—this depends (1) On the depth of water in the offing; (2) the length of the normal accumulations by natural causes; (3) the nature of the material to be arrested. The Hove groynes, if shortened, would run the risk—to my mind the certainty—of permitting the escape of the beach, and their effect would be valueless for coast defence. Hitherto engineers have been unable to prevent heavy scour on the leeside of these structures—which, however, is not in direct proportion to their length—though it must be confessed, until Mr. Lockwood, of Brighton, erected the first concrete groynes, very little science had been employed in their design, or expended in determining their position and direction. Mr. Lockwood's works are most admirably constructed, and in employing concrete he commenced a new era; from which, in the details and in the direction, we are now making a fresh departure. If your theory that short groynes would prevent lee scour be correct, it would be interesting to note the effect of this theory if pushed still further, by gradually diminishing the length of the groynes to leeward; and probably our works in Hove will permit the experiment being carried out. Ever since my attention was directed to this subject, I have desired to try the effect of long groynes, at considerable intervals, to arrest the beach, with shorter and gradually diminishing ones placed intermediately, each smaller groyne being placed at a more acute angle than its weather neighbour; so that on plan they would look something like this :—



Without pledging myself to figures, the above sketch will approximately convey my meaning, the length and angle of each intermediate groyne being in the inverse ratio to their distance apart. I would here wish to remark, in reply to your article, that we have only our own interests to protect; in designing the Hove groynes, an experiment of a costly character is being tried, with the view, as far as is practicable, of preventing injury to the lee shore, remembering always what duty the works have to perform. I trust you will give credit to the Hove Commissioners for the bold way in which they determined to carry out so interesting an experiment.

There appears to be some slight misconception as to the blocks being moulded to form the segments of an arch. They are made to form the voussoirs of a series of arches, as shown in the following sketch. The weight which a groyne has to bear and the heaviest wave-blows are on the weather face; so the greatest resistance should be this direction. Now if you take away the walling shown by dotted lines, you have nothing more nor less than a retaining wall divided into arched bays, with pier abutments, so distributed as to economise material—a form well known and adopted by engineers in deep railway cuttings. It is obvious, however, if the bays are left open on the lee side, waves of percussion striking the piers would tend to dislodge them. So the bays are closed up by a similar wall to that on the weather face, lightened in accordance with the work it has to do. A series of cells is thus obtained, into which a hearting can be placed to give the structure weight—your opinion that



"the power of these works is mainly . . . . . dependent upon weight" being unquestionably a correct one. The hearting weight enables a still further economical treatment of the piers and arched bays, by reducing their cubic contents—a matter of much moment, as the cost of the concrete used in them is very high. This will explain the reason why the new groynes are divided into bays, instead of carrying up plain, solid, and more expensive works, as has hitherto been the practice.

With regard to the weight of the blocks, had it been increased to two or three tons each, as you suggest, it would have largely increased the cost of the works, as it would have been necessary to provide a timber jetty with gantries to each groyne. This would have entailed an additional expenditure of at least 33 per cent. All the blocks have been kept to a size which enables two men to handle them with comfort. In the construction they are so inter-locked, joint-broken, and dowelled that there is little fear of displacement.

As to the use of little water with the cement, Mr. John Grant has demonstrated, and many other engineers have clearly proved, that an excess of water weakens concrete to an alarming extent, and those who are now engaged in the manufacture of Portland cement concrete recognise this fully. All the blocks are rammed by hand as the mixture is put into the moulds, so that there is little fear of air being entangled in the mass, as a broken section of one of the blocks on the works would show. There is a practical difficulty in storing and mixing the cement and concrete in a building kept to an uniform temperature—in fact, in works of this magnitude, and situated on the sea shore, it would entail a cost not commensurate with the good obtained—to obviate injury to the concrete by reason of low temperature. No moulding takes place when the thermometer is lower than 40 deg. Fah. So far as my observations go, the temperature should range between 40 deg. and 60 deg. Fah. The foundations, except under the inshore bays, will rest on the native chalk.

In conclusion, as expressed in a former communication, I cordially agree with you as to the necessity of immediate legislation on the subject of sea defences. The great changes taking place round the coasts—the abrasion of the cliffs at one point—the accretion of land at another, together with the different methods adopted by local authorities and private owners to ward off the common enemy, are matters deeply affecting the public interest, and should be dealt with by Imperial legislation. The doctrine of *Sauve qui peut* has committed the Hove authorities to a large expenditure and increasing responsibility which justly should not be theirs.

E. B. ELLICE-CLARK.

4, Westminster-chambers, London, S.W.,
May 2nd.

HIGH SPEED LOCOMOTIVES.

SIR,—It is always interesting to peruse the correspondence which appears in your pages, particularly when a new light—if only a ray—is thrown upon the matters under discussion; but it is worthy of remark how often we meet with old acquaintances, sometimes in new guises, but more frequently in pristine garb, in many of the ideas that are ventilated and advanced in all seriousness as new.

Writing upon this subject in your last issue, Mr. E. L. Pearce, whilst endeavouring to show what may be done in the way of arranging high-speed locomotives, is either unconscious, or he ignores what has been already done. If he will avail himself of the proverbial courtesy of Mr. Stroudley, he will find his "arrangement No. 1" *in propria persona*, working some of the fastest trains on the Brighton line; and I am sure no one would have greater pleasure than Mr. Stride in introducing him to his "arrangement No. 2," in the engines devised by that gentleman to work at high-speed the heavy and varied traffic of the London, Tilbury, and Southend Railway. He will find, however, these last-named singularly successful engines are minus those elements which proved so fatal to Brydges Adams's "White Raven," but which appear to be present in your correspondent's design. JAMES CLEMINSON.

7, Westminster-chambers, S.W.,
May 2nd

SIR,—Referring to the suggestive letter of Mr. E. L. Pearce, in your issue of the 29th ult., I beg to inform you that engines similar to Fig. 1 can be seen running on the Waterford and Limerick Railway, only the gauge of the rails on that line being the wide Irish gauge, the outside frames are not on them, not being required. The trailing axles are fitted with Widmark's radial axle-boxes. The cylinders are 16in. diameter. I believe it will be found that these engines are doing splendid work.

There is also a smaller engine—12½in. cylinders—of the same type, built to the specification of Mr. McDowell, working on the Waterford and Central Railway of Ireland. Fig. 2 resembles engines that are at work on the Cape railways—Mr. Chas. Hutton Gregory, C.E.—only they are six instead of four wheels coupled. The leading and trailing axles of some of these engines are also fitted with Widmark's radial axle-boxes.

These designs have proved good; but there was much to be considered in them besides the wheel and frame arrangements.

5, Westminster-chambers, Victoria-street, JOHN C. WILSON.
London, May 4th.

THE CENTRAL RAILWAY STATION FOR LONDON.

SIR,—On looking at the sketch plan of the "Central Railway Station for London," on page 308, it has occurred to me that the London and North-Western Railway, &c., could easily come into it by using the existing route by the West London and South-Western to the new junction on the south side of the river, and thence, as shown, by Millbank, thus avoiding having to make the connection from Chelsea to near Millbank on the north side. Were Charing-cross Bridge widened, as the Blackfriars London, Chatham, and Dover Railway Bridge is proposed to be, the line could then be taken to the "Albert Terminus" over it, with comparatively cheap property to disturb; and also this would avoid a skew bridge over the river. In this latter case the terminus could be made architecturally more pleasing than the—I presume—low level as proposed.

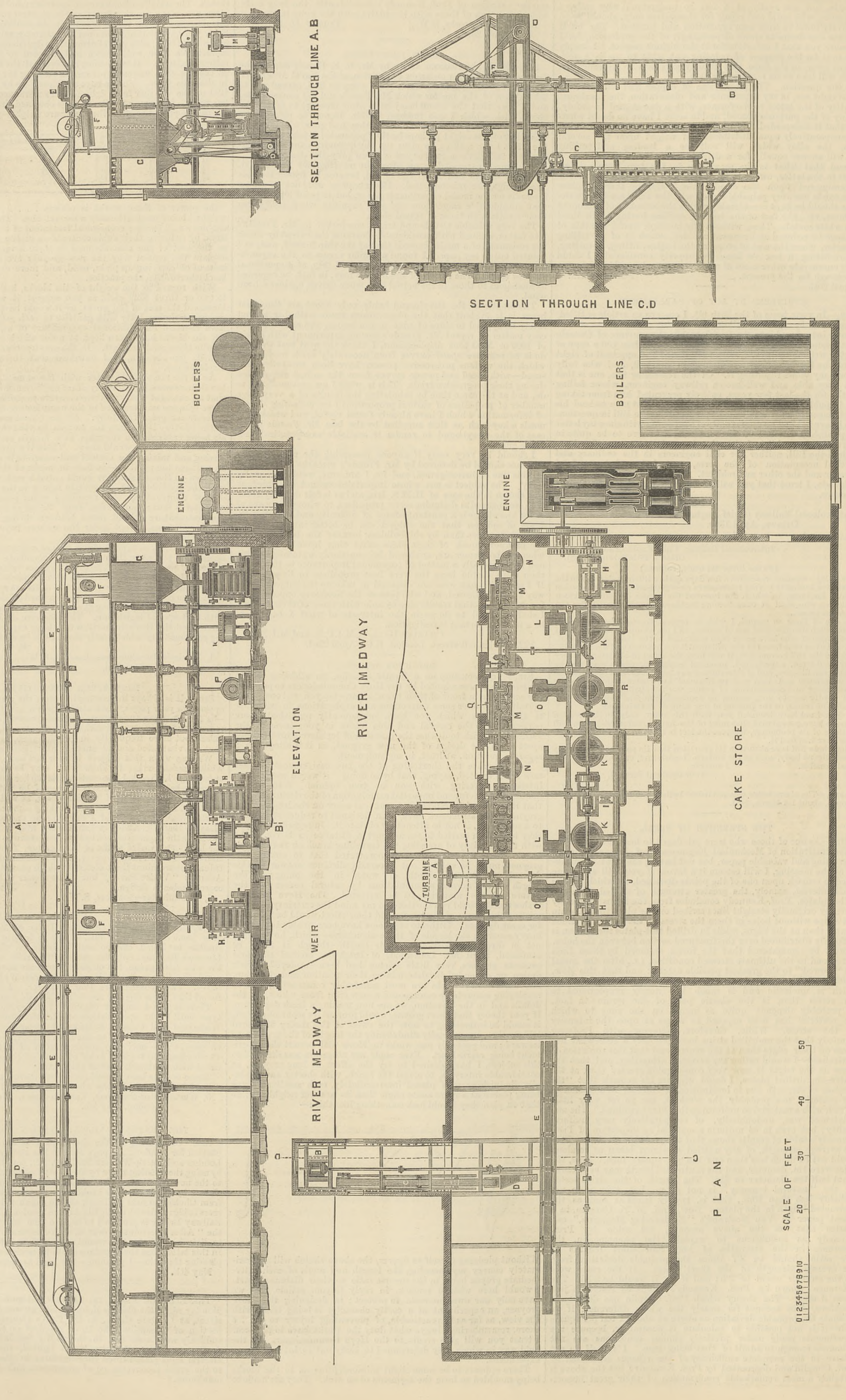
May 4th. W. F. F.

THE ELECTRIC LIGHT IN LONDON.—About half-past ten on Monday night the electric lights on Blackfriars Bridge, in Bridge-street, at Ludgate circus, in St. Paul's Churchyard, and along a portion of Cheapside—the lamps supplied on the Brush system—suddenly went out, due to the faulty insulation of a lead line. As there were very few gas lamps lighted, the extinction of the electric light placed those thoroughfares in almost total darkness, to the great inconvenience of passengers and drivers of cabs and omnibuses.]

OIL MILL, WATERINGBURY, KENT.

MESSRS. ROSE, DOWNS, AND THOMPSON, HULL, ENGINEERS.

(*For description see page 331.*)



OIL MILL MACHINERY, WATERINGBURY OIL MILL, KENT.

MESSRS. ROSE, DOWNS, AND THOMPSON, HULL, ENGINEERS.

Fig. 5.

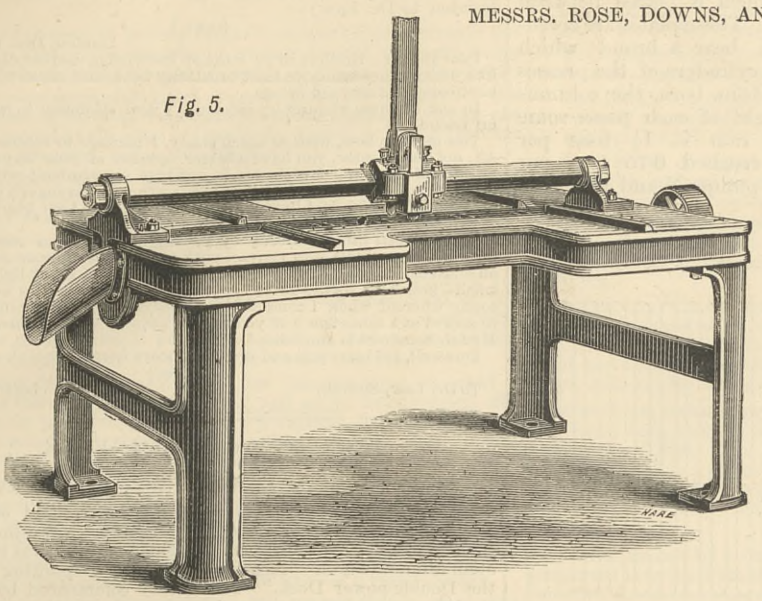


Fig. 1.

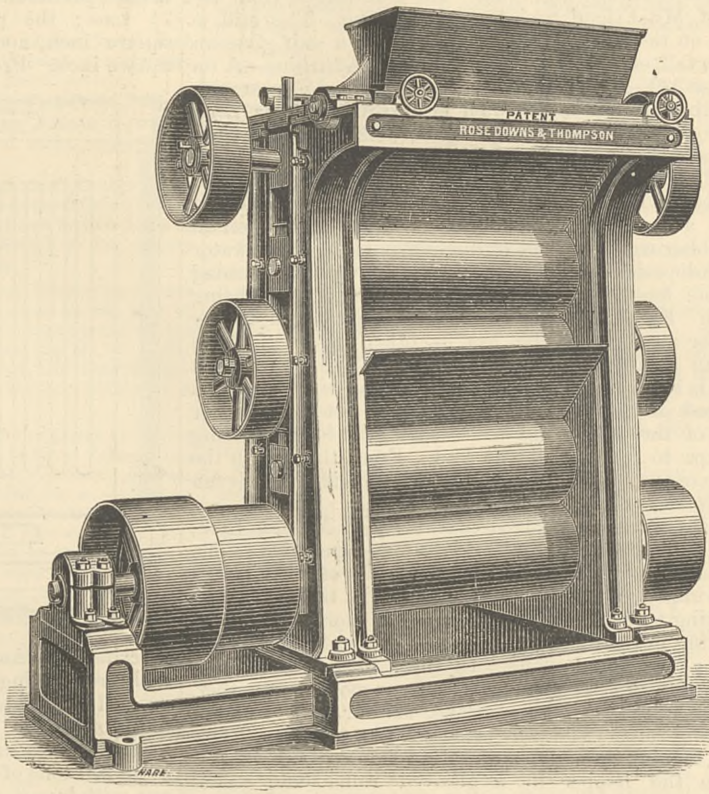


Fig. 6.

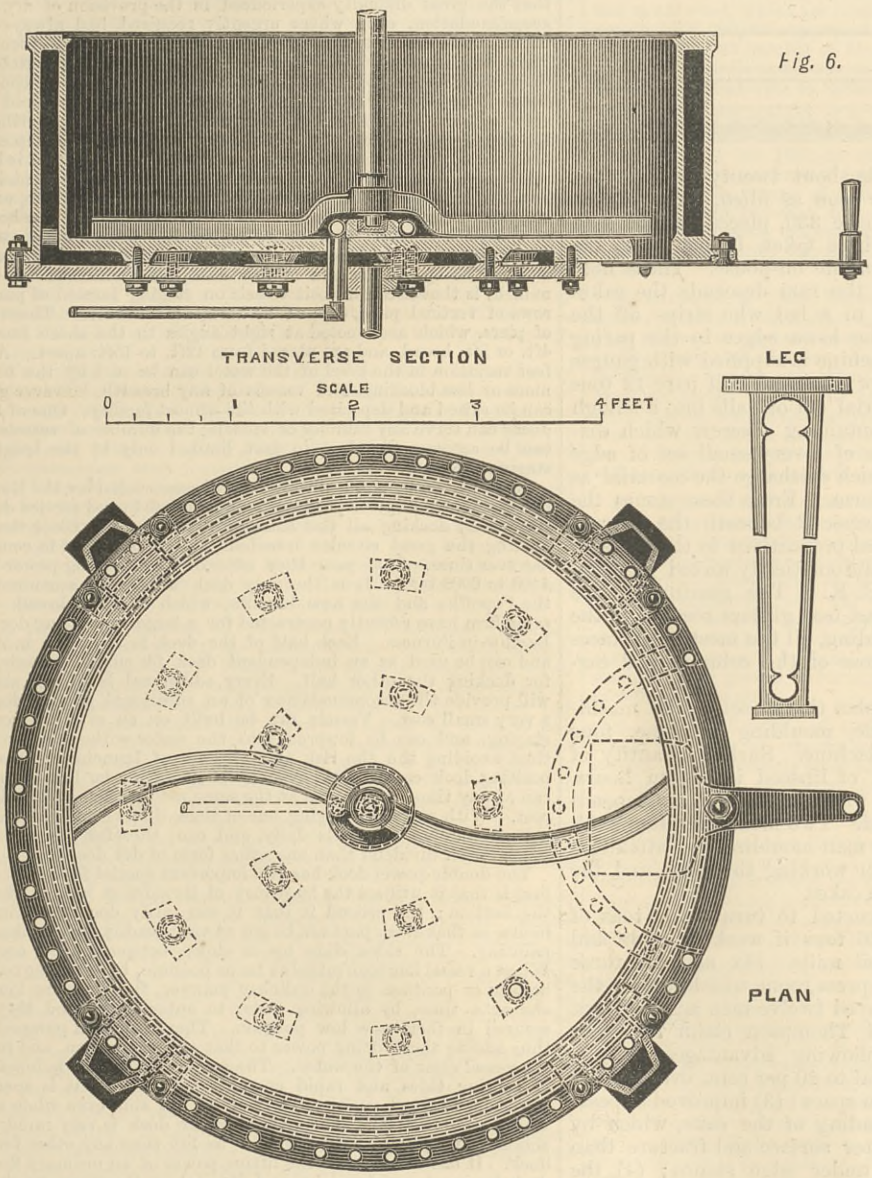


Fig. 2.

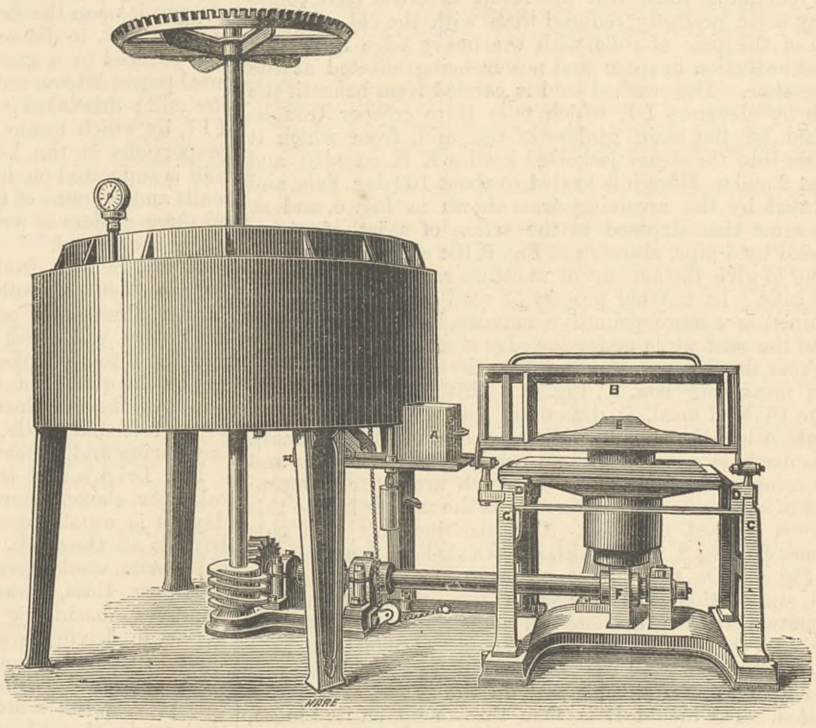


Fig. 3.

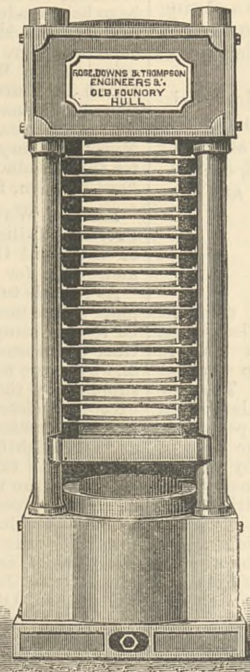
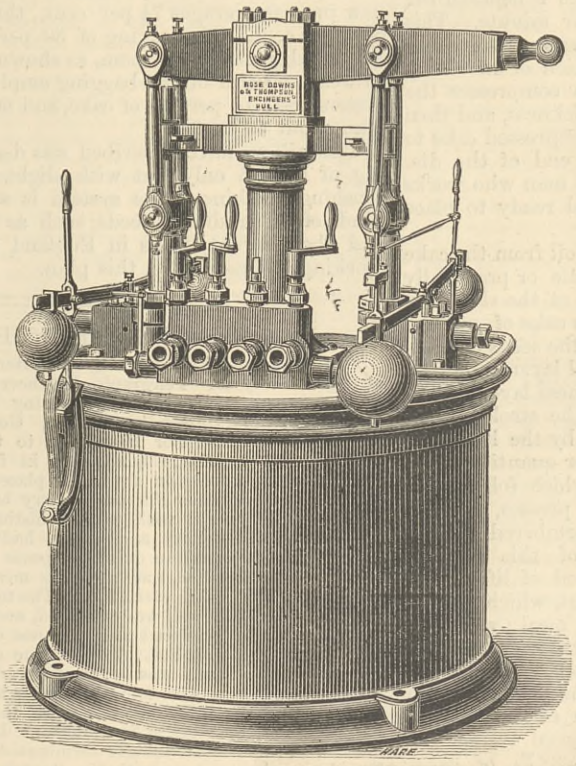


Fig. 4.



PERHAPS no application of the mechanical powers to manufactures can boast such antiquity as the press, by which the "wine and oil," so early reckoned among the wealth of nations, are extracted. The crushing of oil seeds by mechanical means is a comparatively recent industry in England, having been introduced into Hull from Holland about the end of the eighteenth century. The Dutch had long expressed the oil from linseed by means of pressure applied by wedges, which were driven home by falling stamps, similar to those in an ore-crushing works.

In the recent Winter Exhibition of Old Masters at Burlington House, was exhibited a picture of an oil mill by David Teniers, dated 1633, the property of Earl Cowper, K.G., which gave a very accurate view of one of these mills, many of which still exist in Holland, especially about Zaandam, and which many inhabitants of Hull still remember as making a most objectionable noise day and night. Screw presses have met with but little use in seed crushing, and it was not until about 1845 that Bramah's invention was applied to this purpose. The number of mills with hydraulic presses employed in England is estimated at over 150. In the usual process of seed crushing the seed operated on—say linseed—having been screened from all dust and lumps, is passed between rolls of hard or chilled iron, which burst the outer skin, and flatten the mass of oil cells within. From the rolls the seed is thrown upon the bed-plate of a set of edge stones, similar in construction to a mortar mill, but having the runners and bed of a peculiar grit stone, the weight of the runners being some 10 tons. Beneath this the seed is triturated by the peculiar rolling and dragging motion of the runners.

After being ground for some minutes the seed is placed in a steam jacketted pan called a "kettle," in which it is agitated by a revolving stirrer and heated to about 160 deg. From the kettle the seed is withdrawn into taper woollen bags, each holding sufficient seed for a cake. These are flattened by the hand of the workman and placed between the sides of wrappers formed of thickly woven horsehair backed with leather, which is called "a hair." The hair and its contained bag of seed are then placed in the press. This press usually has spaces for four cakes one above another. The ram is 12in. in diameter, and is worked at a pressure of $1\frac{1}{2}$ tons on the square inch, this giving a pressure of about 0·55 tons on each square inch of the cake made. The pressure is given by pumps, two with 1in. rams and two with $2\frac{1}{8}$in. rams being in one set; the larger diameter of pumps gives the pressure quickly until it reaches about 3 cwt. per square inch, when the small pumps give the final nip. The arm of the press rises by a series of impulses corresponding to the strokes of the pumps; this, like the percussive action of the stampers in the old Dutch presses, seems to extract the oil more effectively than the dead pressure of an accumulator or a screw press. We recently visited, and now illustrate on pages 331 and 330, an oil mill on an improved principle, lately erected at Wateringbury, near Maidstone, for Mr. R. Leigh, M.P., member for the latter town. The engine and machinery were designed and supplied by Messrs. Rose, Downs, and Thompson, of the Old Foundry, Hull; the turbine by Messrs. Williamson Brothers, of Kendal; and the boilers by Messrs. Galloway and Sons. The building is from the design of Mr. Friend, architect, Maidstone. The mill is situated on the Medway, at a point where a weir gives an effective fall of 6ft. This is utilised by a turbine—A on plan, page 330—which can be thrown in and out of gear with the shafting of the mill, which is also driven by a horizontal compound condensing engine, with 15in. and 25in. cylinders and 4ft. stroke. The engine is fitted with a balanced expansion valve, controlled by a Porter's governor.

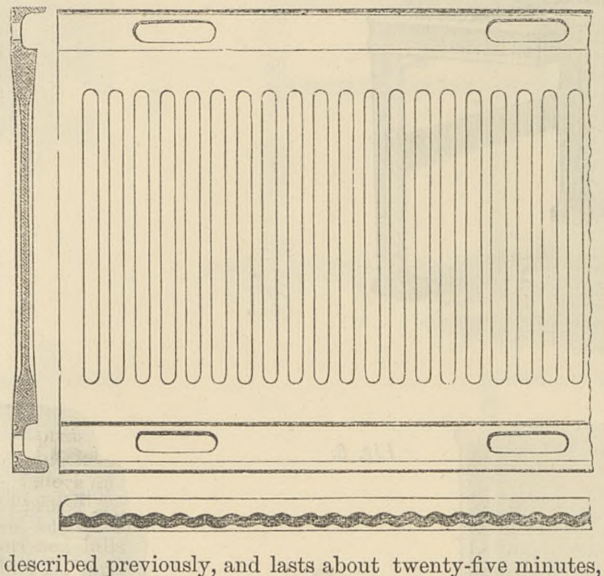
The seed, which is brought by barges, is taken into the mill by a sack-lift B, and the sacks emptied upon an india-rubber conveyor belt C, discharging into the elevator D, which deposits the seed upon another conveyor E, running the whole length of the building, and capable of being reversed. From this the seed can be discharged at any point for storage in the top or other floors. These belts run at about 600ft. per minute. The seed to be crushed is run through the revolving screens F F, which are placed at an angle, the dust passing out in the upper portion of the mesh, and the seed in the lower, leaving any lumps to fall out at the end. From the screen the seed enters the bins G G, each holding sufficient for eleven hours' working of four presses.

At this point the improved machinery of Messrs. Rose, Downs, and Thompson is brought into operation. The seed instead of passing between a pair of rolls is fed into the improved roll frame H, Fig. 1. In the old system of crushing oil seeds the rolls had never more than 20in. of working breadth, and were placed in couples with their axes in a horizontal plane. In these rolls the working surface is 3ft. 6in., and the rolls, four or more in number, have their axes in a vertical plane, similar to a train of calendering rolls. The rolls run in chocks which have free vertical motion in slots in the side frames; the seed is fed from the hopper by a grooved roller, and passes between the top or No. 1 roll and the second roll; an iron plate, which also scrapes No. 2 roll, directs the already crushed material between rolls Nos. 2 and 3, where it undergoes the extra pressure given by the weight of the two rolls above. This grinding process is repeated between the remaining rolls, with the result that the seed comes away more perfectly reduced than with the old combination of the pair of rolls with the heavy edge runners, a great reduction in space and power being effected at the same time. The crushed seed is carried from beneath the rolls by elevators I I, which take it to creeper troughs placed on the main girders of the mill, from which it passes into the steam jacketted kettles K K on plan and Figs. 2 and 6. Here it is heated to about 160 deg. Fah., and agitated by the revolving arms shown in Fig. 6, and at the same time exposed to the action of a jet of steam carried by a pipe, also seen at Fig. 6, the effect of the steam being to give the amount of moisture required in pressing the cake. In the old process of seed crushing this was attained in a more primitive manner, by throwing water upon the seed while under the edge stones.

From the bottom of the kettle the meal is withdrawn in a measuring box, A, Fig. 2. This box, which holds some 18 lb. of meal, is drawn by the workman over the mould below B of the moulding machine (Vittue's patent). This machine consists of two portions, the moulding and the compressing arrangement, which are quite independent of each other, and its action is the master key to this process of seed crushing. The machine has two side frames *c c*, Fig. 2, upon which slides a skeleton carrier frame D, Fig. 2. On this a light steel tray, the size of a cake, is laid, and on this a slightly wider strip of cloth, which is about twice the length of a cake, is placed; the mould B, which is hinged to the side frames, is then closed upon it, and the bottomless measuring box A drawn along it, depositing its seed along the cloth and tray in the shape of the cake desired. The mould B is then thrown up on its hinges, the ends of the cloth doubled over the seed, and the carriers with their load pushed under the die E. The carrier in moving throws into gear a cam F beneath the table, which makes four revolutions per minute. This cam raises the tray and its load off the carriers, permitting them to be drawn back, and the operation of moulding another cake proceeded with. The cam compresses the mould of meal from $3\frac{1}{4}$in. to $1\frac{1}{4}$in. in thickness, and then throws itself out of gear, allowing the compressed cake to be withdrawn by the pressman at the end of the die. During this process of compression the man who works the machine has another mould of meal ready to place beneath the die.

It is a curious fact that in pressing the oil from the cake in the bag, or rather folded cloth, very little or practically none of the oil passes through the cloth at the sides, the whole of the oil finding its way from the cake of crushed seed at the edges. It would appear that the seeds or seed-coverings arrange themselves in horizontal layers, and thus the easiest path for the oil is between these layers. The fact that an intermittent pressure, as by the stroke of the wedge and box presses, or, better still, by the hydraulic press plungers illustrated, extracts a larger quantity of oil than when a dead pressure like that which follows the use of an accumulator for working the presses, is also a curious one, which might be usefully remembered.

The advantages claimed by the use of this machine are:—First, that the pressman is relieved of lifting the heavy hair wrappers, some 26 lb. in weight, which had to be placed in the press with each 12 lb. of meal; secondly, that there is a saving of some 30 per cent. in the woven material used for bags, in addition to which no sewing of bags is required; third, that with this machine the hydraulic press will deal with eighteen cakes of 12 lb. each, or 216 lb. of cake, while in the usual system one press only presses four 8 lb. cakes, or 32 lb. of cake; fourthly, that the hairs used in the old presses, one of which was used for each cake, and which cost some £3 or £4 each, and only lasted a year, are dispensed with. There is also a saving of labour, to which we shall refer at the end of this article. The tray of meal is placed between the plates of the press M, and Fig. 3. These plates are corrugated—as shown at Fig. 7—and bear a brand which they impress upon the cake. The cylinders of the presses are of crucible cast steel, and are 16in. bore, the columns being $4\frac{1}{2}$in. diameter, and the weight of each press some $7\frac{1}{2}$ tons; the pressure on the ram is $1\frac{1}{2}$ tons per square inch, and on the seed crushed 0·75 tons per square inch. Pressure is given by pumps N and Fig. 4, as



described previously, and lasts about twenty-five minutes, each press being sent up as soon as filled. The oil expressed falls into tanks Q, page 330, placed behind each block of presses, from which it is taken by pumps to the store and measuring tanks in the oil-house. These hold some 200 tons of oil. When the ram descends the cakes are withdrawn and handed to a lad who strips off the woollen cloth and cuts off the loose edges in the paring machine O, Fig. 5. This machine is supplied with gauges which ensure a uniform size of cake, and will pare 12 tons per eleven hours. The material cut off falls into a trough in the middle of the table containing a screw which discharges it upon the bed-plate of a very small set of edge stones P, 4ft. in diameter, which discharge the material as it is reduced to a granular form. From these stones the meal passes into a screw creeper R beneath the floor of the mill; this takes it in equal proportions to the elevator I I I, by which means it is automatically mixed in equal proportions in the kettles K K. The gearing of the mill is supported on heavy cast iron girders secured to the walls and columns of the building, all the meeting surfaces of these girders as well as those of the columns and carriages are planed.

It will be seen from the plan that a set of the machinery consists of rolls, kettle, moulding machine, four presses, pumps, and paring machine. Such a quantity of machinery will crush 50 qr. of linseed in eleven hours, yielding 6 tons of cake and 3 tons of oil, the latter depending on the quality of the seed. Two men and a boy work a unit of the machinery, one man moulding and attending to the rolls and kettle, another working the press, and the boy paring and removing the cakes.

Mr. Leigh's mill is constructed to turn out 18 tons of cake per eleven hours, or 36 tons if working night and day, as is usually done in oil mills. Six men and three boys do all the work in the press room which, under the old system, would have employed twelve men and six boys.

Messrs. Rose, Downs, and Thompson claim for their improved machinery the following advantages:—(1) A saving in driving power equal to 20 per cent. over the old system; (2) great economy in space; (3) improved appearance, and more perfect branding of the cake, which by this process has a much better surface and fracture than that made of seed ground under edge stones; (4) the more perfect extraction of the oil; the average percentage of oil in cakes of the old make is $10\frac{1}{2}$ per cent., while the new process averages $7\frac{1}{2}$ per cent., thus showing a saving of 3 per cent.; (5) a saving of 50 per cent. in the labour employed in the press-room, as shown above; (6) a saving in wear and tear of the bagging employed; this in the old system costs 1s. per ton of cake, and made on the improved plan about 4d. or 8d.

The mill we have described was designed for the crushing of linseed only, but with slight modifications in the crushing machinery the system is suitable for all other kinds of oil producing seeds, such as cotton seed, &c. &c., and about twenty mills in England and abroad are now working successfully on this plan.

PROFESSOR HELMHOLTZ.

THE president, Professor G. C. Foster, F.R.S., and members of the Society of Telegraph Engineers and of Electricians gave a *conversazione* on the evening of the 18th ult., in the library of University College, Gower-street, in honour of the visit of Professor Helmholtz to this country. The fine building and the large quadrangle in front were illuminated by one of the Crompton arc lamps placed above the pediment. Another in the circular Flaxman gallery brought out the lines of the beautiful *rilievi* with perfect distinctness. Many of the members of the society and others had lent instruments and apparatus showing some of the purposes to which electricity had recently been applied, and also the means by which electrical research is still being carried on. The telephotographic machine of Mr. Shelford Bidwell was exhibited, and the process by which a picture might be produced at a distance of many miles from the object to be photographed. The outline of a butterfly with the markings on the wings was in this way very distinctly reproduced. Mr. A. Stroh exhibited some ingenious instruments designed to illustrate Professor Helmholtz's vowel theory. The library was partly lighted by electric incandescent lamps, made on Swan's system. Professor Helmholtz terminated his visit to London on Tuesday, and now stays with Mr. Spottiswoode, president of the Royal Society, at his country house at Coombe Bank, Sevenoaks. From thence he will proceed to Dublin, to receive an honorary doctor's degree from the University of that city.

During the evening Mr. Latimer Clark exhibited the accompanying curious and interesting unpublished letter from Sir Isaac Newton to Dr. Law:—

[COPY.]

London, Dec. 15, 1716.

Dear Doctor: He that in ye mine of knowledge deepest diggeth, hath, like every other miner ye least breathing time, and must sometimes at least come to terr; alt for air.

In one of these respiratory intervals I now sit doune to write to you, my friend.

You ask me how, with so much study, I manage to retene my health. Ah, my dear doctor, you have a better opinion of your lazy friend than he hath of himself. Morpheous is my best companion; without 8 or 9 hours of him yr correspondent is not worth one scavenger's peruke. My practizes did at ye first hurt my stomach, but now I eat heartily enow as y' will see when I come down beside you.

I have been much amused by ye singular φενομενα resulting from bringing of a needle into contact with a piece of amber or resin fricated on silke clothe. Ye flame putteth me in mind of sheet lightning on a small—how very small—scale. But I shall in my epistles abjure Philosophy whereof when I come down to Sakly I'll give you enow. I began to scrawl at 5 mins frm 9 of ye clk, and have in writing consmd 10 mins. My Ld. Somerset is announced.

Farewell, Gd bless you and help yr sincere friend

(Signed)

To Dr. Law, Suffolk. ISAAC NEWTON.

SOCIETY OF ENGINEERS.

FLOATING AND DEPOSITING DOCKS.

AT a meeting of the Society of Engineers, held on Monday, May 2nd, in the Society's Hall, Victoria-street, Westminster, Mr. Charles Horsley, president, in the chair, a paper was read by Mr. John Standfield, on "Floating Docks, the Depositing Dock, and the Double-power Dock." The author commenced by observing that the great difficulty experienced in the provision of dry dock accommodation, even where urgently required, had always been the immense amount of the first outlay which had to be incurred. There were many ports where dry docks would be profitable, if they could be provided at half the cost of a stone or concrete dock. The circumstances under which docks were required were very variable, but all the opposing conditions were met either by the depositing dock or by the double-power dock. The depositing dock is L-shaped—that is, having only one side; while it is being raised or lowered it is kept horizontal by the outrigger, which is a broad shallow pontoon attached to the side of the dock, and so ballasted that it always floats at about half its depth. The bottom of the dock consists of a series of parallel fingers or pontoons, firmly connected to the vertical side, but quite free at the outer ends. The special feature of this dock, from which it has been named, is that it can deposit vessels on staging formed of parallel rows of vertical piles, capped by horizontal timbers. These rows of piers, which are erected at right angles to the shore line, are 4ft. or 5ft. broad, and are placed from 12ft. to 15ft. apart. A few feet variation in the level of the water can be met by the use of more or less blocking, and vessels of any breadth, however great, can be raised and deposited with the utmost facility. One of these docks can serve any number of vessels; the number of vessels that can be accommodated is, in fact, limited only by the length of staging provided.

In 1876 Messrs. Clark and Standfield constructed for the Russian Government a large depositing dock which did good service during the war by docking all the Russian vessels in the Black Sea, including the great circular ironclads, and it has been in constant use ever since. Last year they extended its docking power from 4400 to 6000 tons. It is the only dock which can accommodate the Popoffka and the new Livadia, which is 152ft. broad. The same firm have recently contracted for a large depositing dock for Barrow-in-Furness. Each half of the dock is complete in itself, and can be used as an independent dock for smaller vessels, and for docking the other half. Every additional length of staging will provide the accommodation of an additional graving dock at a very small cost. Vessels can be built on an even keel on the staging, and can be lowered into the water without any strain, thus avoiding the risk and expense of launching. The depositing dock cannot sink, even if all its valves be left open. It can at any time be enlarged at the same rate per ton as its original cost. With sufficient staging, one of these docks can accommodate a great number of vessels daily, and can, therefore, earn a very much larger dividend than any other form of dry dock.

The double-power dock has two important special features. The first is that it utilises the buoyancy of its sides as well as that of the bottom; the second is that it can easily dock itself in two hours, so that every part can be got at very readily for cleaning and painting. The sides slide up or down between fixed corners. When a vessel has been raised as far as possible, by pumping out the bottom or pontoon in the ordinary manner, the sides are lowered one at a time, by allowing water to enter them, and they are secured in their new low position. They are then pumped out, thus adding their lifting power to that of the pontoon, and raising the vessel clear of the water. The use of this dock is independent of varying tides and rapid currents and floods; it is specially suited for exposed positions, and it cannot sink even when all its valves are left open. The double-power dock is very rapid in its action, having less useless weight to lift than any other form of dock. It has about twice the lifting power of an ordinary floating dock for its size and weight, and its cost is, therefore, much less. Its money-earning powers are surpassed only by the depositing dock.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—George Sullivan, chief engineer, to the Mutine, when commissioned; William B. Stevens, chief engineer, to the Valiant, vice Fry; Matthew R. Miller, engineer, to the Wrangler, when commissioned; Edward Irish and David D. Murray, engineers, to the Cockatrice, when commissioned; Thomas B. Jordan, engineer to the Hector, additional, for the Britomart, vice Franklin; George Elbron, engineer, to the Mutine; Henry F. Hammond, engineer, to the Asia, additional, for the Dreadnought, vice Elbron; James Brown, engineer, to the Lord Warden, for temporary service, vice Harrison.

LONDON WATER SUPPLY.—In the report of Mr. Crookes, F.R.S., Professor Odling, and Professor Meymott Tidy, to the President of the Local Government Board on the water supplied to the metropolis for the month ending April 20th, the authors say:—"As regards turbidity and colour a further improvement has taken place in the metropolitan waters since the date of our last report. Of the 161 samples examined during the month, in five only was a trace of suspended matter recognisable; 156 were found 'clear;' and five were noted as 'very slightly turbid.' Of the 23 samples supplied by the New River Company, the whole were, without exception, clear, bright, and efficiently filtered. Of the 23 sampled from the mains of the East London Company, four were notes as 'very slightly turbid;' the remainer were bright, clear, and well filtered. Of the 23 samples from the mains of the Chelsea Water Company, the whole were bright, clear, and well filtered. Of the 23 samples from the mains of the West Middlesex Company, the whole were clear, bright, and well filtered. Of the 23 samples from the mains of the Lambeth Water Company, the whole were clear, bright, and well filtered. Of the 23 samples from the mains of the Grand Junction Company, the whole were clear, bright, and well filtered. Of the 23 samples from the mains of the Southwark and Vauxhall Company, one only was noted as 'very slightly turbid;' the remaining 22 samples were clear, bright, and efficiently filtered. The improvement we had occasion to mention as having taken place in the appearance of the metropolitan waters in our last report has been still further noticeable during the past month, and, taken as a whole, they leave nothing to be desired in respect of colour, wholesomeness, complete aeration, or absence of suspended matter."

RAILWAY MATTERS.

THE Christchurch, New Zealand, tramway trains have run 44,247 miles, at a cost of 10d. per mile, the earnings being 1s. 7d. a mile.

TRAMWAYS seem to be very favourite means of locomotion in the colonies. Round the suburbs of Sydney several more are being constructed, including lines to Waverley, Woolahra, and Randwick.

THE Government of Jamaica are advertising for tenders for the construction of forty miles of railways in the island. Tenders are to be delivered at the office of the Crown Agents, or of the Director of Roads, Kingston, before July 28th.

IT was stated at date of departure of last mail, says *India and the Colonies*, that General Rosser had discovered a new route for a portion of the Canada-Pacific Railway, which would save at least 150 miles in distance. General Rosser had better look again; perhaps he could save it all.

A COMPANY is being formed in Canterbury, New Zealand, for the construction of a railway through to the west coast of the Middle Island, to supply the mining population of Westland with all kinds of agricultural and other produce, and to enable the various minerals along the route to be worked profitably.

THE East Indian railway station for Calcutta being on what is known as the other side of the river, and at an inconvenient distance, it is proposed to construct a railway bridge across the Hooghly some miles above Calcutta, which will also serve to connect the East Indian and Eastern Bengal systems.

THE practice of locking carriage doors has been discontinued throughout Victorian railways. A colonial contemporary says that a great service has been performed for Australia by Mr. Mirls, locomotive superintendent of some of the Victorian railways, because he has invented a cheap and very effective spark-catcher. Surely Australia cannot seriously have felt the want of a spark-catcher.

AT Uxbridge, on Wednesday, a boy named Childs, aged nine years, was charged before Colonel Greville with maliciously placing on one of the metals of the Uxbridge branch of the Great Western Railway a piece of iron known as a chair and several large stones. A train was due at the spot at the time. The prisoner and another child, aged seven, were seen to leave the obstruction. Fortunately, it was removed before mischief could be done.

THE railway from Wellington to Manawatu, New Zealand, which was once commenced by the Government and discontinued, is to be recommenced by a public company, to be called the Wellington and Manawatu Railway Company (Limited), with a capital of £500,000, of which £50,000 is to be raised in the colony. The company have been promised considerable advantages by the Government, and propose to ask power to acquire the native lands through which the line will pass. Should the enterprise prove successful, there will be in the course of four or five years one continuous line of railway from Waitara, ten miles north of New Plymouth, to Wellington, about 220 miles, running the whole way, or very nearly so, through fertile country.

WE noticed in our last week's issue the official inspection by General Hutchinson. of the Board of Trade, of the section of those tramways running from Stoke-on-Trent to Longton. The line has since then been opened to the public, and is proving a success, the traffic being found to be very great. The engines, with cars loaded with passengers each journey, do their work most satisfactorily, notwithstanding the severe and continuous gradients of 1 in 16 and 1 in 18 which they have to ascend. The director of the company have placed with Messrs. Merryweather and Sons a further order for engines. The company is extending its lines from Stoke in another direction, namely, to Hanley and Burslem, so that in about three months' time the towns of Longton, Stoke, Hanley, and Burslem, will all be connected by these tramways.

A SELECT COMMITTEE of the House of Commons yesterday passed a Bill authorising the abandonment of the Forth Bridge. The abandonment of this bridge is owing to investigations which have been made into the engineering details of the undertaking by Sir John Hawkshaw and Mr. Barlow since the fall of the Tay Bridge, who have reported that it was impossible for them to join in any opinion approving the bridge as sanctioned by Parliament in 1873, the designs of which were prepared by the late Sir Thomas Bouch. They have, however, suggested the possibility of constructing a tunnel under the Forth, which they consider could be done at much less cost than the erection of a bridge. This proposal for making a tunnel under the Forth in place of Sir Thomas Bouch's next to impossible bridge was first made in articles on the subject in our pages.

THE Great Eastern Railway Company has just issued circulars calling attention to its new arrangements for express parcels service. The rate charged is 4d. for 8 lb., and 1d. additional for every 8 lb. or part thereof. The rate includes delivery within three-quarters of a mile of any of a large number of stations as far from London as [Stratford for instance, and in London as far as three miles from Charing Cross. They also include collection at any of the parcels receiving offices appointed by the company. Passengers' luggage is collected at the same places, and delivered at the rate of 3d. per package. Booking fees have been abolished, and payment may be made for all parcels by means of stamps, similar to postage stamps, which may be obtained at any of the receiving offices. A circular now issued gives a list of the London and suburban receiving offices. This list of places may be improved by arranging the names of places alphabetically.

DURING last summer, engineers of the Nelson River Railway Company surveyed a railway route between the Norway House, at the outlet of Lake Winnipeg, and Fort Churchill, on Hudson's Bay, a distance of about 350 miles. The surveyed route follows Nelson River for a distance of nearly 100 miles over a level surface. Thence the course of the river is through a broken, rocky country, with a descent of nearly 100ft. to a lower plateau, where the country again becomes level, and continues so to Hudson's Bay. Upon entering this rocky range, the surveyed route leaves Nelson River, takes a more northerly course towards the valley of the Churchill River, which it reaches at the entrance on the lower plateau, and continues to follow the course o fthe river to its outlet in Hudson's Bay. The estimated cost for building the road is 1000 dols. a mile on the plateau, and 17,000 dols. through the rocky portion, making an average of 1200 dols. per mile along the whole route. It is claimed that by this route it will be possible to transport grain from Saskatchewan Valley, Manitoba, to Liverpool for less than it will cost to carry it to Montreal by the proposed railway north of Lake Superior.

IN the course of the railway rates inquiry Mr. W. B. Forwood stated in evidence that the average rate from Liverpool to the four great centres of consumption is 2·29d. per mile, and the average rates from three other ports, London, Fleetwood, and Avonmouth, to those centres of consumption, is 1·49d., showing a difference against Liverpool of 0·80d per mile. The average rate for cotton from Liverpool to four centres is 3·90d. per mile, while from other ports to four centres of consumption, the average rate is 2 93d. The quantity of cotton forwarded from the interior to Liverpool is 608,000 tons; the distance between Liverpool and Manchester is thirty-one miles, and the rate is 9s.; but the Lancashire and Yorkshire Railway Company, in order to develope their docks at Fleetwood, are willing to carry cotton from Fleetwood to Manchester, a distance of fifty miles, for the same rate of 9s. In the same way, the Furness Railway Company and the Midland Railway Company, owning the docks at Barrow, are also willing to carry cotton from Barrow to Manchester 87 miles, very nearly three times our distance, for the sum of 9s. per ton. The import of wool into Liverpool is 27,000 tons per annum; there the average of three rates, between Liverpool and Leeds, Rochdale, and Kidderminster, which are the centres of manufacture, is 3·39d. per ton per mile. The average rate from Hull, London, and Bristol to those centres is 2·29d.; an increased rate of 1·10d. per mile, or nearly fifty per cent.

NOTES AND MEMORANDA.

THE population of New South Wales is now over 800,000 Europeans. The aboriginals are less than 1000.

THE length of the second pendulum has been redetermined for Paris by M. C. S. Peirce, who makes it 39·132in.

MR. LIGHTFOOT, of Dartford, informs us that the latent heat of ammonia is probably 900 thermal units, or very nearly that of water.

THE total yield of gold in Victoria in 1879 was less than half the annual average of the colony during the preceding ten years. It was but 758,947 oz.

AS a result of experiment, M. Tréve says he has found that more light, natural or artificial, will pass through a horizontal slit than through a vertical slit. He has not found out why.

THE total quantity of gold raised in the Australian Colonies since 1851 amounted to 1879 to sixty-nine million ounces, valued at £271,000,000, by far the greater portion of which came from Victoria.

A TEMPERATURE of 140 deg. to 150 deg. C., and consequent pressure of $3\frac{1}{2}$ to $4\frac{1}{2}$ atmospheres, converts 71 per cent. of starch into glucose. Dr. M. Stumpf considers that with the aid of one to two parts of acid per thousand, saccharification may be carried so far, *Science* says, as to render the use of malt unnecessary.

SOME more archæological discoveries of a very interesting nature have just been made in Algiers, near the sea coast on the seat of the ancient Utica. The remains of a temple, consecrated to the infant Hercules, a statuette of the god in white marble, evidently Greek, a Bacchus, life-size, also in white marble, and a great number of fine mosaics, indicate it is thought the probability of a "great find."

IT is estimated by a Canadian paper that the quantity of timber imported into the United Kingdom last year, without taking into account staves or mahogany, consisted of 6,206,778 loads of hewn and sawn wood, which are equivalent to 310,338,900 cubic feet, or nearly 3,725,000,000 superficial feet. This quantity, it says, would form a sufficient number of blocks 1ft. cube, if placed end to end, to stretch a girdle twice round the earth, and to leave almost a sufficient number over to extend through the centre of it.

THE following account of a very early application of steam to the propulsion of a vessel is taken from the *Annual Register* for 1801:—"July 1st, 1801, an experiment took place in the river Thames for the purpose of working a barge or any other craft, against tide, by means of a steam engine on a very simple construction. The moment the engine was set to work, the barge was brought about, answering her helm quickly, and she made way against a strong current at the rate of two miles and a-half an hour."

M. LAURENT, of Paris, has constructed "magic mirrors" giving similar effects, *Nature* says, to those brought from Japan, but of glass silvered at the back instead of metal. By engraving patterns at the back and silvering the front surface, the mirror has a perfectly plane surface only when the air pressures at the front and back are equal. If the air behind be compressed or rarefied, the thinner parts will have relatively a greater convexity or concavity than the rest, and in the disc of light which the mirror reflects on to a wall from a luminous point the pattern engraved on the back will accordingly appear dark or light.

SPEAKING of the qualities of some glues and cements, in the course of a recent lecture before the Polytechnic Club of the American Institute, Prof. John Phin said no cement can be fire-proof which contains organic matter, since this is decomposed at a temperature about that of melting lead or, say, 600 deg. Fah. Cements containing oils will not be fire-proof. Silicate of soda mixed with asbestos is the nearest to a fire-proof cement. It will stand a low, red heat; it is decomposed at a bright red. The best waterproof cement, he said, consists of litharge, 3 parts; white sand, 3 parts; plaster of Paris, 3 parts; rosin, 1; boiled linseed oil in sufficient quantity.

M. RAOUL PICTET, of Geneva, seems to follow with great energy the class of experiments which led to his liquefaction of several gases previously considered permanent. He now announces the discovery of a method of distilling alcohol at very low temperatures by the aid of ice. Two kilogrammes of ice are needed for the production of a litre of alcohol; that is, for the distillation of 110 gallons of alcohol, a little less than a ton of ice will be required. The cost of production will include only coal for working the steam engine which drives the air pump and the sulphuric acid, the evaporation of which produces the ice. M. Pictet declares that this will notably diminish the expense of distillation, and suggests that the excise on alcohol should be proportionately increased.

AN improved form of the Töpler air-pump has been devised by Herr Bessel-Hagen, with which considerably higher vacua can be reached than those Mr. Crookes obtains with the more complicated and fragile Sprengel-Gimingham apparatus. The average limit of rarefaction was found to be $\frac{1}{83}$ millionths of an atmosphere—$\frac{1}{95}$, *Nature* says, in one case—while the other pump only gives $\frac{1}{17}$ millionth. It is noted that Prof. Ogden Rood has obtained $\frac{1}{94}$, and in one case even $\frac{1}{110}$, with a modified Sprengel. With his highest vacua the author found electricity to pass—using plate-electrodes and a strong Holtz machine, with Leyden jars. He considers mercury vapour an insulator for electricity, but shows that radiometric movements depend greatly on its pressure *in vacuo*. No diffusion of hydrogen through the glass could be detected.

AT a recent meeting of the Paris Academy of Sciences a communication on "Researches on the Liquefaction of Gaseous Mixtures," was read by MM. Cailletet and Hautefeuille. Operating with a gas easily liquefiable and a so-called permanent gas, in capillary tubes, total liquefaction (yielding a homogeneous liquid) is obtained by first compressing the mixture at a temperature so high that the strongest pressures prove powerless to abolish the gaseous state, then lowering the temperature regularly, so that all points of the tube pass at the same time through the temperature at which is produced a change of state. The authors thus obtained condensed carbonic acid, holding a large proportion of oxygen, hydrogen, or nitrogen, these latter substances concurring to form the liquid, though the temperature was too high for them to exist separately in that state. The results of experiment with cyanogen and carbonic acid are analysed. The assimilation—generally very imperfect—of solution of a gas to its liquefaction probably here applies. The mixture retains its characters at temperatures considerably above that corresponding to the critical point of its less easily liquefied element.

AT a recent meeting of the Royal Society of Edinburgh Prof. Tait communicated the results of his experiments on the pressure errors of the Challenger thermometers, the correction for which, as originally furnished to the expedition, was 0·5 deg. Fah. per mile of depth. The experimenter subjected the thermometers to a pressure of 25 tons per square inch in a hydraulic press. At 3 tons pressure an average effect of 1·5 Fah. was produced upon the inclosed thermometers. Before drawing any conclusion as to the correction to be applied to deep-sea sounding, it was necessary to consider how far this effect could be explained as resulting from the peculiar conditions under which the experiments were made. From the known compressibility of glass it was calculated that the volume of the bore of a thermometer tube, closed at both ends, would be diminished by only one-thousandth part for an increase of pressure of one ton on the square inch; and from a direct experiment made with a metre-long tube this was proved to represent very approximately the real effect. Hence this could have no appreciable effect on such comparatively short thermometers as those of the Challenger, which were besides subject to much graver errors, such as those arising from the shifting of the indices during the ascent from the depths, or even from the effect of parallax when taking the reading.

MISCELLANEA.

A CONTEMPORARY says that artificially made ice is being sold in Kingston, Jamaica, at ½d. per lb.

AN excellent steel engraving of Robert Wilhelm Bunsen, by Mr. C. H. Jeens, was published with *Nature* of the 28th ult.

A FINE bed of hard brooch coal, estimated to contain not less than two million tons, has been found during sinking operations on the estate of Mr. R. Plant, at New Invention, Wednesbury.

EXTENSIVE harbour dredging has been progressing at Colombo, and some shells filled with powder, supposed to have been used in the Anglo-Dutch or Portugo-Dutch wars, have been brought up by the dredger.

IT appears that there is great probability of wide adoption of the electric light in the colonies. It is proposed to light the Melbourne Parliament Houses in this way. The high price of coal in many colonies is an important fact in favour of the electric light.

THE annual meeting of the Agricultural Engineers' Association was held on Tuesday last at the Westminster Palace Hotel. Some new elections of members and re-elections of members of council took place, which, as far as is reported, seems to be nearly all that is ever done.

THE Naval and Marine Engineering Exhibition which was open in Glasgow six months, from the 1st November to the 30th April, was visited by about 65,000 persons. A number of the exhibits have been left in the hands of the Corporation to be added to the local Museum.

THE machinery used in boring the new tunnel under the St. Lawrence River, "was removed," an American contemporary says, "from the ice on the 22nd March. Although the operations were far from complete, the engineers in charge say that the tunnel is practicable, and that they will have a slate-like rock to drill through."

THE Clyde shipbuilding trade is exceedingly busy. During the past month twenty vessels were launched, with an aggregate tonnage of 30,010, as against twenty-two of 27,000 in the corresponding month of last year, while the tonnage of the four months is 90,570, as compared with 72,450 in the corresponding period of last year. There are 134 vessels on the stocks.

THE report of the Birmingham Proof-house shows that, during the past year 638,000 barrels were proved. This was 90,000 in excess of 1879. At the Proof-house in Liège the number proved during the year was 874,929, the increase on the year being about the same as in Birmingham. Ten years since Birmingham proved 36 per cent. more barrels than Liège; but the tables are now turned.

THE jurors of the Melbourne Exhibition have published the list of awards for printing, bookbinding, and publications, and in each of these classes Messrs. Blackie and Son, publishers, London and Glasgow, Edinburgh and Dublin, have been awarded first order of merit. The competition included the publishers of Great Britain, America, and the Continent, and Messrs. Blackie and Son are at the head of the list in each class of awards.

MESSRS. W. and J. Galloway and Sons, of the Knott Mill Ironworks, Manchester, have just completed a pair of engines for blowing Bessemer plant, which are probably the largest of their kind yet constructed. These engines have steam cylinders 54in. diameter, with blowing cylinders 72in. diameter, and both having a stroke of 6ft. They are fitted with expansion gear, which can be disconnected instantaneously; also with air pumps, and condensers. These engines are being erected at the Phœnix Ironworks of Messrs. Steel, Tozer, and Hampton. We hear that Messrs. Galloway are also completing the erection of a new moulder's shop, which will be one of the largest and most perfect foundries in the district.

IN the Melbourne Exhibition, Messrs. Ibbotson Brothers and Co., of the Globe Steel Works, Sheffield, seem to have had one of the largest displays of articles in steel ever exhibited by one firm. Railway materials formed, it might also be said as a matter of course, the larger number of illustrations of the now almost universal application of steel. Amongst them were large numbers of samples of long, light, and heavy flanged, double head and single head rails, tram rails, steel joints, and bulb and angle steel; railway tires and axles; Ibbotson's steel lock-nuts and mild steel bolts for fish-plates; springs and spring buffers of all kinds; shovels and files of every description. Ibbotson's steel clip, and other forms of rail joints to take the place of the common and inefficient plain fish-plate, was looked upon as a very important feature of the whole collection; but a great deal of interest was displayed in Messrs. Ibbotson's collection of dish steel sleepers, and the automatic railway coupling exhibited by them.

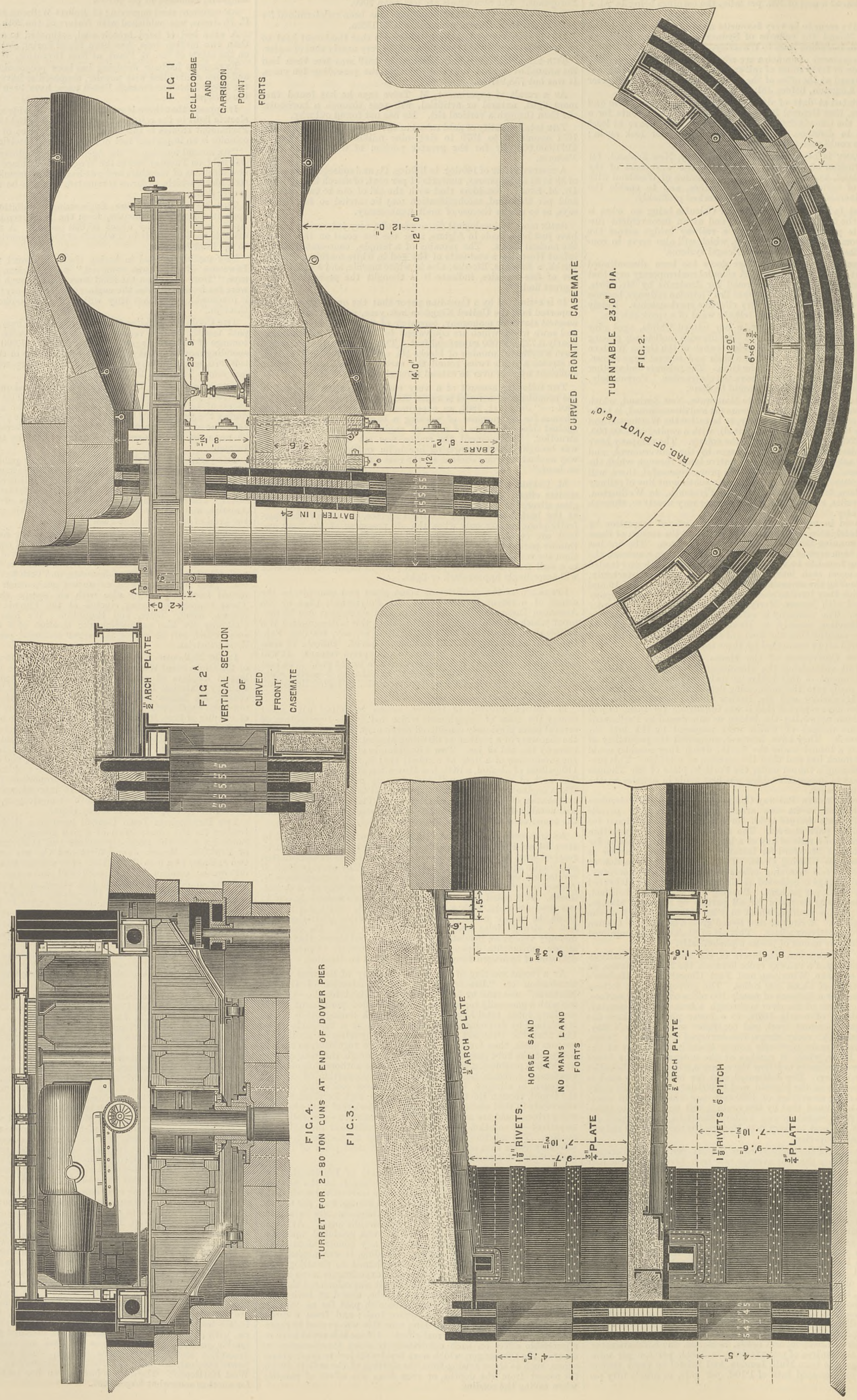
THE Birmingham Town Council have now decided upon the tenders for the construction of a new storage water reservoir at Shustoke, with the necessary engines and buildings, at an outlay of £125,000. Messrs. James Watt and Co. are constructing the two engines, at a cost of £13,750. The engines will be compound differential condensing, and each will have one high-pressure cylinder of 33in. diameter and 10ft. stroke, and one low-pressure cylinder 60in. diameter and 10ft. stroke. Under each cylinder there will be a ram pump, 26in. diameter and 10ft. stroke. Each of these engines will be equal to an 80in. diameter cylinder Cornish engine. The quantity of water each engine will be capable of delivering is $4\frac{1}{2}$ millions of gallons per day. Steam will be supplied by five Root's patent steam boilers. For these the Patent Steam Boiler Company, of Heneage-street, Birmingham, have secured the contract, at £4485. The construction of the reservoir alone is to cost £78,900, and the work has been entrusted to Messrs. John Aird and Sons.

WE are requested to state that during the summer term, commencing May 2nd, 1881, Professor Armstrong, Ph.D., F.R.S., and Professor Ayrton, A.M. Inst. C.E., will continue their tutorial and laboratory courses of instruction in chemistry and physics as applied to the arts and manufactures, at the Cowper-street Schools, Finsbury, in rooms rented from the Middle-Class School Corporation, pending the present erection of the City and Guilds of London Technical College, Finsbury. The classes and laboratory practice are, through the liberality of the eighteen companies comprising the Institute, open for an almost nominal fee to female, as well as to male, students. The day classes would be of service to ladies who have not the time or means to follow a Newnham or a Girton education, and to men who are similarly situated with reference to the established universities; while the evening classes will be of great use to those who take more than a mere mechanical interest in their daily work, since from the course of instruction and their own experiments performed in the laboratories, the students will gain such a thorough knowledge of principles as should distinguish a skilled intelligent worker from a mere machine.

THE trial trip of a fine new steamer, the Bothwell Castle, took place on Thursday last from Middlesbrough to the Royal Albert Dock, London, and was in every way satisfactory. She has been built by Messrs. Raylton, Dixon, and Co., of Middlesbrough, to the order of Messrs. Thos. Skinner and Co., to take her place in their Castle line of steamers to China. The Bothwell Castle will carry 4000 tons of tea on a draught of water of 21ft., and on her trial trip, when loaded down to this depth, we are informed that she maintained an average speed of over 12 knots between the Tees and London. Her leading dimensions are—length, 345ft.; beam, 38ft. 6in.; depth of hold, 26ft.; gross register tonnage, 2550 tons. She is three-deck built, and the deck houses and casings are all of iron, the decks, charthouse, rails, &c., being of East Indian teak. She has a clipper bow, graceful lines, and brigantine rig, with pole masts. In the small saloon coloured glass, polished marble panels, and oak artistic furniture are employed in the decoration and furniture. The engines, which are of 300-horse power nominal, are built by Messrs. T. Richardson and Sons, of West Hartlepool. The owners have given her builders an order for another somewhat larger boat.

BRITISH ARMOURED FORTS.

(For description see page 326.)



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C. AND L. (Lombard-court).—*Nothing has appeared on the subject in our pages.*

G. A.—*You will find the information you want concerning Engineers in the Mercantile Marine in* THE ENGINEER *for Sept. 13th and 20th and Oct. 25th*, 1878.

MAQUINISTA.—*If your invention is the same as that of the person to whom you refer, you cannot now take out a patent for it. If you have used the invention before the date of the patent you mention, you may continue to use it.*

G. C. (Edinburgh).—*You will find your proposition dealt with in most works on heat. Your arguments are sound in theory, but could not be reduced to practice, because a cylinder of enormous dimensions would be required, and the condensation which would take place within the cylinder on the entry of fresh steam at the beginning of each stroke would be excessive. If you will consult Clerk-Maxwell's treatise on heat, and examine some of the diagrams he gives, you will understand this we have no doubt.*

CONSTANT READER.—*No general rule can be given for stuffing-boxes. Experience alone will dictate the best dimensions, as these not only vary for the same purpose with the diameter of the rods, but with the necessary length of the gland for rods of the same size. The necessary capacity for an air pump will vary through the proportions you mention according to the pressure of the steam used. The vacuum box of a condenser may be as large as you can conveniently get it, but not of less capacity than the cylinder. The exhaust pipe, when of more than two or more feet in length, may be considered as part of the condenser capacity.*

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 10th, at 8 p.m.: Paper to be read and discussed, "On Torpedo Boats and Light Yachts for High-Speed Steam Navigation," by Mr. John I. Thornycroft, M. Inst. C.E.

SOCIETY OF ARTS.—Monday, May 9th, at 8 p.m.: Cantor Lectures, "The Art of Lace-making," by Mr. Alan S. Cole. Lecture IV.—*Resumé* as to styles of design in hand-made lace. Traditional patterns. Sketch of the development of inventions for knitting and weaving threads to imitate lace. Differences between machine and hand-made laces. Modern hand-made laces at Burano, Bruges, Honiton, &c. Tuesday, May 10th, at 8 p.m.: Foreign and Colonial Section, "Trade Relations between Great Britain and her Dependencies," by Mr. William Westgarth. Sir Robert R. Torrens, K.C.M.G., will preside. Wednesday, May 11th, at 8 p.m.: Ordinary meeting, "The Manufacture of Glass for Decorative Purposes," by Mr. H. J. Powell, Whitefriars Glass Works. Thursday, May 12th, at 8 p.m.: Applied Chemistry and Physics Section, "Recent Progress in the Manufacture and Applications of Steel," by Professor A. K. Huntington. Friday, May 13th, at 8 p.m.: Indian Section, "Burmah," by General Sir Arthur Phayre, G.C.M.G., K.C.S.I., C.B. Sir Rutherford Alcock, K.C.B., will preside.

THE ENGINEER.

MAY 6, 1881.

THE CONTINUOUS BRAKE CONFERENCE.

WE recently called attention to the fact that several important railway companies contemplated taking steps to adopt a uniform system of continuous brake, which would permit the vehicles of any one company in the federation to be run in trains with the vehicles of any of the other companies. We possess now information which we did not possess then. A conference was held at Euston Station on the 2nd April. Mr. F. W. Webb took the chair, and there were present Mr. Charles Sacre, Manchester, Sheffield, and Lincolnshire Railway; Mr. P. Stirling, Great Northern; Mr. McDonnell, Great Southern and Western of Ireland; Mr. W. Kirtley, London, Chatham, and Dover; Mr. J. Stirling, South-Eastern; Mr. W. Adams, London and South-Western; Mr. S. W. Johnson and Mr. Clayton, Midland; Mr. Deans, Great Western; Mr. W. Barton Wright, Lancashire and Yorkshire; and Mr. Tomlinson, Metropolitan Railway. Mr. Webb stated that he had called these gentlemen together because of a request made by Mr. Moon, that he would see what had to be done to London and North-Western carriages to enable them to interchange with other companies. Mr. Webb had prepared a letter or report in reply, in which he said that he had made inquiries, and found that on most of the principal lines the automatic vacuum and the vacuum were preferred to the automatic pressure brake, and that all that was necessary to enable the London and North-Western stock to work with that of other companies was a standard pipe coupling between the carriages. The report goes on to recommend a coupling invented by Mr. Clayton of the Midland, and after stating that the vacuum brake "appears to work out much simpler than the pressure brake," he concludes with the following words: "Nature itself in the case of a vacuum provides the datum from which we may all work, so that the details of the gear may be left to the companies themselves; and in such of our carriages which may be required to work on any of the lines I have named, it would not be a difficult or expensive job to apply the vacuum principle to the present rigging. Seeing then that an universal coupling, as I have before stated, is the principal thing to be brought about to ensure interchangeability of stock with others, if you bring about any means by which this could be accomplished, you would most facilitate the work of interchanging our stock with others and also amongst themselves; and I have very little doubt, if a meeting could be arranged with the engineers of the various companies, we should not have much difficulty in arriving at this." In pursuance of this report, which was directed to Mr. Moon, the conference took place, with what result we shall show in a moment. Before doing so we have something to say concerning Mr. Webb's statements.

Until a very recent period Mr. Webb was the uncompromising advocate of his own brake, and we confess we are puzzled to understand to what his conversion to the vacuum, or any other system, is due. It cannot, we think, be attributed to the failure of the Clark and Webb brake, for its whole career has been one long failure—a circumstance to which Mr. Webb so vigorously shut his eyes that we find him permitting, without protest, statements to be made in the returns to the Board of Trade which are flatly contradicted by the facts, as pointed out by a correspondent not long since. But Mr. Webb's sudden conversion to faith in the vacuum brake is not so amazing as his discovery that the only thing wanted to enable continuous brakes to be generally adopted is a good standard coupling. The public, the Board of Trade, Parliament, each and all, for years and years clamoured against the railway companies, and the companies have always urged in their defence that they could not get a satisfactory brake; that nothing good enough existed; that working interchangeably was impossible if continuous brakes were adopted; and so on. Are we to believe that these excuses had no foundation in fact? that they were intended simply to throw dust in the eyes of the Board of Trade, the public, and shareholders who lost each year in the shape of sums paid for compensation much more than would almost suffice to prevent collisions altogether? Can it be true that nothing more was wanted than a standard coupling? We are in the cleft stick, that if the statements made by railway men were true, then they were unable to invent such a small detail as a standard coupling. Our readers will see for themselves what the other horn of the dilemma is. It cannot be urged that only lately railway engineers have hit upon a good brake. Mr. Webb does not seem to know anything about such a thing. He is not in any way particular as to what brake is used. Anything will do, if only there is a standard coupling. In his own queer phraseology, "Nature itself, in the case of a vacuum, provides a datum from which we may all work." We do not venture to assert that we quite comprehend what this means; but it seems to hint that, as a vacuum may be made by anyone, vacuums are common property, and each company may use them as it likes for stopping trains. It is more than probable, however, that Mr. Webb will find himself mistaken; that some one or other of the various patentees now in the field will, to use a sailor's phrase, bring him up with a round turn if he attempts to make too free with the datum provided by nature. Leaving Mr. Webb, let us see what the conference had to say on the whole subject.

In order to simplify matters, Mr. Webb had five questions printed, and these questions having been discussed (?) were answered. On the question of a standard coupling the members were unanimous, the majority being in favour of the Midland coupling. They were also unanimously in favour of the vacuum system. In reply to the third question, nine were favourable to the simple, and three—Messrs. Adams, Dean, and Wright—to the automatic vacuum brake. In the event of the Board of Trade insisting on an automatic brake, they were unanimously in favour of the vacuum system; and, lastly, on the question of brake power to be used for ordinary brake stops, there was a diversity of opinion, but only one, Mr. Tomlinson, spoke out freely in favour of using the full power on all occasions. We are by no means surprised by the opinions expressed, as each and all the locomotive superintendents present, save Mr. Webb, have long since expressed themselves in favour of the vacuum system; indeed, several of them have invented vacuum brakes. We are at some loss to see what was gained by asking Mr. McDonnell to be present, as, to say nothing of the interference of the Irish Channel, the gauge of all Mr. McDonnell's stock prevents it from running on English railways, and the standard coupling could not affect him. The conference was in a sense packed, no one being asked to be present who was likely to say a word in favour of pressure brakes. Mr. Britain, of the Caledonian, was the only engineer invited and not present. It will be seen that some very important railways were not represented at all. Thus the whole of the gigantic North-Eastern system was conspicuous by its absence. But the Great Northern Company is pretty much in the hands of the North-Eastern, and it is far more important that these two companies should work together than it is that the Great Western and London and North-Western coaches should be able to work over each other's lines. The North British, one of the most powerful railway systems in Scotland, was also left out, obviously because Mr. Drummond is at one with Mr. Harrison on the subject of brakes; and Mr. Stroudley, of the Brighton line, received no invitation for the same reason The Great Eastern is a very large and growing railway; why was not Mr. Massey Bromley asked to be present at the conference? Thus while the engineers of nine great railway companies are in favour of the vacuum system, there are at least four of the same importance as any four of the nine lines represented, opposed to the vacuum system, besides many others of less size, as for example the Metropolitan District line, on which the Westinghouse pressure brake is employed. It will be seen, therefore, that the opinions of the conference by no means represent the opinions of railway engineers in general; and indeed, if we leave out Mr. Webb, whose recent conversion deprives his opinion on the subject of a great deal of weight, the diversity of opinion becomes pretty evenly balanced. The Great Northern and the London and North-Western will gain very little by the use of a standard coupling so long as the North-Eastern, North British, and Great Eastern, stand out for the pressure brake.

It is a noteworthy fact that none of the engineers we have named save Mr. Tomlinson thought it necessary to give any explanation of the causes which induced him to prefer the vacuum to the pressure system. Mr. Tomlinson's reasons are thus expressed:—"Owing to the difficulties in dealing with delicate apparatus and complicated fittings to control high pressures, and to the stock being liable to be laid aside for months, and only ordinary labour available at stations, it would not be safe to depend on, and therefore I prefer the vacuum system, as it can be made either on the simple or automatic system." Now this is a very lucid exposition of the arguments urged against the Westinghouse or pressure system, and it is not too much to say that it is assumption from beginning to end. There is no difficulty whatever in dealing with air pressures of 100 lb. or 120 lb., and no one who has used the automatic pressure brake has ever made any complaint against it on that score. Mr. Tomlinson has had no experience worth mentioning with any brake but the one, namely, Smith's original vacuum, and that has no doubt answered his purpose very well on the Metropolitan Railway; but it has none the less been condemned by all engineers for main line work. The pet argument urged against the Westinghouse brake is the assumed complication of the so-called triple valve; but none of the automatic vacuum brakes can dispense with a triple valve or its equivalent. Three valves, or something answering to them, must be provided if the brake is to be efficient. To prove this our readers need only turn to page 327. They will find the brake favoured by Mr. Adams, illustrated. It will not have escaped notice that Mr. Dean, Mr. Wright, and Mr. Adams are the only three engineers in favour of the automatic system. The others prefer simplicity to efficiency. But the question is not worth discussing, for the Board of Trade insist on automatic action; and if this is to be used, then the vacuum brake becomes as complex as the pressure brake. From this there is no escape. Parts may be made larger or differently arranged, but they must be there. Practically, the engineers present at the conference have pledged themselves to the adoption of an untried invention, or inventions, for there are several automatic brakes in the field. Thus, Mr. Clayton, of the Midland, has one system, Mr. Adams, of the South-Western, another, and Mr. Dean, of the Great Western, a third. Not one of these systems has been practically tested on a large scale. One or two experimental trains have been run, and these have undergone continual change; and yet the engineers at the conference unhesitatingly pledged themselves to spend their shareholders' money on inventions quite untested, in the sense that concerning what they will do in regular service, what they will cost for maintenance, and how or in what way they are likely to fail, literally nothing is known. Concerning the vacuum brake a great deal of information, for the most part adverse, exists; but we are not speaking of the simple brake, but of the automatic vacuum brake; and in favour of some three or more untested—in the practical sense—inventions, the engineers of many great railways deliberately reject a brake about which everything is known that can be known—a brake which is in use on more miles of line than would go round the world; a brake which is as marketable a commodity now as a wheelbarrow—as much part of the railway system of the world as a rail or a chair; and, lastly, a brake which in all the tests to which it has been submitted, either by the Government, by private enterprise, or for the purpose of scientific experiment, has never been beaten as a train stopper. Is it too much to say that the verdict of the conference is not only against evidence, but against the opinion of the majority of railway men; and that in so far pledging themselves to expend the money of shareholders on new and untried inventions, its members have taken a step the importance of which they have failed to realise. Other points present themselves for consideration, on which we shall probably have more to say. Meanwhile we think we in no wise exaggerate when we assert that the calling together of a conference of engineers merely to say whether they think a standard coupling would be a good thing or not, was a means altogether out of proportion to the end secured; while if Mr. Webb's intention was to get support in a scheme for the introduction of a vacuum brake on the London and North-Western system, the device, although well contrived, has not been satisfactory in its operation, because only a limited section of engineering opinion was represented, the greater number of those present knowing about as much practically concerning the daily working in regular service of the Westinghouse brake which they condemned, as they do concerning the automatic vacuum brake which they praised; that is to say, little or nothing.

THE THEORY AND PRACTICE OF RETAINING WALLS.

ENGINEERING science would be in a bad way if in its literature the word theory were to be generally synonymous with or interpreted as hypothesis. Yet the word theory is often so used by engineers, who know on the other hand that they could not stir a step without the theory of their work in the various branches of their profession, though they may be completely successful without any knowledge of any of the hypotheses advanced to account for some phenomena which may occasionally be met with. The word theory in ordinary literature may still be held to be the name given to an assumption made to account for known facts or phenomena, or to a scheme of things which terminates in mere speculation; but in engineering matters it has acquired a very different meaning, and is properly only applied when used as the name of an exposition of the principle or principles on which the practice of any particular branch of engineering depends for its most successful results. That an ounce of practice is worth a pound of theory was never true except by rendering the word theory as hypothesis—a rendering not now, if ever, admissible. Even in so small a matter as the construction of a steam engine very little improvement would ever have been made without theory. Practice might have continued to this day to make steam engines as Smeaton made them, but practice would never have got to the compound engine. So with the construction of a bridge. William Edwards had to construct the Pont-y-tu-Prydd over the Taff twice before he got one to stand; but if that country mason had known the theory of the arch before he commenced the first, he would have known what he had to learn before he constructed the second. Again, if Rennie had not known that theory, he might have had to construct two London Bridges before he got one to stand, simply because practice had not constructed one of the same form and span before him. These remarks are suggested by a paper by Mr. B. Baker, recently read before the Institution of Civil Engineers, and the discussion which took place thereon. The paper was entitled, "The Actual Lateral Pressure of Earthwork," though it would more correctly have been entitled, "The Success and Failure of Retaining Walls," for there was little in it of the actual lateral pressure of earthwork. What this pressure may be we are still uninformed as far as concerns the teaching of Mr. Baker's paper, except that generally it is about half what it is generally assumed to be by reference to the angle of repose of different materials. The paper describes a number of thin revetment walls which have stood firmly, and a number of others, including very thick walls, which have not; but what was the actual pressure of the earthwork which caused the failure of the thick walls the Institution was not told. The author described his paper as upon the actual pressure of earthwork as distinguished from the text-book pressures, but every engineer knows that he can find very little in text-books as to the actual pressure of earthwork. The theory of the stability of retaining walls is given upon certain assumptions as to the pressure they may have to withstand. It is left to the engineer to find out what the actual pressure may be under the circumstances of any given situation. Having discovered accurately what this pressure is, there is no engineer that could say the theory of stability is wrong any more than he could say the theory of the necessary strength to be given to a dock gate is wrong.

The whole gist of Mr. Baker's paper was a proof of the necessity for finding out the nature of the material to be retained by a wall, and the nature of the foundation upon which the wall was to be built, before assigning its proper dimensions, and building it. It gave no evidence whatever of the incorrectness of the theory of retaining walls. It only showed that some of the conditions, instead of all the conditions, were taken into account by certain engineers in applying the theory to the design of the walls that failed. Mr. Baker said his "experience on the thirty-four miles of deep timbered trenches and other works on the Underground Railway furnished many examples of the actual pressure on timber railings, tunnel headings, retaining walls, and vaults. Exceptionally light work standing perfectly, and apparently very heavy works which had failed, alike served to prove that the designing of retaining walls was in most instances more a matter for judgment and experience than for calculation. Thus one of the walls of the Metropolitan Railway, which should have failed with a fluid pressure of 19 lb. per square foot, stood perfectly, whilst another wall, capable of resisting 107 lb., had occasioned much trouble." Other heavy walls which failed were also described, but the author said that "the softening and lubricating action of water on clay was the proximate cause of these failures, as, otherwise, the latter would have resisted a fluid pressure of 92 lb. per square foot." All this, it will be seen, only shows that a thin or a heavy wall is necessary, according to circumstances. Theory does not say that the stability of a wall will be equally great under a light or a heavy pressure, and Mr. Baker's experience only shows that an approximately correct value must be assigned to the pressure before he asks theory what thickness or weight he must give his wall. But even with the pressure properly or accurately determined, the author of a text-book cannot be expected to follow an engineer everywhere to inform him of the nature of the foundation upon which he proposes to build a wall. The author referred to an exceptionally lightly proportioned wharf wall, built by Colonel Michon, at Toul. This wall has a height of 26ft., and a batter of 1 in 20, the thickness of the wall through the counterforts being only 3ft. 7in. at the base, "and though the filling was ordinary material, and the floods rose within 6ft. of the top of the coping, no movement had occurred." Subsequently Mr. Baker said that "as a result of his own experience he had made the thickness of retaining walls, in ground of average character, equal to one-third of the height from the top of the footings, and if any material was taken out to form a panel, three-fourths of it was put back in the form of a pier." After what had been previously said as to the success of some thin walls, as of that at Toul, this thickness seems to be wholly unnecessary in some if not in many cases, while it would be as certainly insufficient in others. Theory would say that if the conditions are the same as at Toul, the same thickness as that adopted by Col. Michon would be sufficient; but it would seem that Mr. Baker would make everybody pay for a wall with a thickness one-third its height because these dimensions were successfully used on the Metropolitan District Railway, in many places on which that thickness may have been unnecessary. Yet the author said: "To assume upon theoretical ground a lateral thrust, which experiments prove to be excessive, and to compensate for this by giving no factor of safety to the wall, was not a scientific mode of procedure." Mr. Baker's paper was a very excellent paper, and gave a great many facts of the utmost value, but the tendency of the arguments as to the theory of retaining walls was most decidedly pernicious. In the sentence last quoted, the word theoretical was obviously incorrectly used in place of hypothetical, and when theory is held up to ridicule it should only be with sufficient reason, for to throw doubt on its value is misleading, and has a bad effect on young engineers, who do not see that the so-called incorrect theory is only hypothesis. There is always a tendency with the half-informed part of any profession to appreciate anything that deprecates the attainment of theoretical knowledge, and this was evident by the titter observable in the Institution when Mr. Baker observed that he had set up an example of the theoretical stability of a retaining wall merely to knock it down by practical illustration. It must be here observed that this example depended upon certain assumptions as to the lateral pressure, and hence was not correct for any much greater pressure. The example given by Mr. Baker, and the whole of the results of practical experience detailed by him, only served to show that the theoretical stability of any revetment wall depended entirely upon the assumed lateral pressure, and that the proper application of theory could only be made by taking into consideration all the conditions affecting that stability. It further showed that without an intelligent application of theory a great waste of material and a loss of money may follow the design and construction of a retaining wall, just as it may follow the unintelligent application of theory or the blind dictates of misdirected practical experience in any other work of art.

NORTHERN TRADE EXTENSION.

It has not obtained sufficient notice in the press that, whilst two years ago the North of England suffered perhaps more severely than any other of the great producing districts of the country, the loss then accruing has been now almost recouped, and, in consequence, the trading activity of the north is greater than probably at any previous period. It is not in one branch, but in nearly all that this is the case. In the crude iron trade, which is one of the chief industries of the north, the production is at the highest pitch that has yet been attained, and this bespeaks a corresponding activity in iron and coal mining, and in limestone quarrying. In the manufactured iron trade the output is proved by the returns of the Board of Arbitration to be about 7000 tons less per month than it was about seven years ago—the falling off being due to the declension of the iron rail branch. But if the production in the substitutional industry—that of steel rails—be added to that of manufactured iron, it will be found that the output is now greater in the North of England than in any previous period. In marine engineering the output last year was greater than in any of its predecessors, and large and costly extensions of marine engineering works are in progress at Stockton-on-Tees, at Hartlepool, and on the Tyne. In no previous period has the number or the tonnage of the vessels launched been so large as last year from the shipbuilding yards between the Tyne and Whitby; and there are grounds for the belief that the numbers and the tonnage will be for the present year still larger—a fact which bespeaks a correspondingly increased activity on the part of many subsidiary industries, such as chain and cable making, and the manufacture of donkey engines and steam winches. All these facts have their effect on the state of the industries of the north, and it is thus that it is found that one by one the whole of the works that were laid idle during the period of depression have been or are being re-opened. Over 25 per cent. more of the blast furnaces in the North of England are now at work than there were two years ago, and with two exceptions, every one of the then closed rolling mills has been put into work, though it is true that in a few instances it has been needful to change rail to plate mills. It is also true that this very great increase of production is at a comparatively speaking low value, and that this low value must tend to reduce the profits. But it is when prices are low, but remunerative, that the industries benefit most, for the trade that is done is a solid one, and one that gives greater promise of permanence. In the one instance of pig iron, it is true that the profit at the best must be exceedingly small at the market prices; but it needs to be borne in mind that the average receipts of the producer are increased by the fact that there is a considerable percentage of higher-priced iron now made in the North. It may be considered that the Cleveland and Durham district has been enfranchised from the too-great dependence that it had on the iron rail trade. Its dependence is now in a degree on the steel trade and on the shipbuilding industries, and though the latter is on the lines of iron vessels, it must be considered that for the present it is one that is soundly based. In the future there may be a revolution in the metal used for shipbuilding, but if steel should take the place of iron, there are indications that it will not be soon, and before the time comes, the North will be prepared for production. The two chief firms in the iron trade have now the question of the steel-plate industry fully before them, and it may be that an early decision to enter into it will be made known.

THE NEW FRENCH TARIFF.

France and Spain are alike unkind to the manufacturers of England. Taking one description of goods alone—those produced in Sheffield—the new commercial proposals of France will have the effect of immensely increasing the duties paid by the cutlery firms of Hallamshire. Under the present French tariff all Sheffield goods, with the exception of cutlery, pay specific duties, and the French Government propose to do away with this exception. The Sheffield Chamber of Commerce do not object to the present *ad valorem* duty on cutlery being converted into a specific duty, if the equivalent of the present rate of 15 per cent. were imposed. But the French Government propose to charge duties varying from 125f. to 600f. per 100 kilos., which would be a very serious increase. Common table-knives sold in Sheffield and in French towns at 2s. 2d. per dozen will be liable to a charge of 100 per cent. The value per kilo. of common pocket-knives usually sent to France is about 5s., the present duty of 15 per cent. representing 9d., but the new duty of 375f. per 100 kilos. would represent 3s., or more than 50 per cent. In Spain, the policy is one of retaliation. Spain resents the budget proposal to tax alcoholic strength in wines—resents it on the logical ground that Spanish wines contain more alcohol than those of France and Germany, and, therefore, as England practically professes to increase the taxation on Spanish wines, Spain retaliates by piling up the duties on English cutlery. At least this is the prayer of the petitions presented by Spanish people to their Government. This is all very comfortable to the French and Germans, who do not drink the heavy wines of Spain, and can afford to give Alfonso's subjects as favourable a tariff as they please. And while the Spaniard waxes wroth at John Bull, France and Germany are quietly "taking" the trade in the secondary kinds of cutlery and hardware for which Spain is in the habit of calling.

THE LOSS OF THE DOTEREL.

The cruiser Doterel was destroyed by an explosion of some kind on the 26th ult. at Sandy Point, Straits of Magellan, at ten a.m., and it is probable that eight officers and 133 men have lost their lives. There are but twelve survivors, who are on their way home. The cause of the explosion is unknown. There are three theories in circulation. The first is that a boiler exploded and caused the explosion of the magazine; the second is that a torpedo on board her exploded in the magazine; and the third is that she was sunk by a Chilian or Peruvian torpedo put down during the war. As to the first, inasmuch as the three boilers of the ship were new, it involves so grave a charge against her engineers that we refuse to credit it; concerning the second we know nothing; concerning the third, it is very difficult to see what object Chilians or Peruvians could have in going all the way to Sandy Point, in the Straits of Magellan, to lay torpedoes, and we reject that theory. In about a month, when the survivors reach this country, all will be known that can be known about a very deplorable event, and until then it cannot be dealt with to advantage.

LITERATURE.

Lighthouse Construction and Illumination. By Thomas Stevenson, F.R.S.E., M.I.C.E. London: E. and F. N. Spon. 1881.

Notice sur les Phares, Fanaux Bouées et Signaux Sonores. Par L. Sautter, Ingenieur Civil. Paris: A. Chaix et Cie., and MM. Sautter, Lemonnier, et Cie. 1880.

Although the literature of the subjects treated in the two books whose titles are given above is far from limited in quantity or quality, there was room for both. With the exception of the fine work entitled "Memoire sur l'Eclairage et le Balisage des Cotes de France," by M. Leonce Reynaud, who died last year, after having many years held the position of director of the lighthouses of France, most books treated only of one or a few lighthouses, or of parts of the subject of lighthouse illumination. Smeaton's admirably complete account of the Eddystone Lighthouse only dealt with the several structures built on the Eddystone, while Mr. Robert Stevenson's elaborate description of the Bell Rock Lighthouse referred to few other similar structures, though the optics of lighthouse illumination was very fully considered. The same may be said of Allan Stevensons' account of the Skerryvore lighthouse. Most of the several other writers have confined themselves to one subject, the theory of the design and construction of the several forms of lenses having received most attention.

Mr. Thos. Stevenson has aimed at the production of a complete treatise on the whole subject indicated by the title of his book, while M. Sautter disclaims all intention of treating the strictly theoretical questions, or the history belonging to his subject, as he considers that these have been dealt with by M. Reynaud in the work already referred to, and by M. E. Allard in his "Memore sur l'Intensitie et la Portée de Phares Lenticulaires," in so complete a manner as to leave no room for additions, except as to the improvements which have been made in recent years, especially as respects the employment of electricity as the light source. In fact, a very considerable portion of M. Sautter's work as far as it deals with the distribution of lighthouses on a coast, their dimensions and distinctive characters, their visibility, forms of lenses, and construction of lamps and lanterns, consists of quotations from the two authors named, and principally from M. Reynaud's book. Both Mr. Stevenson and M. Sautter have been many years engaged in lighthouse construction, and their books are thus almost necessarily chiefly illustrative, or most strongly coloured by their own special experiences. With the exception of the matter which refers to electric illumination, there is little that is new in the first portions of M. Sautter's work; but the appendix, which forms half the volume, contains a great deal of information, which must be of great value to all interested in lighthouses, buoys, and beacons. It deals with the practice of the world-famed firm of Sautter, Lemonnier, and Co., whose works are described, and besides giving specifications for the whole of the apparatus for a lighthouse, and the rules and regulations for lighthouse management as observed in France, it gives a large number of lithographic illustrations of lamps, lenses, lanterns, and buoys, with full particulars of dimensions and other features, accompanied by the cost of all the different forms and orders of apparatus. These, however, not only include the whole of the apparatus for lighthouses, but the lighthouses themselves, including the central tube form of structure and the wrought iron plate towers, such as that designed by M. Reynaud, which was exhibited in the Paris Exhibition of 1867, and afterwards erected on the Douvres rock. From a list of the lighthouses and apparatus, the latter term including the large lense structures and lamps, lanterns, and machinery for intermittent and flashing lights, &c., which accompanies the book, it may be gathered that MM. Sautter and Lemonnier have made a large proportion of all the optical apparatus of the lighthouses of the world. From what we have said, it must not be inferred that M. Sautter's book is an elaborate catalogue of the manufactures of the firm with which he is associated, for though it comprises this, it contains that which makes it a necessary addition to the library of every engineering institution and lighthouse engineer.

Inasmuch as it would be impossible in the space at our disposal to follow Mr. Stevenson through all the questions treated in his book, we cannot do better than quote the titles of his chapters. Chapter I. is on lighthouse construction; Chapter II., lighthouse illumination adapted to the illumination of every azimuth, or of certain azimuths only, by light of equal power acting either constantly or periodically; Chapter III., azimuthal condensing system for distributing the light unequally in different directions either constantly or periodically; Chapter IV., distinctive characters of lights; Chapter V., the illumination of beacons and buoys; Chapter VI., the electric light; Chapter VII., statistics of lighthouse apparatus; VIII., sources of illumination; IX., miscellaneous subjects connected with lighthouses; and X., fog signals. An appendix contains mathematical formulæ, description of plates, and a complete index.

In the first chapter the subject is illustrated by the Eddystone lighthouses of Winstanley, Rudyerd and Smeaton, and by a number of those constructed by Mr. Robert Stevenson, or by Mr. David A. Stevenson, and the author. As engineers to the Commissioners of Northern Lights for many years, Mr. Stevenson finds in the works of himself, brother, and father, a sufficient number of illustrations of lighthouse construction to make it, he apparently considers, unnecessary to describe the works of other modern engineers, but it may be here noted that the "Proceedings" of the Institution of Civil Engineers contain a number of examples of lighthouse engineering which cannot be overlooked in a study of this branch of engineering. Iron lighthouses are very briefly treated by Mr. Stevenson, and though he gives an illustration of the fine tower above alluded to, he does not give any particulars of it, or even say where or by whom it was designed or built. Apart from the construction of lighthouse towers, however, this chapter contains a very valuable description of the experiments made to determine the force of the stroke of the sea against sea walls, or other similar structures exposed to the fury of ocean waves. From these it appears that the greatest pressure registered by the spring dynamometer was equal to 3013 lb. per square foot on the exposed face of the Bell Rock in the German Ocean. At Dunbar, experiments gave at high water level as much as 3½ tons per square foot on the sea wall, while at a much higher level, where the horizontal pressure was only 28 lb., the vertical pressure capable of acting against a projecting coping once reached a ton per square foot. The various systems of lenses and the modes of their illumination are fully described in the second chapter; the formulæ for calculating the angles of the prisms as developed by Fresnel, Swan, Tait, and others is given in the appeudix. Full credit is given to most of those who have played an important part in the development of the several orders of lenses, and the application of the science of optics generally to lighthouse illumination; but the important services of Teulére, who was really the inventor of the catoptric system as applied by Borda in the Tour de Corduan, receive but scanty notice. Amongst other points dealt with in the chapter on the distinctive characteristics of lights, the author refers to colour blindness, and the suggestions that have been made for the use of a sort of Morse system of rapid dot and dash signalling to supersede the use of coloured light, as proposed first by Babbage and lately by Sir W. Thompson. This would convert the whole of the lights into a set of blinking signals, only because the Board of Trade examinations for colour blindness have showed that 0·4 of 1 per cent. of masters and mates have proved more or less colour blind. The origin of the proposal seems to have been based on the idea that most wrecks at night have been caused by mistaking one light for another; but such has not been the case, the real cause being the non-visibilities or want of penetrating power of the lights. With so small a percentage of colour blindness, and remembering that the recognition of the real colour of a light would hardly ever depend on the eyes of one man of a crew, there seems every reason to agree with Mr. Stevenson that it would be a great mistake to change a system of readily recognisable differences for one that would be difficult to remember, and which would require appeal to a watch to ensure certainty of identity. In speaking of illumination by means of gas, Mr. Stevenson speaks in high terms of the system as applied by Mr. Pintsch, and he suggests the application to the buoys or light ships illuminated under this system, of a form of meter operated by the flow of gas in such a way as to produce distinguishing lights. This he has tried, and apparently with success, and it is clear that an intermittent light, variable through a considerable range of intensity, could be produced in this way without necessarily involving disadvantageous complication. Respecting the electric light, Mr. Stevenson still thinks that there is some truth in the objection made to it on the ground of inferior penetrating or carrying powers, an oil light of equal intensity at the lamp being visible, or giving greater light at long distances. In the course of the discussions last year at the Institution of Civil Engineers, the relative values of these lights were warmly contested; and the evidence seemed to be nearly equally convincing on both sides, but it was, perhaps, a little the stronger on the side of the electric light. We cannot dwell further on Mr. Stevenson's book; but, in conclusion, can confidently recommend it to every one interested in its subject. It is the most complete general treatise published in English, and the publishers' work is well done.

THE INSTITUTION OF CIVIL ENGINEERS.

ON THE RELATIVE VALUE OF TIDAL AND UPLAND WATERS IN MAINTAINING RIVERS, ESTUARIES, AND HARBOURS.

AT the Meeting on Tuesday, the 26th of April, Mr. Abernethy, F.R.S.E., President, in the chair, the paper read was by Mr. Walter R. Browne, M.A., M. Inst. C.E.

The two natural agencies which tended to keep clear the channels of tidal rivers and estuaries were— the tidal flow, *i.e.*, the run of the tide passing up and down such channels twice in about every twenty-four hours; and the low-water flow, *i.e.*, the current of water passing through such channels between the end of each ebb tide and the beginning of next flood. It was proposed to investigate the relative value of these two agencies in preserving the depth and section of such channels. The author, while declining to lay down any universal rule, held as a general principle that the main scouring agent was not the tidal but the low-water flow. This principle could be supported by the following line of argument:—(1) The silt, which tended to choke up tidal channels, was almost wholly due to the tidal water, and not to the fresh water. (2) The tidal water brought up more silt on the flow than it took down on the ebb; *i.e.*, on the whole it tended to choke the channel, not to scour it. (3) The low-water flow, if left to itself, scoured away the deposit and kept the channel open. (4) Hence it was concluded that where the two acted together, the scour must be due mainly, if not entirely, to the low-water flow, and not to the tidal flow.

(1) Rivers below the tidal area were much larger and much more muddy than above, the mud being derived from the beating of waves upon the foreshore. (2) The banks of a river, between high and low water, were thickly covered with silt, and any single tide left a film of silt over the whole slope down to low water. This silting up was only checked by the mud on these slopes slipping down into the low-water channel; and the deposit was always less in winter than in summer. When low-water flow was absent, the channel silted up, as was shown by half-tide basins, and by special instances. (3) All rivers scoured out their own channels, and the low-water flow, even in tidal waters, kept the bottom perfectly clean, as had been proved in the case of the Avon. Low-water scour was in its nature self-regulating, whilst tidal scour, if it once began, would tend to increase indefinitely. The essential point was to discover the ratio of the bottom to the surface velocity under all possible circumstances, since it was obvious that the former alone had any scouring effect. A table was given, prepared from Grave's experiments on the Oder, which showed that between the depths of 2 and 3 metres the ratio of bottom to surface velocity diminished from 0·67 to 0·55, or by about 18 per cent. It would thus appear that the ratio diminished rapidly with an increase of depth. This conclusion was supported by the experiments of Mr. Révy, of General Ellis, on the Connecticut River, and of the Dutch Government, on the Lower Rhine. These observations were all made in ordinary fresh-water rivers; their application to tidal channels was doubtful, because then the river instead of being (in a theoretical point of view) indefinitely long, fell at a short distance into an estuary whose waters might be considered at rest. Hence the river waters must expend some energy in displacing the waters of the estuary, and this would check their velocity higher up and near the bottom, and might destroy the velocity altogether. By the assistance of Mr. T. Howard, M. Inst. C.E., and of Mr. H. S. Hele Shaw, Assoc. M. Inst. C.E., the author was able to conduct two series of experiments on the surface and bottom velocities of the river Avon, in the course of an ebb-tide. Both series of experiments showed that during the greater part of the ebb the bottom velocity was actually nil. When about two-thirds of the ebb was over, the bottom layers of water appeared to start into activity, and to assume a velocity about two-thirds of that at the surface.

The following conclusions were drawn from these and other experiments:—In the largest rivers the bottom velocity was for practical purposes the same as the surface velocity. In ordinary rivers the bottom velocity bore to the surface velocity a ratio which was about three-fourths at 5ft. deep, one-half at 15ft., and one-third at 25ft. In tidal channels, such as the Avon, during two-thirds of the ebb, the slope of the surface was exceedingly small; and while the surface velocity was large, the bottom velocity was nil. During this period no scour, but rather deposit, was going on. For the remainder of the ebb the conditions approximated to those of an ordinary river; scour did go on, but its amount was insufficient to sweep away the silt which had been deposited, not only at the top of the tide, but also during two-thirds of the ebb. At the same time there were certain circumstances in which the tidal waters might have a distinct scouring effect; viz., if they were so far kept back (either artificially or by soaking into wide mud flats), that a portion of them remained to increase the velocity of the low-water flow.

Opinions were quoted to show that while the author's views were opposed to those of many engineers, they were supported by others, and by numerous facts adduced in evidence before the Tidal Harbours Commissioners, and elsewhere. With regard to the practical application of these principles, it was suggested that, whether a given diminution should be made in the tidal area of any river, would be as follows:—The low-water discharge at some point below the proposed embankment should be carefully measured, and the total discharge of the inlet or fresh waters should be measured at their entrances into the tidal area. The difference between the two would show the extent to which the low-water flow was increased by tidal waters. The effect of the proposed operations might then be judged of, by ascertaining how far they would reduce, not the cubic content of water passing up and down on each tide, but the area of mud, which was submerged by the tide, and hence contributed on the low-water flow. Embankments had frequently proved beneficial rather than the reverse; a fact explained by the author's experiments, since the level of the ebb-tide would in consequence fall more rapidly, and the point at which the water at the bottom began to move would be reached at an earlier period. Another application of the principle was to the process called "dockising," a process which had frequently been condemned on account of supposed injury to the river itself, or even to the estuary in which it flowed, but, as would appear from this paper, without foundation.

THE INSTITUTION CONVERSAZIONE.—Mr. Abernethy, as president, and Mrs. Abernethy will give a conversazione in the South Kensington Museum, under official sanction, on Friday, the 3rd June, being the fifty-third anniversary of the date of the incorporation of the society. The sixty-fourth session will terminate on Tuesday, the 31st inst. All applications for admission to be dealt with prior to the recess should at once be lodged with the secretary.

STEAM ENGINE TESTS.

By F. F. HEMENWAY.

THE following article from the *American Machinist* may be read with advantage by those who have taken an interest in Mr. Longridge's report on a compound engine at Messrs. Nuttal's Oak Mills.

Various circumstances have led me to inquire whether "Steam Engine Tests," as usually carried on, are of much scientific or practical value. The writer has always been inclined to question their utility in settling the relative economy of different engines, and this feeling of distrust has been intensified in witnessing a series of tests of two large engines, presumably exact duplicates. In these tests the coal was selected, and the furnaces all charged by one man, and he an expert fireman; while the engines were under the charge of those perfectly familiar with every detail of their construction and management. The same boilers were used for all tests, and equal steam pressure and load maintained, and there were no atmospheric or other changes noted that would be liable to affect the results. Under these circumstances the results that did obtain possess some features of interest on the subject of steam engine tests.

For instance, the mean of all tests from each engine showed a difference in economy, as between the two, of less than 1½ per cent.; but the difference between the best performance of one engine and the poorest performance of the other, for a single test was 11½ per cent. Again, the least difference between two tests of the same engine was 5 per cent., and the greatest corresponding difference was more than 12 per cent. The mean difference of all tests from both engines was 5 per cent. An inference to be drawn from this is, that while the performance of these engines for considerable periods was practically identical, they could not be run for eight or ten hours at a less average variation than 5 per cent., or at a maximum variation of 12 per cent.; and that there could be no adequate reason assigned for this variation. Any single test of either engine might, for al observations to the contrary, have been taken as conclusive, in which event there would have been a probable variation of 5 per cent., or a possible variation of 11½ per cent. A variation of 5 per cent. would naturally lead to an examination for some defect; but a variation of 11½ per cent. would have been almost proof positive of something seriously wrong. Had these engines been operated at different steam pressures, or at different cut-offs, an easy solution would have been at hand, with an excellent showing for superheating, or a steam jacket. But had they been from different builders, or of different types, compound or simple, high speed or low spead, Mr. A. or Mr. B. would have gained notoriety cheaply and unjustly. It should be stated that these tests were not made by a novice, but an engineer of extended practice in making such tests, assisted by four educated engineers, and that their system of observations was such as to present two complete logs, even to the minutest detail. What would have been the results with different experts, and different management of engine and boilers for each test, can only be conjectured.

Some years since several tests of steam engines were made at the fair of the American Institute, and, in some instances, results obtained which the best engineers of to-day do not even try to equal, viz., the accounting for 91 per cent. of feed-water in dry steam at exhaust opening, in an unjacketted cylinder, at a cut-off at less than a quarter-stroke piston speed of 425ft. per minute, and steam noted as being "wet." Now, if this result cannot be reached in the best practice, such a test can hardly be considered of much scientific value, and it is quite as difficult to see in it any practical value. The prospective purchaser of a steam engine is not, usually, particularly interested in an experiment, the chief end of which is the determination of the relative efficiency of different bureaus of experts. He will hardly be willing to pay them 50 dols. a day as practical engineers. Neither does he care much about the quantity of coal that would have been burned in a certain number of hours, if the boiler had evaporated—pounds of water with—pounds of coal, and if the water was correctly measured. What he wants to know is, how much his power will cost him, or so far as coal is concerned, how much he will have to pay for per month or per year, with reasonably careful management; and this is what he don't find out in six or eight hours. The test of an engine, to be of much value, should be not less than one week in duration, and should be made under ordinary running conditions, and calculated from the coal burned. I am aware this is not orthodox—saddling the boiler performance to that of the engine, and *vice versâ*; but I believe that in tests of two engines from the same boiler, the coal burned is a better standard by which to measure their relative economy than is the water supplied. In all boilers of ordinary construction a considerable per cent. of the water supplied is entrained with the steam, and there has been no way devised, or at least none made public, to which one would be justified in pinning a great amount of faith, for determining the quality of steam as ordinarily drawn from a boiler.

The water thus entrained is a fluctuating quantity, varying with every change in the conditions under which the boiler is operated, and particularly with the manner in which the steam is taken from the boiler. Of two engines using steam from the same boiler and doing equal work, the one may take, along with an equal quantity of steam, twice as much water as the other. If we had means for determining accurately the quantity of water in, or with, the steam, we do not know with any certainty the effect of its presence on the economical performance of the engines. Some of the tests at the fair of the American Institute previously referred to, throw some light—or darkness—on the water test. For instance, of two engines of equal dimensions and operated at the same piston speed and with steam from the same boiler, the one with its cylinder steam jacketted accounted for but 79 per cent. of the feed water, while the one with an unjacketted cylinder accounted for 91 per cent., and the committee were of the opinion that this difference of 12 per cent. represented the difference in the amount of water entrained in the two instances. Had the results been reversed, is it not considerably more than probable that it would have been claimed as a triumph for the steam jacket? As the boiler used had a grate surface of 45 square feet, it does not seem probable that heavy firing had much to do with the result; nor is it easier to believe that the "manner of firing or opening the fire doors" was accountable for it. However this may be, the pertinent fact is that if 12 per cent. more of the feed water was carried off un-evaporated in the one instance than in the other, the water test did not amount to much, and the coal actually burned would have been a better standard of comparison. If no more than eight hours can be devoted to the test of a steam engine, more accurate knowledge can be gained by supplementing the indicator diagrams with a careful examination of the parts of the engine as a machine, and particularly the valves and piston under steam at every position in the stroke. While I am not rash enough to claim infallibility for the indicator, or that it can properly supersede extended tests, I do believe that a perfect instrument—and some brains—can determine the cylinder efficiency of a steam engine so closely, as to leave little for improvement, and that calculations based on its indications and a careful examination are by far more reliable than any other test of six or eight hours duration.

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

(*From our own Correspondent.*)

MERCHANT bars were to be had in Wolverhampton yesterday, and in Birmingham to-day—Thursday—at £5 12s. 6d.; while better bars were £6 to £5 15s. Marked bars remained at £7 to £7 12s. 6d. There was a somewhat better business than for some time past doing in unmarked bars of the different qualities. Bridge and girder plates were £8 to £7. Angles were to be had at from 5s. to 15s. per ton in advance of merchant bars of corresponding quality. Boiler plates, variously quoted at £9, £8 10s., and £8, received but little attention.

Baling strip was £6 5s. up to £6 10s. There have been some encouraging sales recently. Sheets are going fairly well ungalvanised to India. Galvanised sheets were no firmer upon the week. Telegraph advices show a decline in the Australian markets to the extent of 15s. per ton in some of the high-class sorts.

Pig iron is difficult of sale at £3 2s. 6d. Hematites are quoted at from £3 7s. 6d. to £3 10s.; Derbyshire pigs were quoted £2 5s., and Northampton and Lincolnshire from that figure down to £2 2s. 6d.

Furnace coal was a shade easier to buy, at from 8s. down to 7s.; and forge and mill coal at from 7s. down to 6s. per ton.

The Horsley Engineering Company, of Tipton, informs me that, amongst recent contracts entered into are three for railway constructive work, which will consume between them 6000 and 7000 tons of iron. One contract is in connection with the widening of the railway from the Victoria Station, Manchester, and the extension of the station itself. In this job the largest of the main box plate girders has a clear span of 180ft., and will weigh close upon 200 tons; there are other girders of 160ft. and 140ft. span. It is worthy of note that the holes in the top and bottom flanges of these girders are to be all drilled work. The second contract includes some eight or ten wrought iron bridges with ironwork palisading, and having spans of 50ft. each. These are for erection at Southampton in connection with the work now being prosecuted there by the South Western Railway Company. The third contract includes the girders and columns and general warehouse ironwork for the work at the Liverpool Docks, which the London and North-Western Railway Company have in hand. The Horsley Company has supplied the iron cylinders which have been used in testing the foundations of the late Tay Bridge.

The business of the Atlas Engine Company, Oozells-street, Birmingham, has been bought by Messrs. Thos. Piggott and Co. Before the Atlas Company took it, it had been carried on by Messrs. Duvallon and Lloyd.

The Wolverhampton Town Council propose to spend £8150 in increasing the water supply for the borough. Twelve applications were issued for tenders to supply the engine, and five tenders were received. That of the Lilleshall Engineering Company has been accepted provisionally.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is but little material change and certainly no improvement that I can report in the condition of the iron trade of this district. Consumers are in want of very little iron, and buyers who might otherwise come into the market seem to be so thoroughly convinced that prices must be lower that they evince no disposition whatever for business except on terms which sellers can scarcely be expected to accept. Prices continue to tend downwards, with apparently very little prospect of any early recovery in the market except with a considerably diminished output, and this fact would seem to be forcing itself upon makers in the Lincolnshire district where a number of furnaces are already being damped down. Any present fluctuations of the market, however, are almost entirely disregarded by buyers, and even offers for long forward delivery at very low figures lead to no business of importance.

Lancashire makers of pig iron, although they are doing nothing like their usual amount of business, have been able during the past week to secure a few tolerably good orders at prices averaging about 44s. for forge, and 45s. for foundry, less 2½ per cent. delivered equal to Manchester, and as they are still making tolerably fair deliveries on account of old contracts, they are not quite such anxious sellers as many of the makers from outside districts. For outside brands offering in this market, quotations nominally are without change, and for Lincolnshire and Derbyshire irons, delivered equal to Manchester, some makers are still asking from 45s. to 46s. per ton, less 2½, but there are needy holders in the market who are willing to sell at 2s. to 3s. per ton below these figures. For Middlesbrough g.m.b.'s, delivered equal to Manchester, about 46s. 4d. per ton, net cash, is still quoted.

In the finished iron trade prices are not quite so weak as for pig iron. Several of the principal local makers are still tolerably busy on old orders, and are moderately firm in their prices. New orders, however, are coming in very slowly, and for good specifications there are sellers at very low figures. Bars delivered into the Manchester district are to be bought at from £5 12s. 6d. to £5 15s. per ton, hoops at £6 5s. to £6 10s., common sheets at £7 10s. to £7 15s. with doubles about 30s. per ton extra.

Engineers and machinists, as a rule, are very quiet, with but little new work coming in. A few firms who have specialities in hand are, however, tolerably busy, and with regard to cotton machinists, I may mention that the exceptionally dirty condition in which this season's crop of cotton is coming into the hands of spinners is throwing a good deal of business into the hands of makers of special descriptions of scutching machines suitable for dealing with this class of cotton. The present keen competition in the cotton trade also necessitates a close attention to all improved methods of working, and this helps to give an impetus to the demand for new special machinery. This, however, simply means replacing old machinery with new, and there are extremely few local inquiries in the market for fitting new mills, any orders in this direction being almost entirely from abroad.

Less activity is noticeable generally throughout the coal trade of this district, and large numbers of the pits are not now being kept on full time. For the better classes of round coal especially there is a lessening demand, and prices are gradually easing downwards, reductions of from 3d. to 6d. per ton having in many cases been made this month. Common round coals continue in very poor demand both for iron making and steam purposes, and prices are extremely low. Engine classes of fuel, however, show a tendency to stiffen, and advances of from 3d. to 6d. per ton are announced this month at some of the collieries. The average prices at the pit mouth are about 8s. 6d. to 9s. for best coals; 6s. 9d. to 7s. 6d. for seconds; 5s. to 5s. 9d. for common coal; 4s. 6d. to 5s. 3d. for good burgy; 4s. to 4s. 9d. for good slack; with inferior sorts offering at about 6d. to 1s. per ton under these figures.

It has been decided to dissolve the Manchester Scientific and Mechanical Society, a resolution to this effect which was passed some time back at a special meeting having been confirmed at the last general meeting of the members. A committee has been appointed to wind up the affairs of this society, and at the same time to ascertain whether arrangements can be made for amalgamating with some kindred institution in the district.

A scheme is now being set on foot by the Building Trades' Associations of the country to provide an insurance fund out of which to meet claims for compensation which may arise under the operation of the Employers' Liability Act; and although this is a matter which in itself is somewhat foreign to my usual "notes" it will be of interest—as a similar scheme is at present under consideration amongst employers in the iron trades—to give the basis upon which the master builders propose to fix the premiums for insurance. Of course, the risks run in the building trade are much heavier than in the various branches of iron industry, shipbuilding, perhaps, excepted, and the following are the terms on which it is proposed to form a building trades insurance fund:—Where the amount of wages paid per week is £12 10s., or under, the annual premium for insurance is to be £2 10s.; not exceeding £25 per week, £4 15s.; not exceeding £37 10s. per week, £7 10s.; not exceeding £50 per week, £8 9s.; and £4 4s. 6d. per annum extra for every additional £25 or part of £25 paid in wages per week. These premiums have been worked out from returns similar to those which have recently been collected throughout the iron trades, but for the present they have fixed at a somewhat high rate, which it is expected will eventually be lowered.

It will be in the recollection of your readers how the proposal to form a mutual insurance fund in lieu of the Employers' Liability Act led to the disastrous strike in the Lancashire coal trade. The Lancashire and Cheshire Permanent Relief Society was to have been the medium for this joint insurance, and it will be interesting to note the benefits which the miners receive from this source. The eighth annual meeting of the society was held on Saturday at Wigan, and the accounts presented showed that during the year, £850 had been paid for funeral allowance, £3949 for medical aid, £11,171 on account of disablement of members, and £5753 to widows and children of deceased members. The society is being carried on upon the old basis prior to the passing of the Employers' Liability Act, but if the proposal for substituting the society entirely for the Act had been carried out, the benefits to members for disablement would have been considerably increased in consequence of the augmented subscriptions promised by the masters. There is, however, a strong hope that the proposal which the men rejected will ultimately be carried into effect.

Barrow.—Since my report of last week there has been no material change of any moment in the hematite pig iron trade. The low prices which now rule the market are the means of keeping makers in the background, as they decline, in most cases, to contract orders at present quotations. I am informed that there is need for working with the greatest economy to get a profit. The quantity of metal which has been shipped so far has been very small, considering that the shipping season has been open for some time, and stocks in consequence have largely accumulated. The shipping now is a little brisker, and stocks are diminishing as deliveries are made to America and the Continent. Present prices for pig iron at makers' works is from 56s. to 60s. per ton. The demand for steel is good; but as low prices rule in this department makers are not anxious to do much new business, being well sold forward. Iron ore is in good request, at late rates. Shipbuilders, engineers, &c., busy. Coal and coke in fair consumption.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

One of our leading companies has orders for steel rails on its books sufficient to keep its mills going for six months. About 20,000 tons of steel rails have been ordered from this company during the fortnight ending last Saturday. I am in a position to state that none of these orders have been accepted at a loss, though the profit is unquestionably small.

Hematite billets have this week been offered at the works as low as £6 10s., with 7s. 6d. addition if carriage is required to any Yorkshire port. This quotation, which is a reduction of 2s. 6d. per ton on the fortnight, is for billets of guaranteed temper, of a quality which at the close of last year realised £9 per ton.

In the iron trade there is still less pleasant news to record. At Elsecar Ironworks—Mr. George Dawes—the two furnaces which remained in blast have been damped down.

The Change-lane Colliery dispute has at last been settled, the majority of the hands agreeing to resume work at the owners' terms. At the Rockley Colliery the 7½ per cent. given to the miners while trade was brisk, owing to the Lancashire strike, has been given back.

About 1200 tons of steel-faced armour have been added to the orders in hand at the Atlas and Cyclops Works. They are for H.M.S. Colossus and Majestic.

In cutlery the American market is very brisk.

The Australian market is somewhat depressed, orders which were last year obtainable in January and February not yet having reached Sheffield so far this season.

The returns of Sheffield trading with America during the month of April do not quite bear out the sanguine expectations formed from the figures given for the quarter ending March.

As I close this letter I hear of the death at Sheffield of Mr. George Walker, who was a noted man at Sheffield in his day. He was the first to introduce the electro-plating trade into Sheffield, and on the premises of Messrs. Walker and Hall, Electro Works, Howard-street—where Mr. J. E. Bingham and Mr. C. H. Bingham conduct the business under the old name—is displayed a portrait of Mr. Walker, in which he is represented standing beside his apparatus, with the two first spoons ever electro-plated in Sheffield displayed in a jar, which serves the purpose of a miniature vat.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

Middlesbrough iron market was on Tuesday rather thinly attended, and in tone was far from satisfactory. Several of the leading ironmasters were absent, having taken their departure for London to attend the spring meeting of the Iron and Steel Institute. This may account for the poor attendance. Prices remained much the same as the previous week, quotations for No. 3 g.m.b. being 38s. buyers, and 38s. 3d. sellers, f.o.t. Middlesbrough. Sales were effected at the former figure. Warrants were offered at 39s., and forge iron at 37s. 3d. The shipments for April have now been published, and are found to amount to 78,894 tons, against about 81,000 tons for the previous month. This total is not considered at all satisfactory for the time of year. It must be borne in mind, however, that the shipments of the last few days of the month were considerably in excess of those at the beginning, a fact which indicates a tendency towards improvement.

There is less talk now than some time ago of blowing out Cleveland blast furnaces. This is due to the announcement that in other competing districts no less than fifteen furnaces have gone out of blast during the last few months, and since the present very low prices set in, it is becoming clear that the pinch is felt elsewhere more keenly than in Cleveland, and with the usual effect of the weakest going to the wall. Cleveland ironmasters, therefore, feel encouraged, and think they have only to continue their policy of holding on, and economising to the utmost, and they will soon have a firmer hold of the markets of the world than ever. The stock in Connal's Middlesbrough store has now reached 169,020 tons, being an increase during the week of 2057 tons.

In manufactured iron Tuesday's market was steady even to firmness; one large sale of ship plates was announced to have been made to a Tyne shipbuilder at £6 5s. per ton free alongside. General quotations ranged from £6 2s. 6d. to £6 5s. f.o.t. Middlesbrough. Boiler plates were from £1 to £3 per ton more according to quality. Best bridge or ship plates 10s. per ton extra; angle iron was £5 10s. per ton and bars about the same; puddled bars were from £3 10s. to £3 15s. according to size and quality. In bridge building there is decidedly more doing, some of the local engineering works being quite full. The foundry trade is also somewhat better, as bridge construction always involves a certain amount of cast iron as well as wrought iron work. Building operations have again been resumed at Mr. C. E. Muller's Erimus Steel Works, and it is expected a start will be made to manufacture in two to three months. Although designed to work by the basic process, it is not intended to do this at first; but simply to buy ordinary hematite, and use the Bessemer process with silica lined converters. Rails and blooms will be the products for some time to come.

The Darlington Iron and Steel Company—in liquidation—are still continuing to manufacture energetically. They have their own converters—originally brought from Gorton—and are turning out over 1000 tons of ingots per week. The demand for steel rails is indeed having its full effect in stimulating the trade of Cleveland.

At Eston one-fourth of the total make of rails is now of steel made out of Cleveland iron by the basic process. The attitude of our American competitors in this respect is naturally watched with great interest. Mr. Sydney G. Thomas is at present in the United States, and is receiving quite an ovation wherever he goes. He is spoken of as "That inspired youth," and is evidently regarded with that unbounded veneration which is characteristic of our transatlantic cousins when a new lion appears, and which endures till a newer or greater arrives. It is said that the American Bessemer Association, which practically holds a monopoly of the steel rail manufactures, has bought up Thomas's patents for £55,000; not directly of him, but of a third party to whom they were sold before their full present value was dreamed of. The Bessemer Association has, it is believed, no immediate intention of working them at all, but simply desires to avoid competition and to strengthen its own position as a body of monopolists. This is perhaps favourable to the growth of the basic steel trade in England, and especially in Cleveland, where it is likely to be produced at the lowest cost. Such steel can in the future, as at present, only be kept out of the American market by encouraging high import duties, and out of foreign and colonial markets only by the bounty system, or by foreign manufacturers being content to lose on such orders and recoup themselves where protection applies. All such trade is, of course, in a state of unstable equilibrium only, and liable to topple down at the first breath of common sense in the form of a return on the part of the protecting nations to the only sound and permanent principle of seeking the greatest good for the greatest number.

The Tees Conservancy Commissioners have decided to purchase a steam launch of Messrs. Halsey and Co., of London, for £1000. This decision led to considerable discussion at the board, being vigorously opposed by Mr. T. H. Bell on the ground that it was an unnecessary extravagance. Inasmuch as the commissioners already possess two or three excellent steam tugs, and have by no means despicable banqueting facilities at the fifth buoy light, it is probable that Mr. Bell's view is the correct one. The majority of the commissioners, however, do not seem to think so; or at all events they believe that their hitherto gratuitous services ought to be rewarded by unlimited excursions in state up and down their not very picturesque river.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Scotch iron trade has not as yet shown any change for the better so far as regards prices, which are indeed a shade lower than they were a week ago. The market has been exceedingly idle, there being hardly any business even of a speculative nature.

During the past week between 2000 and 3000 tons of pigs have been added to the stock in Messrs. Connal and Co.'s stores, bringing it up to 552,000 tons; and the production is increasing, for an additional furnace has been put in blast, and several more are said to be on the eve of being blown in.

The warrant market has been quiet. Business was done on Friday morning at from 47s. 10½d. to 47s. 9d. cash, and 47s. 11½d. to 47s. 10d. one month; the afternoon quotations being 47s. 8½d. to 47s. 8d. cash, and 47s. 9½d. to 47s. 9d. one month. Monday being a bank holiday, there was no market on that day. On Tuesday a quiet steady business was done at 47s. 6½d. to 47s. 7d. cash. Business was quiet on Wednesday at 47s. 6½d. to 47s. 7d. cash and 47s. 8d. to 47s. 8½d. one month. To-day—Thursday—the market was easier, at 47s. 7d. cash and 47s. 8d. one month, to 47s. 5½d. cash and 47s. 7d. one month.

Makers' iron is slightly lower this week, the quotations being as follows:—g.m.b., f.o.b., at Glasgow, per ton, No. 1, 48s.; No. 3, 46s.; Gartsherrie, 57s. 6d. and 50s.; Coltness, 57s. 6d. and 50s.; Langloan, 58s. and 50s.; Summerlee, 56s. 6d. and 49s. 6d.; Calder, 57s. 6d. and 49s. 6d.; Carnbroe, 54s. and 49s.; Clyde, 49s. and 47s.; Monkland, 48s. 6d. and 46s. 6d.; Quarter, 48s. 6d. and 46s. 6d.; Govan, at Broomielaw, 48s. 6d. and 46s. 6d.; Shotts, at Leith, 58s. and 50s. 6d.; Carron, at Grangemouth, 52s. 6d. —specially selected, 56s.—and 51s. 6d.; Kinneil, at Bo'ness, 48s. 6d. and 46s. 6d.; Glengarnock, at Ardrossan, 54s. and 49s.; Eglinton, 48s. 6d. and 46s. 6d.; Dalmellington, 48s. 6d. and 46s. 6d.

Those iron and steel works engaged on shipbuilding contracts continue busy, but the other departments of the trade are for the most part quiet, although some of them are doing a good steady business.

The inland household demand for coals is not quite so brisk, but there has been a large demand for shipment, and the Lanarkshire pits have been quite busy. Very good prices are being got for steam coals, which are in keen request, and the quotations for other qualities do not exhibit any alteration. The gas coal contracts are now being placed for the year, and, so far as I can learn, the terms do not differ materially from those of twelve months ago. At the Ayrshire ports a heavy shipping trade is being done, and in Fife it is rapidly increasing, no less than 16,705 tons of coals having been put on board in the course of the past week at Burntisland alone.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The dispute at the Bute Dock continues, and is likely to last until the men accept the liberal terms offered: 24s. per week for day work, and 30s. night work all the year round, work or not.

The inquiry into the Penygraig explosion was begun on Monday last at Cardiff Town Hall, and is now proceeding.

Penrhiwceiber Colliery, Mountain Ash, after turning out 800 tons of coal per diem, and coal of the best character, is now somewhat at a standstill, a fault having been encountered. It is expected, however, to be only a temporary hindrance. Harris's deep navigation is turning out more freely. The coal is of the best four feet, the seam a large one, and its inclination such as to make working very easy, a little holing at bottom bringing down large quantities.

I hear of changes in the sub-management at Plymouth collieries, which are now most ably and energetically managed by Mr. Simpson.

The iron and steel trades are moderately brisk, and prices are evidently looking up. This applies to the leading works. There is no disposition to sell the stocks of pig and puddled bars under full market price—pig, for instance, at 60s., though West Coast brands are offered at less.

Iron rails are quoted at £5 5s. Demand for scrap is very slow. I hear in the Swansea district that a considerable degree of sluggishness prevails, and is a marked feature of all the industries. This does not apply to Newport, where a good deal of animation prevails. Three of the outstanding works have allowed the men to go to work at the old rates. This week Messrs. Hosgood and Smith's men, Gadlys, Aberdare, resumed work.

In the Swansea district ordinary coke is quoted at 16s. This may be taken as a higher figure than prevails generally. It is estimated that the stock of plates at Bristol is now 200,000 boxes, and 300,000 in Liverpool.

The trams and horses were taken out of Abercwmboy Colliery last week. Messrs. Nixon and Co. are in treaty with Messrs. Davies for this colliery, but prospects of a settlement are not great.

The industries of the Dean Forest are passably brisk, some little dispute at Russell's forges having been settled. I also am pleased to report favourably of steady operations at Messrs. Finch's, Chepstow, where, as stated a few weeks ago, large orders are held, and are in process of completion.

International Machinery Exhibition at Altona.—An International exhibition of power and work machinery for small industries will be held in Altona next August. The arrangement of this International Exhibition has been fixed as follows: Department I., for power machinery, subdivided as follows: Class I., for gas power machinery; Class II., water power machinery; Class III., steam power machinery; Class IV., hot air power machinery; and Class V., dynamic-electric-hydrocarbon power machinery; whilst Class VI. has been set aside for models and drawings of power machines. Department II., for work machinery, implements, and tools, is subdivided into the following classes: machines for the manipulation of wood, for joiners, turners, carpenters, &c.; machines for working iron, for smiths, locksmiths, &c.; machines for the manipulation of tin and pewter-ware; machines for brass-founders, tin-founders, &c.; machines for watch-makers, goldsmiths, mechanicians, &c.; machines for working in leather; sewing-machines; looms; stocking looms; cloth shearers; winding and twisting machines; hemp-dressing and hackling machines and rope making machines; for hat making; brush making; colour grinding machines; pottery and glass ware machines; stone working machines; horn working machines; machines for millers, bakers, and confectioners; machines for printers, lithographers, photographers, &c.; machines for bookbinders, &c.; machines for cigar-makers; machines for butchers; machines for the manufacture of ice, mineral waters, &c.; machines for the manufacture of screws, nails, pins, needles, &c.; and coupling apparatus, as far as necessary for work machines. Department III. comprises miscellaneous articles, as also objects manufactured by the machines and implements exhibited in Departments I. and II., such as: specimens of wood and iron work; tin and pewter ware; textile fabrics; printing; bookbinding; fancy leather goods, &c. Department IV. is set aside for dairy machines and utensils, such as churns, cheese vats, and presses, &c.; whilst Department V. is devoted to agricultural machines and implements. In the announcement of the Exhibition it is stated that: "The title 'International' will not have been given to this Exhibition without cause, for, being held in the closest proximity to Hamburgh, the chief commercial town of the Continent, manufacturers will undoubtedly exhibit on a large scale, in order to draw the attention of Hamburgh export houses to the adaptability of their wares for shipment to all parts of the world." His Excellency the Minister of State von Böttcher has consented to act as president of this International Exhibition.

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 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.

26th April, 1881.

1788. Furnaces, J. Mason, Eynsham Hall.
1789. Block Signalling, J. W. Fletcher, Stockport.
1790. Diving Costumes, S. J. Woodhouse, Leeds.
1791. Raising a Nap on Cloth, A. M. Clark.—(*E. Gessner, Aue, Saxony.*)
1792. Discharging Condensed Water from Steam Pipes, H. G. Grant.—(*E. Briart, Jeumont, France.*)
1793. Tobacco Pipes, J. Koppenhagen, London.
1794. Bottle Stoppers, H. Bonneville.—(*J. Wills, U.S.*)
1795. Glass, &c., C. A. Schön.—(*G. Leuffgen, Berlin.*)
1796. Railway Signalling, H. Morris, Manchester.
1797. Halter Heads, J. Goodrick, jun., Birmingham.
1798. Steam Generators, B. Brazelle, St. Louis, U.S.
1799. Lamps for Velocipedes, G. Burt, Birmingham.
1800. Oyster Culture, E. Johnson, Isle of Wight.
1801. Preventing Radiation of Heat, R. Stewart, Leadenhall-street, London.
1802. Electric Lights, &c., J. Jensen.—(*T. A. Edison, Menlo Park, U.S.*)
1803. Types, L. Weiss, Vienna.
1804. Cultivating Plants Without Soil, J. Imray.—(*A. F. P. Dumesnil, Paris.*)
1805. Grinding, &c., Substances, H. Seck, London.
1806. Preparing, &c., Metal Pipe or Tube, A. M. Clark.—(*H. von Hartz and O. Fix, Cleveland.*)
1807. Slide Valves, A. M. Clark.—(*W. S. Hughes and J. Gregory, Long Island, and C. J. Howe, New York.*)
1808. Utilising Liquid, &c., Hydrocarbon as Fuel, W. R. Lake.—(*J. W. and J. R. Houchin, New York.*)
1809. Telegraphic Cables, &c., W. R. Lake.—(*P. B. Delany, New York.*)
1810. Garment, W. R. Lake.—(*A. Peschel, Berlin.*)
1811. Treating Vegetable Textile Materials, W. R. Lake.—(*A. F. I. Bang and C. V. Clolus, Paris.*)

27th April, 1881.

1812. Concrete, A. E. Carey, Newhaven, and E. Latham, Birkenhead.
1813. Combined Brake, &c., H. S. H. Shaw, Bristol.
1814. Button-hole Sewing Machines, W. Morgan-Brown.—(*J. Reece, Boston.*)
1815. Moulding Water-closet Cisterns, H. and W. Sutcliffe, Halifax.
1816. Valves and Taps, T. G. Messenger, Leicester.
1817. Artificial Stone, W. Gedge.—(*G. Boden, U.S.*)
1818. Regulating the Flow or Pressure of Gases, F. W. Clark, Millbank-street, Westminster.
1819. Furnace Fire-bars, R. Macpherson, London.
1820. Magnesia, S. Pitt.—(*T. Schloesing, Paris.*)
1821. Looms, F. S. Witham, Nelson, near Burnley.
1822. Producing Inlaid Designs, E. Ormerod, R. J. Edwards, and A. Edwards, London.
1823. Printing Machines, E. F. Kelly, London.
1824. Tricycles, T. Banister and S. Leos, Rochdale.
1825. Padding Colours, G. W. Clayton, Manchester.
1826. Galvanic Soles for Boots, &c., G. W. von Nawrocki.—(*A. Wienand, Pforzheim, Germany.*)
1827. Drills, W. L. Wise.—(*A. Derome, Paris.*)
1828. Pebble Gunpowder, E. A. Brydges.—(*A. Mayr, Felixdorf, Austria.*)
1829. Nail Machinery, J. L. Heward, Newport.
1830. Nail Machinery, J. L. Heward, Newport.
1831. Regulating Heat, W. R. Lake.—(*L. Tredholm, Stockholm, Sweden.*)

28th April, 1881.

1832. Brake Apparatus, G. L. Joy, Southwark.
1833. Oils, H. J. Haddan.—(*H. Fink and C. Fink, U.S.*)
1834. Reflectors, H. J. Haddan.—(*C. F. Brush, U.S.*)
1835. Current Governors, H. J. Haddan.—(*C. F. Brush, Cleveland, U.S.*)
1836. Hardware, F. C. Glaser.—(*C. Haegele, Germany.*)
1837. Coke Ovens, H. Simon.—(*A. Hussener, Germany.*)
1838. Cattle Food, E. J. T. Digby, London.
1839. Musical Apparatus, M. A. Wier, London.
1840. Sweetmeats, S. P. Wilding.—(*H. Zimmermann, Thiele, and Holzhause, Magdeburg, Germany.*)
1841. Harmonicons, M. A. Wier, London.
1842. Volatile Solvents, E. B. Hart, Ireland.
1843. Rymer for Wood, &c., G. W. von Nawrocki.—(*Werkzeug und Maschinenfabrik Oerlikon, Switzerland.*)
1844. Filtering Chemical Solutions, H. E. Newton. (*D. Monnier, Paris.*)
1845. Fastening for Cravats, &c., J. Hinks and T. Hooper, and F. R. Baker, Birmingham.
1846. Rotary Engines, J. Swallwell, Battersea.
1847. Extracting Copper, W. W. Hughes, London.
1848. Extinguishing Fires, J. K. J. Foster, Bolton.
1849. Coffee Berry, A. Gough, Buckingham.
1850. Extinguishing Fires, J. K. J. Foster, Bolton.

29th April, 1881.

1851. Carving Forks, W. B. Hatfield, Sheffield.
1852. Electric Lighting, H. J. Haddan.—(*L. Somzée, Brussels.*)
1853. Propelling Ships, J. I. Thornycroft, Chiswick.
1854. Lifts, J. Day, W. Green, & H. Walker, London.
1855. Preparing, &c., Cotton, R. Clegg and J. Taylor, Oldham.
1856. Railways, A. W. L. Reddie.—(*J. Hunebelle, Paris.*)
1857. Curing Fish, &c., H. Susmann, Manchester.
1858. Dressing Grain, &c., E. Keighley, Scarborough.
1859. Brick-making Machinery, T. C. Fawcett, Leeds.
1860. Tricycles, J. Harrington, London.
1861. Thickening Compositions, G. W. von Nawrocki.—(*E. R. von Portheim, Bohemia.*)
1862. Centrifugal Machines, W. R. Lake.—(*S. S. Hepworth, Yonkers, U.S.*)
1863. Clipping Horses, A. M. Clark.—(*Bariquand and Son, Paris.*)
1864. Velocipedes, J. E. Hatch, Camberwell.
1865. Lime Kilns, E. Crosland, Arnside.

30th April, 1881.

1866. Letting-off Warp, J. Heap, Ashton-under-Lyme.
1867. Mules, J. Haughton, Manchester, and J. Roberts and J. Buckley, Staley Bridge.
1868. Torpedoes, W. N. Hutchinson, Wellesbourne.
1869. Elastic Cotton, G. G. de L. Byron, Brighton.
1870. Sorting Grain, S. Handscombe and C. Dellar, Melbourne.
1871. Velocipedes, A. G. Meeze, Redhill, and N. Salamon, Holborn Viaduct, London.
1872. Small-arms, H. Walker, Birmingham.
1873. Telegraph Cables, W. T. Henley, Plaistow.
1874. Annealing Iron, &c., W. Ramsden, Tingley.

2nd May, 1881.

1875. Reeling Yarns, &c., G. Bernhardt, Radcliffe.
1876. Brushes, G. W. von Nawrocki.—(*T. B. Gunzberg, Kowno, Russia.*)
1877. Engine Wheels, H. Lawrence, Durham.
1878. Finishing Fabrics, M. McCallum, Barhead.
1879. Raising Balloons, W. N. Hutchinson, Bideford.
1880. Straw Hats, &c., M. Andrieux, France.
1881. Driving Belts, &c., W. T. Henley, Plaistow.
1882. Clock, J. Nadal, Southampton-row, London.
1883. Boots, &c., A. Greer, Beswick.
1884. Labels, S. A. Varley, Hatfield.
1885. Electric Telephones, W. Main, Brooklyn.
1886. Washing Clothes, A. Cooper, London.
1887. Smoothing Machines, G. W. von Nawrocki.—(*O. Lauge, Köhsel, Hanover.*)
1888. Stools, A. W. L. Reddie.—(*M. H. Wilson, U.S.*)
1889. Removing Burrs, &c., from Wool, F. Moore, Trowbridge.
1890. Pottery, J. H. Johnson.—(*P. Dodé, Paris.*)
1891. Permanent Way, A. J. H. Smythe, Ireland.
1892. Fishing Nets, H. and S. G. Boyce, and S. Callaway, Sandown, Isle of Wight.
1893. Absorbing, &c., the Sulphuric Acid in Furnace Gases, &c., C. D. Abel.—(*D. K. Schnabel, Germany.*)
1894. Gas, C. D. Abel.—(*E. Langen, Cologne, Germany.*)
1895. Surgical Instruments, E. A. Brydges.—(*M. V. Schiltz, Cologne, Germany.*)
1896. Separating Lime, &c., Contained in Dolomite, S. Cliff, Wortley, Leeds.
1897. Obtaining, &c., Gas, W. A. Barlow, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

1794. Bottle Stoppers, H. A. Bonneville, Cannon-street, London.—A communication from J. Wills, New York, U.S.—*26th April*, 1881.
1833. Treating Oils, H. J. Haddan, Strand.—A communication from H. and C. Fink, Washington, U.S.—*28th April*, 1881.
1862. Centrifugal Machines, W. R. Lake, Southampton-buildings, London.—A communication from S. S. Hepworth, Yonkers, U.S.—*29th April*, 1881.
1863. Clipping or Shearing Horses, &c., A. M. Clark, Chancery-lane, London.—A communication from Messrs. Bariquand and Son, Paris.—*29th April*, 1881.

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

1661. Polishing Metal, A. Edwards, Shoreditch.—*25th April*, 1878.
1687. Pump, A. M. Clark, Chancery-lane, London.—*26th April*, 1878.
1739. Operating Railway Switches, W. S. Oxborrow, Stowmarket.—*30th April*, 1878.
1740. Transmitting Motion, A. M. Clark, Chancery-lane, London.—*30th April*, 1878.
1747. Cooling Air, W. Hargreaves, Bolton.—*1st May*, 1878.
1696. Preventing Sea Sickness, J. C. Thompson, London.—*27th April*, 1878.
1704. Printing, &c., Machinery, W. R. Lake, London.—*27th April*, 1878.
1824. Breaking Stones, G. Dalton, Leeds.—*7th May*, 1878
1859. Water Taps, G. Arundel, Sheffield.—*9th May*, 1878.
2693. Vehicles, &c., J. J. Halcombe, Balsham.—*5th July*, 1878.
1706. Pressing Sugar into Cubes, W. R. Lake, London.—*29th April*, 1878.
1725. Bicycles, V. Renard and C. Renard, Paris.—*30th April*, 1878.
1753. Locking Nuts, H. Bezer, Smithfield, London.—*1st May*, 1878.
1771. Concrete Materials, W. R. Lake, London.—*2nd May*, 1878.
1791. Brick-making Machinery, F. Firth, J. Firth, and E. Firth, Dewsbury.—*3rd May*, 1878.
1795. Sewing Machines, M. Benson, London.—*4th May*, 1878.
1803. Lasting Boots and Shoes, W. R. Lake, London.—*4th May*, 1878.
1722. Grinding, &c., Grain, J. Higginbottom and E. Hutchinson, Liverpool.—*30th April*, 1878.
1765. Vertical Tubular Locomotive Boilers, F. de Valsuzenay, Froncles, France.—*2nd May*, 1878.
1769. Furnace Grate Bars, A. Godillot, Paris.—*2nd May*, 1878.
1888. Carriage Axles, J. Lones, C. Vernon, E. Holden, & R. Bennett, Smethwick.—*10th May*, 1878.
1754. Water Meters, C. Michel and A. Frager, Paris.—*1st May*, 1878.
1757. Joining the Ends of Lead Pipes, A. L. Bricknell, London.—*1st May*, 1878.
1764. Gas, S. Cutler, Millwall.—*2nd May*, 1878.
1779. Speaking Telephones, J. F. Bailey, Charing Cross, London.—*2nd May*, 1878.
1781. Breech-loading Fire-arms, H. A. Silver and W. Fletcher, Cornhill, London.—*2nd May*, 1878.

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

1502. Spinning and Doubling, S. Brooks, G. Harrison, and T. Goodbehere, West Gorton.—*29th April*, 1874.
1435. Coal Tar Products, C. Lowe and J. Gill, Manchester.—*24th April*, 1874.
1458. Locomotive Carriages, W. D. Scott-Moncrieff, Glasgow.—*27th April*, 1874.
1517. Raised Surfaces for Printing, P. M. Shanks, London.—*30th April*, 1874.
1642. Working Lock Gates, P. G. B. Westmacott, Elswick.—*9th May*, 1874.
1522. Working Signals and Brakes, R. D. Sanders, Great Missenden.—*30th April*, 1874.
1540. Working Brakes, &c., G Westinghouse, jun., London.—*1st May*, 1874.
1556. Label, &c., W. R. Lake, Southampton-buildings, London.—*2nd May*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 20th May, 1881.

5398. Securing the Stoppers of Bottles, W. C. Eaton, Sheffield.—*23rd December*, 1880.
5406. Rotary Blower, &c., Engine, P. Goldschmidt, G. Hahlo, and A. Heussy, Albert-square, Manchester.—*23rd December*, 1880.
5422. Piled Velvet, J. Perkins, jun., Coventry.—*24th December*, 1880.
5434. Safety Valves, W. R. Lake, London.—Com. from G. W. Copeland.—*24th December*, 1880.
5442. Card-grinding Appliances, J. S. Dronsfield, Oldham.—*27th December*, 1880.
5453. Artificial Ear Drums, H. P. K. Peck, Cincinnatti.—*28th December*, 1880.
5468. Opening, &c., Doors, R. Waller, Leeds.—*29th December*, 1880.
5515. Crucibles, A. Landsberg, Stoberg, near Aachen, Prussis.—*31st December*, 1880.
4. Shaping, &c., Hat Brims, T. Robotham, Hazel Grove.—*1st January*, 1881.
29. Receptacles or Vessels, F. C. Glaser, Berlin.—Com. from H. Schomburg.—*4th January*, 1881.
186. Counter-sinking Wood Screws, A. M. Clark, London.—Com. from J. Eckford.—*14th January*, 1881.
354. Pumping Engines, M. Silvester, Mayall-road, Brixton.—*26th January*, 1881.
671. Velocipedes, A. Kirby, Harpur Place, Bedford.—*16th February*, 1881.
1138. Ornamental Blind, W. P. van Wyk, Honey-lane Market, London.—*16th March*, 1881.
1255. Printing Fabrics, R. Ritchie and J. Ferguson, Dumbarton.—*22nd March*, 1881.
1296. Spring Safety Valves, T. Adams, West Gorton, Manchester.—*23rd March*, 1881.
1441. Furnaces, W. Dutton and M. Croft, Walsall.—*1st April*, 1881.
1478. Treating Woven Fabrics, W. Mather, Salford Ironworks, Manchester.—*5th April*, 1881.

Last day for filing opposition, 24th May, 1881.

5463. Staining, &c., Wood, E. A. Brydges, Upton.—Com. from A. Thimm.—*28th December*, 1880.
5465. Raising Sunken Vessels, W. Atkinson, London.—*29th December*, 1880.
5467. Destruction of Field Mice, H. A. Bonneville, London.—A communication from Mr. Gouteau.—*29th December*, 1880.
5469. Moulding, F. Wirth, Germany.—Com. from P. Gallas and H. Aufderheide.—*29th December*, 1880.
5473. Window Sashes, J. Terry, R. Judson, and G. Smith, Keighley.—*29th December*, 1880.
5474. Preparing Seeds for Crushing, C. Eskrett and W. H. Searle, Hull.
5478. Ammonia, H. A. Dufrené, London.—Com. from la Société l'Azote, Paris.—*29th December*, 1880.
5479. Applying Motive Power, J. Graddon, Forest Hill.—*29th December*, 1880.
5490. Illuminated Clocks, C. H. Leycester, South Wales.—*30th December*, 1880.
5500. Preventing the Shifting of Cargoes, J. Goudie, East Hartlepool.—*31st December*, 1880.
5502. Valves for Pumps, N. Foley, Jarrow-on-Tyne.—*31st December*, 1880.
5507. Mould Candles, W. E. Nutt, Hounslow.—*31st December*, 1880.
5508. Feeding Fibrous Substances, W. Fox and J. Hall, Leeds.—*31st December*, 1880.
5513. Gas, P. J. Wates, Brooklands, Balham.—*31st December*, 1880.
19. Boots, Colonel E. Harnett, Aldershot.—*3rd January*, 1881.
49. Tentering Machines, W. R. Lake, London.—Com. from Messrs. Gourdiat.—*4th January*, 1881.
51. Working Railway Brakes, J. Imray, London.—Com. from A. Wenger.—*5th January*, 1881.
59. Railway Brake Apparatus, J. Batey, Stockwell, London.—*5th January*, 1881.
102. Metallic Wagons, R. Hudson, Gildersome.—*8th January*, 1881.
120. Working Railway Switches, &c., J. T. Bucknill, Cockcrow Hill.—*10th January*, 1881.
168. Piston Rod Packings, H. J. Haddan, London.—Com. from C. C. Jerome.—*13th January*, 1881.
312. Testing the Presence of Combustible Gases, A. W. L. Reddie, London.—A communication from D. Monnier.
320. Gas Engines, C. M. Sombart, Magdeburg, Germany.—*25th January*, 1881.
519. Alarum Apparatus, P. Everitt, London.—*7th February*, 1880.
552. Digging, &c., T. Parker, Springfield.—*9th February*, 1881.
596. Dilated Air Motive Power Engines, P. Gifford, Paris.—*11th February*, 1881.
714. Sawing Machines, S. W. Worssam, Chelsea, London.—*18th February*, 1881.
728. Magnesia, C. Pieper, Berlin.—A communication from M. Sprenger.—*19th February*, 1881.
729. Bicycles, G. G. M. Vernum, Birmingham.—*19th February* 1881.
742. Compound Brake, W. J. Adams, Queen Victoria-street, London.—*21st February*, 1881.
757. Pumping Water and Air, W. Anderson and W. Airy, Westminster.—*22nd February*, 1881.
1292. Castings, J. Watson, Rotherham.—*23rd March*, 1881.
1293. Kitchen Ranges, J. Watson, Rotherham.—*23rd March*, 1881.
1311. Casting, &c., Shaft Bearings, &c., A. Howat, Manchester.—*24th March*, 1881.
1328. Boilers, W. Arnold, Barnsley.—*24th March*, 1881.
1422. Electric Light, W. Crookes, Boy-court, Ludgate-hill, London.—*31st March*, 1881.
1469. Mining Machines, H. H. Doubleday, Washington, U.S.—A communication from F. M. Lechner.—*4th April*, 1881.
1499. Tobacco, J. Hopkinson, Manchester, and F. Wills, Bristol.—*6th April*, 1881.
1584. Treating Ores, &c., J. Hargreaves and T. Robinson, Widnes.—*12th April*, 1881.
1600. Tanning, C. Michel, jun., C. Kollen, and G. Hertzog, Reims, France.—*12th April*, 1881.
1602. Photographic Objectives, H. A. Steinthal, Munich.—*12th April*, 1881.
1636. Producing Motion by Electricity, St. G. L. Fox, London.—*14th April*, 1881.
1697. Scutching Cotton, &c., W. R. Lake, London.—Com. from A. Clarke & H. Perham.—*19th April*, 1881.
1701. Wheels, W. R. Lake, London.—A communication from R. N. Allen.—*19th April*, 1881.
1726. Electrical Call, &c., W. R. Lake, London.—Crom. from D. Rice & J. Currier.—*20th April*, 1881.
1743. Clarifying Apparatus, W. R. Lake, London.—Com. from E. Welz & A. Rittner.—*22nd April*, 1881.
1833. Treatment of Oil, H. J. Haddan, London.—Com. from H. Fink and C. Fink.—*28th April*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 29th April, 1881.)

2226. Bearings for Bicycles, R. Green, Birmingham.—*1st June*, 1880.
4439. Strings of Violins, R. Holliday, Crewe.—*30th October*, 1880.
4458. Metal Wheels, &c., R. R. Gubbins, New Cross.—*1st November*, 1880.
4459. Felted Thread, W. A. Barlow, St. Paul's-churchyard, London.—*1st November*, 1880.
4466. Cleaning, &c., Textile Fabrics, G. Macaulay-Cruikshank, Glasgow.—*2nd November*, 1880.
4471. Lithographic Cylinder Printing Machines, T. W. Woodhouse, London.—*2nd November*, 1880.
4475. Fences, D. Rowell, Poet's Corner, Westminster.—*2nd November*, 1880.
4479. Puddling Furnaces, W. Griffiths, West Bromwich.—*2nd November*, 1880.
4483. Safety Valves, S. Hallam, Manchester.—*3rd November*, 1880.
4491. Preventing Explosions in Coal Mines, T. Canning and W. E. Thomas, Newport.—*3rd November*, 1880.
4493. Metal Planing Machines, H. Olrick, Leadenhall-street, London.—*3rd November*, 1880.
4507. Carding Engines, G. Ashworth and E. Ashworth, Manchester.—*4th November*, 1880.
4524. Tilting Casks, P. J. Catterall and J. S. Crowley, Manchester.—*4th November*, 1880.
4525. Embroidering, A. Heaven, Manchester.—*4th November*, 1880.
4540. Detecting Escape of Gases, R. R. Reeves, Parkhurst, Isle of Wight.—*5th November*, 1880.
4545. Pipe Couplings, &c., W. Stainton, Liverpool-street, London.—*6th November*, 1880.
4553. Turning, &c., Machines, W. W. Hulse, Manchester.—*6th November*, 1880.
4570. Waterproofing Cloths, &c., P. M. Justice, London.—*6th November*, 1880.
4609. Direct-acting Hydraulic Machines, R. H. Tweddell, London, and J. Platt and J. Fielding, Gloucester.—*10th November*, 1880.
4622. Steam Reducing Valves, J. Wright, Tipton.—*10th November*, 1880.
4630. Anchors, J. Wright, Tipton.—*11th November*, 1880.
4632. Puddling Furnaces, W. S. Williamson, Congleton.—*11th November*, 1880.
4653. Velocipedes, T. Pritchard, Coventry.—*11th November*, 1880.
4658. Tricycles, E. Hughes, Green's End, Woolwich.—*12th November*, 1880.
4695. Thermometer, H. H. Lake, Southampton-buildings, London.—*13th November*, 1880.
4717. Economising Fuel, W. R. Lake, Southampton-buildings, London.—*16th November*, 1880.
4937. Heating Water, &c., B. J. Grimes and L. Dove, London.—*27th November*, 1880.
5311. Cans, &c., for Conveying Milk, W. W. Marsden, Wirksworth.—*18th December*, 1880.
338. Smutting Wheat, &c., W. P. Thompson, High Holborn, London.—*26th January*, 1881.
761. Purifying Cast Iron, &c., W. P. Thompson, High Holborn, London.—*23rd February*, 1881.
793. Oil-cloths, &c., W. Ayrton, Ormskirk.—*24th February*, 1881.
849. Bituminous Cements, &c., J. H. Johnson, Lincoln's-inn-fields, London.—*28th February*, 1881.
883. Cast Steel, &c., C. W. Siemens, Queen Anne's-gate, Westminster.—*1st March*, 1881.

(*List of Letters Patent which passed the Great Seal on the 3rd May*, 1881.)

4484. Collapsing Signal Ball, J. H. Shoebottom, Birmingham.—*3rd November*, 1880.
4509. Supplying Disinfectants to Water-closets, &c., E. Warner, Stowmarket.—*4th November*, 1880.
4512. Grinding Dyewoods, T. J. and C. H. Pickle & S. Smithson, Ravensthorpe.—*4th November*, 1880.
4518. Disinfecting Closet Pans, &c., H. Seward London.—*4th November*, 1880.
4526. Surface Polishing and Pasting Machinery, W. Weems, Johnstone, and C. D. Douglas, Glasgow.—*4th November*, 1880.
4539. Targets and Butts, R. Neilson, King's-cross-road, London.—*5th November*, 1880.
4541. Disinfecting Alcohol, W. A. Barlow, St. Paul's-churchyard, London.—*5th November*, 1880.
4543. Jacquard Needles or Cross Wires, W. Martin and J. Hind, Nottingham.—*5th November*, 1880.
4546. Railway Switches, &c., C. W. Hartley, Bradford.—*6th November*, 1880.
4549. Belts or Bands, J. Heap, Ashton-under-Lyne.—*6th November*, 1880.
4559. Lubricating Axles, W. S. Laycock, Sheffield.—*6th November*, 1880.
4568. Agricultural Drills, L. W. Gatward, Hitchin.—*6th November*, 1880.
4580. Elevating, &c., Drawing-boards and other Surfaces, E. Hill, Huntingdon.—*8th November*, 1880.
4585. Supplying Fuel to Fireplaces, W. S. Melville, Frederick-place, London.—*9th November*, 1881.
4591. Flexible Ink, &c., Compounds, L. B. Bertram, Cornwall-road, London.—*9th November*, 1880.
4595. Raising, &c., Vessels, D. H. Sisson, Goole.—*9th November*, 1880.
4608. Generating, &c., Electric Currents, C. F. Heinrichs, London.—*9th November*, 1880.
4617. Malt and Drying Kiln, E. Walker, Newark-upon-Trent.—*10th November*, 1880.
4638. Beverage, E. W. Allen, Peckham.—*11th November*, 1880.
4641. Runners and Top-notches for Umbrellas, &c. G. G. Lusher, Birmingham.—*11th November*, 1880.
4656. Lubricating Apparatus, W. P. Thompson, High Holborn, London.—*12th November*, 1880.
4657. Expanding Dress Stand, E. Eavestaff, London.—*12th November*, 1880.
4673. Preparing, &c., Fibrous Materials, J. M Hetherington, Manchester.—*13th November*, 1880.
4715. Paper-folding Machinery, W. Conquest, Tudor-street, London.—*16th November*, 1880.
4763. Tricycles, C. G. Hawkins, Leighton-road, Forest Gate.—*18th November*, 1880.
4770. Steam Safety-valves, P. M. Justice, Southampton-buildings, London.—*19th November*, 1880.
4936. Roll Tobacco, A. T. Lendrum, Belfast.—*27th November*, 1880.
4948. Velocipedes, W. H. Thompson and F. G. Henwood, London.—*27th November*, 1880.
5013. Printing, &c., Copies from Drawings, A. J. T. Wild, Nunhead.—*2nd December*, 1880.
5108. Securing the Ends of Wire, H. Eyre and E. Heathfield, London.—*7th December*, 1880.
5153. Propelling Vessels, C. O. Rogers, Old Broad-street, London.—*9th December*, 1880.
5154. Winding Gear, R. Hitchcock, Albemarle-terrace Taunton.—*9th December*, 1880.
5456. Rotary Pumps, G. Waller, Holland-street, Southwark.—*28th December*, 1880.
5484. Pumping Apparatus, E. H. Greeven, Cheapside London.—*30th December*, 1880.
40. Steam Boilers, G. Petrie, Rochdale.—*4th January*, 1881.
129. Galvanic Polarisation Batteries, J. H. Johnson, London.—*11th January*, 1881.
131. Valves, J. N. Rowe, Rockland, U.S.—*11th January*, 1881.
250. Piercing Doubled Yarns, G. Balfe, Stockport.—*20th January*, 1881.
298. Magnesia, C. Scheibler, Berlin, Prussia.—*22nd January*, 1881.
331. Sugar, C. Scheibler, Berlin, Prussia.—*25th January*, 1881.
512. Bicycles, &c., J. White, Coventry, and G. Davies, Manchester.—*7th February*, 1881.
663. Telephonic Apparatus, P. M. Justice, Southampton-buildings, London.—*16th February*, 1881.
725. Preparing, &c., Cotton, W. H., J. H., and C. H. Haynes, Salford.—*19th February*, 1881.
827. Type-writing Machines, P. M. Justice, Southampton-buildings, London.—*26th February*, 1881.
834. Perforating Paper, H. H. Lake, Southampton-buildings, London.—*26th February*, 1881.
843. Cards and Magnetic Needles, H. J. Haddan, Strand.—*28th February*, 1881.
866. Steam Boilers, T. Moy, Farringdon-street, London.—*1st March*, 1881.
875. Treating Concrete and Cement, H. Faija, Great Queen-street, Westminster.—*1st March*, 1881.
909. Musical Instruments, H. J. Haddan, Strand.—*3rd March*, 1881.

List of Specifications published during the week ending April 30th 1881.

2220, 6d.; 2459, 8d.; 2703, 2d.; 2768, 2d.; 2862, 2d.; 2909, 2d.; 2967, 2d.; 2977, 4d.; 3036, 8d.; 3044, 6d.; 3064, 6d.; 3069, 2d.; 3122, 2d.; 3128, 2d.; 3154, 4d.; 3206, 4d.; 3247, 2d.; 3291, 6d.; 3317, 10d.; 3321, 10d.; 3353, 6d.; 3368, 6d.; 3380, 2d.; 3408, 2d.; 3412, 2d.; 3413, 6d.; 3456, 2d.; 3459, 6d.; 3482, 2d.; 3508, 6d.; 3519, 2d.; 3580, 6d.; 3610, 6d.; 3623, 10d.; 3634, 6d.; 3648, 6d.; 3682, 2d.; 3684, 4d.; 3685, 1s. 2d.; 3686, 6d.; 3690, 6d.; 3701, 8d.; 3703, 6d.; 3720, 6d.; 3725, 6d.; 3737, 6d.; 3749, 6d.; 3763, 2d.; 3779, 6d.; 3780, 6d.; 3781, 6d.; 3783, 6d.; 3784, 10d.; 3788, 10d.; 3789, 6d.; 3790, 2d.; 3797, 6d.; 3798, 6d.; 3802, 2d.; 3809, 6d.; 3816, 6d.; 3818, 6d.; 3820, 6d.; 3822, 6d.; 3824, 6d.; 3829, 6d.; 3832, 6d.; 3838, 6d.; 3848, 10d.; 3849, 6d.; 3851, 8d.; 3856, 6d.; 3859, 10d.; 3863, 6d.; 3867, 4d.; 3880, 6d.; 3890, 8d.; 3892, 8d.; 3900, 6d.; 3910, 6d.; 3911, 6d.; 3915, 6d.: 3912, 2d.; 3920, 2d.; 3921, 10d.; 3922, 2d.; 3924, 2d.; 3928, 8d.; 3929, 2d.; 3930, 2d.; 3931, 2d.; 3933, 4d.; 3935, 6d.; 3939, 2d.; 3940, 2d.; 3942, 6d.; 3943, 2d.; 3945, 6d.; 3949, 2d.; 3951, 6d.; 3954, 2d.; 3955, 2d.; 3956, 4d.; 3965, 2d.; 3967, 2d.; 3968, 2d.; 3970, 2d.; 3974, 2d.; 3975, 4d.; 3976, 2d.; 3977, 4d.; 3981, 2d.; 3985, 2d.; 3986, 2d.; 3990, 2d.; 3993, 6d.; 3997, 2d.; 4001, 2d.; 4002, 6d.; 4004, 2d.; 4009, 6d.; 4010, 2d.; 4011, 2d.; 4021, 4d.; 4036, 6d.; 4045, 6d.; 4133, 8d.; 4151, 2d.; 4529, 6d.; 5129, 6d.; 5337, 6d.; 74, 6d.; 274, 6d.

*** 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.*

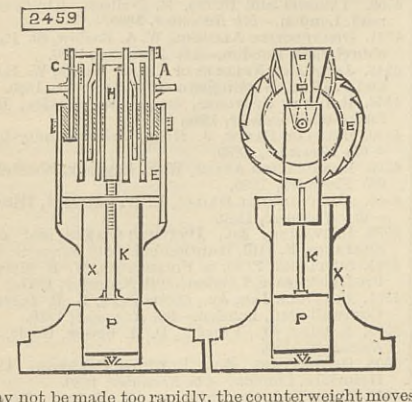
2220. System of Musical Notation, *A. Mills.—Dated* 1st *June*, 1880.—(*Provisional protection not allowed.*) 6*d*.

This consists in having the stave so constructed and printed as to be almost a prolonged facsimile of the keyboard of the instrument, the black notes being, as on the keyboard, the guide to finding the notes.

2459. Railway Signalling, *A. A. Dupont.—Dated* 17*th June*, 1880. 8*d*.

The inventor devises apparatus to show the position, speed, &c., of a train by means of electric signals. He places contact pieces at intervals to be struck by the train or by the signalman. A lever (Figs. 1 and 2) A actuated by the train or otherwise carries round drum H raising piston P in pneumatic cylinder. The return movement is slow. A somewhat similar action goes on when the lever is struck in the opposite direction. The periphery of each contact wheel E and C is divided into four parts, each provided with a group of as many teeth as there are contacts to be made with that particular apparatus. When a train passes the spring arm or projection on the engine strikes the lever A, carries it round a quarter of a circle, and with it the drum H. After the locomotive has passed, the weight P returns the lever and drum to their former position, and carries round one of the contact wheels. In order that the electrical contact

2459



may not be made too rapidly, the counterweight moves as a piston in the pneumatic cylinder, from which it can displace the air but slowly.

2703. Gauntlet Gloves, *J. F. Wanner.—Dated 2nd July, 1880.—(Provisional protection not allowed.)* 2d.

This consists of a cuff made of satin or velvet, and lined so as to keep the wrist warm, attached to the top of the glove, and provided with eyelet holes to receive a lacing cord.

2768. Cartridges, *M. Bauer.—Dated 6th July, 1880.—(A communication from J. G. Soler.)—(Provisional protection not allowed.)* 2d.

This relates to cartridges for short distance practice, and to the weapon for discharging them, which consists of a block of the same size as the bore of the gun in which it is placed, so as to enable a small cartridge to be fired.

2862. Checking Number and Amounts of Fares on Omnibuses, &c., *J. M. R. Francis.—Dated 12th July, 1880.—(Provisional protection not allowed.)* 2d.

A book has its leaves perforated so as to divide it into the number of different fares on the route, and the conductor gives the proper fare ticket to each passenger.

2909. Labels for Express Post, &c., *W. R. Lake.—Dated 14th July, 1880.—(Provisional protection not allowed.)—(A communication from J. H. Small.)* 2d.

This consists of a book of labels, each composed of a stub and address portion, numbered consecutively, and provided with a value designation, the address portion being gummed on its reverse side. A receipt form is combined with the adhesive label, and may be sent out with it, and returned to the sender as a voucher for the receipt of the package.

2967. Self-supplying Compressed Air Engine, *H. Boden, F. Thorn, and H. Ivey.—Dated 19th July, 1880.—(Provisional protection not allowed.)* 2d.

On the shaft of an ordinary engine is fixed a slot wheel or crank connected with a lever attached to air or other pumps, by which means a receptacle is charged with compressed air, which is admitted to the engine cylinder at the required times.

2977. Self-acting Detachment for Life-buoys, *J. F. J. Dahse.—Dated 19th July, 1880.—(Not proceeded with.)* 4d.

A spring is attached to the side of the vessel, and on it hangs a ring attached to the life-buoy, so that should the vessel sink the buoy will be lifted by the action of the water and cause the ring to be detached from the spring.

3044. Carding Engines, *R. Tatham.—Dated 24th July, 1880.* 6d.

One or more knives or bars 6 and 8 having angular edges in contact, or nearly so, with the surface of the "taker-in" 2, and a roller 9 provided with wings or blades is caused to revolve with considerable velocity, the said wings or blades as they revolve being in contact or nearly so with the surface of the taker-in. As the taker-in revolves and takes the cotton from the feed rollers 4 and 5, the motes, seeds, and shell strike against the knives or bars, and if not removed thereby are raised up and are struck off by the blades or wings of the roller, and fall either upon the floor, or

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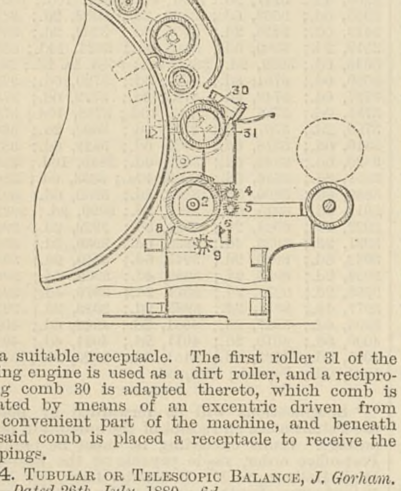

into a suitable receptacle. The first roller 31 of the carding engine is used as a dirt roller, and a reciprocating comb 30 is adapted thereto, which comb is actuated by means of an excentric driven from any convenient part of the machine, and beneath the said comb is placed a receptacle to receive the strippings.

3064. Tubular or Telescopic Balance, *J. Gorham.—Dated 26th July, 1880.* 6d.

This consists of two tubes sliding one within the other, the outer tube being by preference thinner and lighter than the inner one. Near one end of the outer tube a scale pan is suspended by suitable means, in

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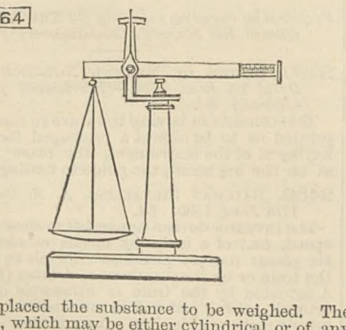

which is placed the substance to be weighed. The inner tube, which may be either cylindrical or of any convenient shape, or in the case of a heavy balance may be of a solid rod, and made of any metal, accurately fits and slides within the outer tube, so that when pressed in or pulled out it retains its position. A point is found upon the outer tube, from which if suspended the tube or tubes and rod will exactly balance the scale pan, and at this point a knife edge is inserted upon which the balance turns. The balance is now at rest, but if the inner tube or rod be drawn out its equilibrium is disturbed. A known weight being placed in the pan, the inner rod or tube is lengthened or shortened until equilibrium is restored. By dividing the space upon the inner tube or rod between the zero point and that point at which the weight referred to is balanced into as many equal intervals as there are grains in the weight a graduated scale is obtained, in which the intervals are all equal, and correspond to equal multiples of weight in the pan.

3069. Ventilating Apparatus, *E. Priestley.—Dated 26th July, 1880.—(Provisional protection not allowed.)* 2d.

A kind of casement is fitted against the inside and extending about half way up the window. This casement is formed with only three sides, and without a top, the part coming against the window being the open part. Glass doors may be formed in the front, so as to enable the window to be opened and closed to allow air to enter.

3122. Shaping and Finishing Hat Brims, *G. Cook.—Dated 29th July, 1880.—(Provisional protection not allowed.)* 2d.

To curl the brims a plate is used which has a central opening for the passage of the hat body, and its outer edge is thicker at the sides than at the ends, and is tapered off gradually. The edges of the sides are rounded to suit the intended curl of the hat brim. The hat with the plate on it is first operated upon by a machine which moulds the brim, and then by the ironing down machine, after which the plate is removed.

3128. Transport of Vehicles by Gas Engine Power, *J. R. Pursell.—Dated 29th July, 1880.—(Provisional protection not allowed.)* 2d.

This relates to improvements connected with the transport of cars by gas engine power.

3154. Knife Cleaner, *J. Hunt.—Dated 31st July, 1880.* 4d.

The drawing is a cross section, in which A is the frame, made by preference of one casting, and B is a cover secured by set screws; D is a presser plate or cap by which the strips of india-rubber F G H and I

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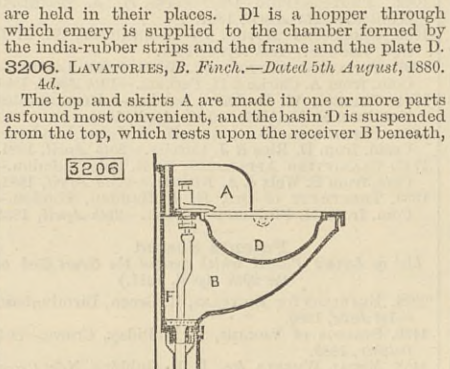

are held in their places. D^1 is a hopper through which emery is supplied to the chamber formed by the india-rubber strips and the frame and the plate D.

3206. Lavatories, *B. Finch.—Dated 5th August, 1880.* 4d.

The top and skirts A are made in one or more parts as found most convenient, and the basin D is suspended from the top, which rests upon the receiver B beneath,

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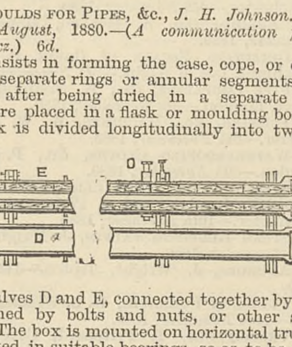

this latter being supported by a pilaster C forming base, and enclosing both supply pipe F and waste pipe.

3247. Bankers' Cheques, &c., *J. Tullidge.—Dated 9th August, 1880. — (Provisional protection not allowed.)* 2d.

This relates to the prevention of fraudulent alterations of cheques by means of a series of numbers which can be torn off so as to indicate the sum for which the cheque was originally drawn.

3291. Moulds for Pipes, &c., *J. H. Johnson.—Dated 12th August, 1880.—(A communication from J. Kudlicz.)* 6d.

This consists in forming the case, cope, or exterior mould in separate rings or annular segments, which segments after being dried in a separate drying chamber are placed in a flask or moulding box. The mould box is divided longitudinally into two semi-

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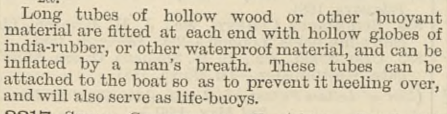

circular halves D and E, connected together by hinges, and fastened by bolts and nuts, or other suitable devices. The box is mounted on horizontal trunnions O, supported in suitable bearings, so as to be capable of being caused to assume a horizontal or vertical position as required.

3380. Treating Limestone, *A. H. J. Douglas.—Dated 20th August, 1880. — (Provisional protection not allowed.)* 2d.

This relates to the treatment of limestone so as to render it fit for manurial, building, and other purposes, and consists in dispensing with burning the limestone in contact with fuel. The limestone is reduced to a pulverised state by means of stamp press or crusher.

3408. Steadying Floats for Ships and Boats, &c., *R. Grahame and C. E. A. Baloche.—Dated 23rd August, 1880.—(Provisional protection not allowed.)* 2d.

Long tubes of hollow wood or other buoyant material are fitted at each end with hollow globes of india-rubber, or other waterproof material, and can be inflated by a man's breath. These tubes can be attached to the boat so as to prevent it heeling over, and will also serve as life-buoys.

3317. Steam Generators, *H. Ashton.—Dated 16th August, 1880.* 10d.

The generator is designed to effect an efficient circulation of water, and procure a rapid and ample generation of steam with a moderate consumption of fuel. It consists of a horizontal steam generator 1, fitted with fire or flame tubes 2, and having at each end water spaces 3, formed in the standards which support the generator. A horizontal tube 4 connects the two water spaces, and it is placed partly above and partly below the fire-bars, the portion below the bars serving as a mud chamber or sediment collector, to remove

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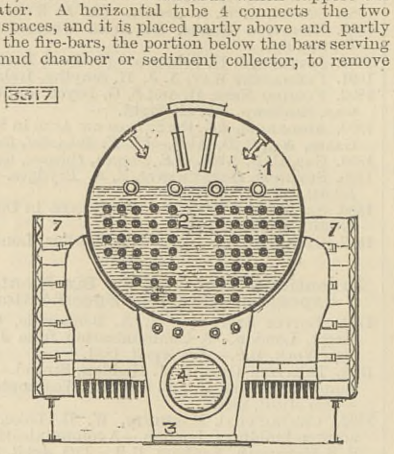

which a door is provided at one end of the tube. The generator is surrounded by a brick chamber 7, through openings in which the air to support combustion enters.

3321. Effecting the Combustion and Utilisation of Fuel, *W. L. Wise.—Dated 16th August, 1880.—(A communication from B. Rober.)* 10d.

The drawing represents a longitudinal section of an arrangement of fire-grate. F are the bars of the grate; G the generator; and H and J doors arranged in the front wall of the furnace; M is a partition separating the space H^1 under the fire-grate, from a space I in front of the entrance damper L of the generator; another damper K affords or prevents communication between the two spaces H^1 and I. The base of the generator is formed by a water pan N, in the upper portion of which is a grating N^1, which extends from the base of the generator to the bottom of the water contained in the pan N, for introducing steam and

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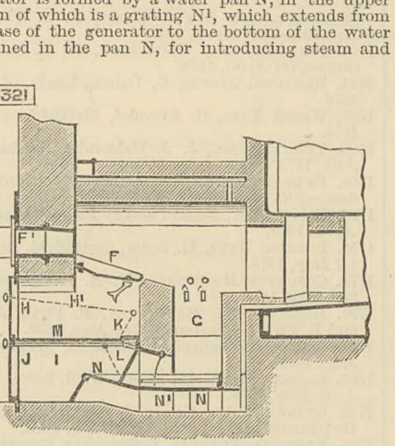
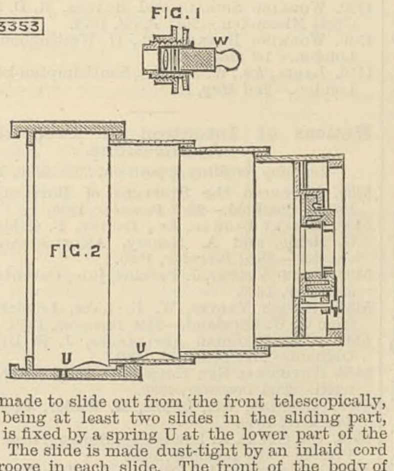


cooling the grate-bars and the sides of the generator. The fuel is fed by being pushed slowly and continuously or periodically through the channel F^1, and its volatilisation or partial combustion takes place on the fire-grate bars F. The coke formed on the fuel carbonised then falls into the generator and fills it. The dampers J K and O O having been closed—on the ignition—and the damper H only having been opened, a large quantity of air is introduced, it may be by the open spaces of the grate-bars, which gives, in combination with the mixture of gas proceeding from the generator, the requisite degree of combustion.

3353. Photographic Cameras, *W. F. Stanley.—Dated 18th August, 1880.* 6d.

Fig. 1 shows improvements in the lens, which consist in enclosing the lens in a metal case, so that one or two may be used at one time to alter the focus of the camera without the risk of scratching the lens or the need of a separate cell fixed in the lens mount. The inner fitting of the lens is made to screw for a fine adjustment. The stops are made with exterior out-turned rim and slide in from the front. A plug W is used to close the lens, instead of an external cap. Fig 2 shows the body of the camera, the separate parts

3353



being made to slide out from the front telescopically, there being at least two slides in the sliding part, which is fixed by a spring U at the lower part of the slide. The slide is made dust-tight by an inlaid cord in a groove in each slide. The front of the body of the camera is made to tip the lens to an angle by fixing one part within another. The third part of the invention relates to improvements in the dark slide, and consists in making an inner adapter to carry dry plates to fit the ordinary slide, there being six adapters to hold twelve dry plates, so that the dark slide is in two parts, the carrier and the adapter, instead of being one part as hitherto.

3368. Carding Engines, *B. A. Dobson.—Dated 19th August, 1880.—(Partly a communication from J. Beck.)* 6d.

This consists, First, in shaping or forming ridges or grooves in the inner surface of the covers of carding engines when such covers are close to the card wire, the section of the covers presenting a serrated appearance. The ridges are made at an angle more or less acute to the circumference of the card wire, and set with their projecting edges towards the fibre as it is carried round by the cylinder, thus tending to straighten or smooth the cotton or other fibre being operated upon. The Second part consists in placing a V-shaped box between the main cylinder and the doffer, of which the serrated card cover forms one side; and supported in bearings in this box and parallel to the axis of the card cylinder is placed a fluke rod, which is caused to revolve by friction bowls, one on the end of the fluke rod and one on a stud driven by the one edge or both edges of the doffer, and so arranged that the diameter of the lap on the fluke rod does not interfere with the driving, and so as to be removable by lifting straight out. At the upper side of this box a slot is made in the serrated card cover just below the flats, and the full width of the cylinder. In this slot is placed a blade or doctor which catches the neps, or motes, or leaves, or fly in the fibre being carded, and causes them to be thrown

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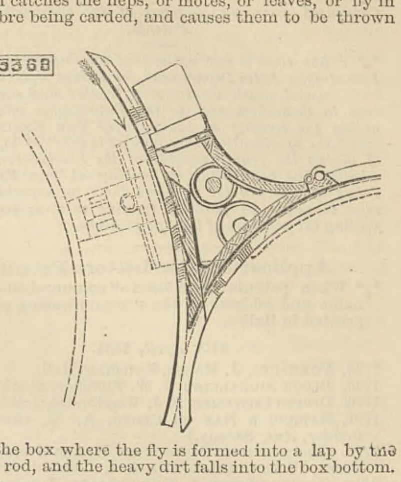


into the box where the fly is formed into a lap by the fluke rod, and the heavy dirt falls into the box bottom.

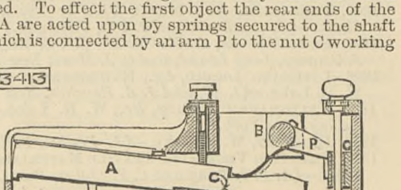
3412. Bankers' Cheques, &c., *J. Fielding.—Dated 23rd August, 1880.—(Provisional protection not allowed.)* 2d.

This relates to the application of a series of figures to be obliterated by a perforating stamp, so as to indicate the sum for which the cheque was originally drawn, thus preventing fraudulent alteration.

3413. Digitoriums, &c., *W. and T. H. Lowe.—Dated 23rd August, 1880.* 6d.

This relates to means for rendering adjustable the weight and depth of touch of the keys in digitoriums or dumb key boards used to strengthen the fingers and wrists of musicians, and also in mounting the keys so as to ensure smooth and noiseless action, at the same time allowing their easy removal when desired. To effect the first object the rear ends of the keys A are acted upon by springs secured to the shaft B, which is connected by an arm P to the nut C working

3413



on a screw, and by raising or lowering which the pressure of the springs can be regulated. The rail adjustable by means of the screw as shown, regulates the depth of touch. The keys are pivotted so as to move smoothly and noiselessly by forming a groove in their under sides, into which fit the heads of a series of T-shaped pins G, a spring keeping them in position.

3456. Application of Alloys of Iron, *C. F. Claus.—Dated 26th August, 1880.—(A communication from H. Velsmann.)—(Provisional protection not allowed.)* 2d.

The apparatus, tools, and machinery which are exposed to the action of mineral acids, are made of silicon iron, that is, an iron containing larger quantities of silicon or silicide of iron than is found in the ordinary cast iron of commerce.

3459. Unsinkable Boats and Ships, *W. E. Gedge.—Dated 26th August, 1880.—(A communication from P. Duval.)* 6d.

This consists in the application of cork in plates, sheets, planks, or suitable pieces L superposed along

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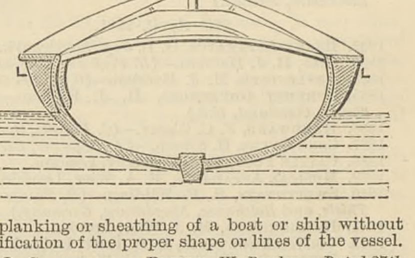


the planking or sheathing of a boat or ship without modification of the proper shape or lines of the vessel.

3482. Grammatical Puzzle, *W. Rowley.—Dated 27th August, 1880.—(Provisional protection not allowed.)* 2d.

This consists of a set of movable or exchangeable blocks or plates having on one or more sides words or letters used in teaching grammar, such words being arranged in a systematic manner, according to the particular purpose for which the blocks are intended.

3508. Folding Seats, Forms, and Tables, &c., *H. Kinsey.—Dated 30th August, 1880.* 6d.

As applied to seats or forms with a "back" rail, the seat, legs, and back rail are made in separate parts, the legs being hinged to the underside of the seat, so as to allow them to fold under it. On each leg at the back of the seat is fixed a support which is continued up and carries the back rail. The legs are similarly attached when this invention is applied to tables.

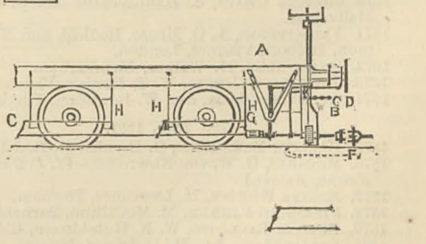
3519. Dormer Windows, *W. R. Lake.—Dated 30th August, 1880.—(Void.)* 2d.

The frame portion of these windows is formed from a single piece of rolled sheet metal, and is so made that there is a flat or horizontal base to fit upon the roof, and the metal is turned up all round on the inside edge of the base, so that there is no necessity to solder or rivet the flat and vertical portions together, and an embossed or raised rib or border is provided on the base.

3580. Brake Apparatus for Railway Trains, *R. Smith.—Dated 3rd September, 1880.* 6d.

A shaft A is arranged running transversely across the vehicle under or near the buffer plank, supported by suitable guides B. Attached to this shaft are arranged two arms C C, fitted with forks or horns D to embrace each buffer rod and abut against the inner face of the buffer. To the ends of the shaft a link is attached, or its equivalent, the lower end of which clutches a boss which is threaded to receive the end

3580



of the rod F, which operates the usual system of levers G operating the brake blocks H. On the end of the screwed rod is fixed a cog wheel longitudinally. Below each van or carriage is arranged a shaft carrying a wheel or excentric, to which is attached a crank operating a bell crank lever carrying another small pinion or cog wheel at its extremity, and having an escapement fitted to fall into its teeth and permit revolution only in one direction. These shafts are arranged to clutch or connect with each other throughout the train.

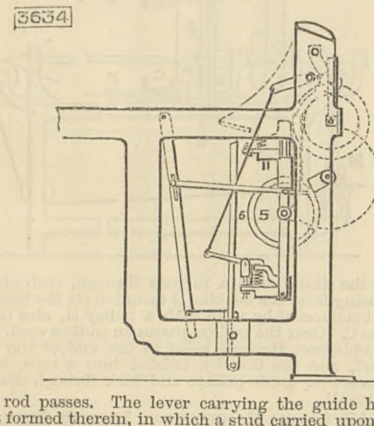
3623. DISTRIBUTING AND COMPOSING TYPE, *J. Dittrich and P. Ganty.—Dated 6th September, 1880.* 10d.

The First part of the invention relates to the distribution of type. The types are arranged face upwards in an inclined stick at the lower end, and at right angles to which is a pushing device, against which the types are pressed by a strip of metal behind them. On the pushing device is a shoulder, not greater than the narrowest type, and which is adjustable to suit different sizes of type. When the pusher is actuated the lowest type falls down on to a metal table having a race diagonally across it, from which a number of parallel channels extend to the bottom of the table. The top of each channel has a door, which is normally shut, and it is these covers which, when shut, form the race. The types are distributed by means of keys, of which there is one for each channel. The Second part of the invention relates to improvements in apparatus for distributing and composing type, and consists in the application to the bent arms of springs to arrest the descent of all but the lowermost type, also the application, in connection with the wall between the grooves of guide pieces, hinged so as to prevent the type turning. Thirdly, the arrangement, in combination with the cam which pushes the type along the case or stick, of two plates which prevent the entry into the case of more than one type at a time.

3634. TAKING-UP MOTIONS FOR LOOMS, *W. Clayton.—Dated 7th September, 1880.* 6d.

A disc or pulley 5 provided with a flange 6 is mounted upon a stud carried by a bracket attached to the loom, and connected by gearing to the usual roller, upon which the piece as woven is wound upon the stud. A lever is mounted on a shaft, turning loosely thereon, the end of which carries a guide piece capable of turning therein, through which guide a rod 11 passes, the other end of the rod embracing the flange of the pulley 5, so that it will slide around the said flange in one direction only, being prevented from sliding around the flange in the other direction by a spring acting upon the guide piece, through which

3634



the rod passes. The lever carrying the guide has a slot formed therein, in which a stud carried upon one end of the rod connected to the slay passes, which as the slay vibrates imparts motion to the aforesaid lever, and thereby through the medium of the guide piece and rod runs the disc in the direction for taking up. To compensate for the increasing diameter of the cloth or beam, as the cloth is wound thereon the pin passing through the slot in the slotted lever is caused to move further from the fulcrum thereof. Extending from the bracket aforesaid is an arm, which carries a guide piece, mounted so as to be capable of turning therein, but forced in one direction by a spring, and through which guide piece a rod passes, one end thereof embracing the flange of the disc or pulley, and which is thereby allowed to be turned in one direction by the previously described apparatus for taking up, and such movement having taken place will retain the said disc or pulley in that position until it is again acted upon for taking up.

3648. COMBINED LAMP AND TIME INDICATOR, *F. M. Robertson and J. Joyce.—Dated 8th September, 1880.* 6d.

The varying level of the oil used for producing the light is utilised to actuate the time indicating mechanism; and also, when desired, to ring an electric bell and warm food. The oil reservoir contains a float to which a rod is attached, such rod having teeth to gear with a wheel on the shaft carrying the hands, which moves over a clock dial. To ring the bell the hand at the desired time is caused to bear upon a pin, and so complete an electric circuit in which is a bell.

3682. PLAYING CARDS, *N. Salamon.—Dated 10th September, 1880.—(Provisional protection not allowed.)* 2d.

This consists in printing the four different suits in a pack of cards, in four distinct colours, so as to prevent confusion.

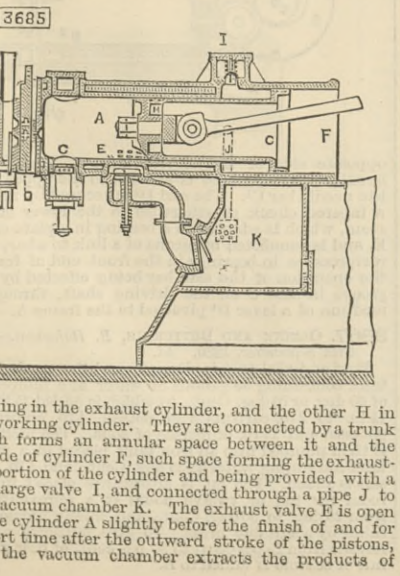
3684. JACQUARD MACHINERY, *T. Spivey.—Dated 10th September, 1880.—(Not proceeded with.)* 4d.

This relates to the slot formed in the needles, which receive the jack hooks and soon get enlarged by friction, to remedy which a loose piece is inserted in the flat and pressed by a spring against the jack hook. A new joint is employed to join the jack hooks and jack levers.

3685. ATMOSPHERIC AIR AND GAS MOTOR ENGINE, *H. Williams and J. Malam.—Dated 10th September, 1880.* 1s. 2d.

The cylinder is bored to two diameters, the smaller A, being the working cylinder, is closed at one end and has an admission valve C, ignition valve D, and exhaust valve E. The larger diameter F is used as an exhausting cylinder. Two pistons are used, one G

3685



working in the exhaust cylinder, and the other H in the working cylinder. They are connected by a trunk which forms an annular space between it and the outside of cylinder F, such space forming the exhausting portion of the cylinder and being provided with a discharge valve I, and connected through a pipe J to the vacuum chamber K. The exhaust valve E is open to the cylinder A slightly before the finish of and for a short time after the outward stroke of the pistons, and the vacuum chamber extracts the products of combustion from the cylinder A, causing a vacuum, so that when the exhaust valve E closes, a fresh charge rushes in through the valve C and is compressed by the in stroke, being afterwards ignited by valve D.

3686. COOLING ATMOSPHERIC AIR, *J. Sturgeon.—Dated 10th September, 1880.* 6d.

This relates to machinery by which cold is produced by the compression and after expansion of air, and it consists in applying an independent air compressing cylinder for compressing air to drive an entirely independent expansion cylinder which is employed to drive another air compressing cylinder for supplying an extra quantity of compressed air; thus there are two compressing cylinders A and A[1], the latter driven by the steam cylinder E, and the former by the expansion cylinder C. By this arrangement the

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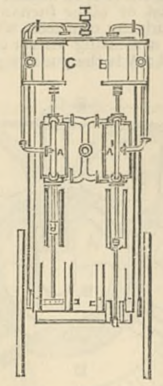


relative speeds of the compression and expansion cylinders can be varied so as to obtain the best effect by regulating the speed of the expansion cylinder to suit the volume of air returned from the compression cylinder. So as to regulate the proportion between the compression and expansion cylinder, a crank lever or arm is coupled to the expansion cylinder, and so arranged that by varying the throw of the crank the stroke can be altered, the piston being adjustable to suit the stroke.

3690. BOOTS AND SHOES, *C. F. Gardner, and W. H. Dorman.—Dated 10th September, 1880.* 6d.

This relates partly to apparatus for trimming heels, and consists of a clamp for holding the boot firmly and presenting it to the trimming knife, such clamp being formed in two parts hinged together, and with a flange for securing it to the U-shaped frame of the machine described in patent No. 2736, A.D. 1872, and a broad curved and inclined rim which encloses and conforms to the shape of the seat or back of the boot, and while holding the same serves as a guide. The knife is arranged to bear against the rim, which is formed so as to cause the upper part of the knife to move in the desired path, while the lower part is guided by a cam which causes it to move in a path corresponding with the shape of the top piece of the heel. When the heels have a large pitch or slope the knife has an up-and-down movement imparted to it during its passage round the heel. To attach the soles and heels to boots, rivets or nails are simultaneously driven into the boot by means of a die and series of drivers, the die being of the shape of the sole, and having holes into which the drivers enter and force the rivets into the sole or heel.

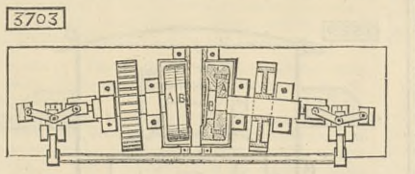
3701. LOCK AND LATCHES, *J. M Hart.—Dated 11th September, 1880.* 8d.

As applied to railway doors the lock or latch consists in forming a recess in the bolt to receive an arm of the central axis, which withdraws the latch bolt, the latching movement being actuated by a lever player maintained in working position by springs. The dead bolt is worked by a second arm from the central axis acting upon a reversing lever, the opposite end of which works in a recess in this bolt. The central axis is held in position by the toothed end of a separate trigger lever working on its own centre and actuated by a spring. The two arms of the central axis are applied in relation to each other, so that when the dead bolt is withdrawn, the latch bolt is free to act, but when the latch bolt is withdrawn the dead bolt will remain unmoved. If the handle of the lock be turned partly round in the opposite direction until a tooth of the trigger lever catches into a notch provided for it, the second arm will actuate the reversing lever and cause the dead bolt to be thrown forward. By the same action the first arm will be caused to abut against a curved portion of a recess in the latch bolt, thus effectually blocking that bolt in a locked position, and giving the lock the strength of two dead bolts.

3703. FORMING SCREW THREADS, *G. W. von Nawrocki.—Dated 11th September, 1880.—(A communication from W. Erichson.)* 6d.

This consists in a machine for producing screw threads on a bolt or other article while hot or plastic, in the application of two discs A placed excentrically to each other and having concentric rings or dies B

3703



with grooves corresponding to the desired screw thread, the said discs being revolved in opposite directions, so that the rings or dies produce screw threads on the bolt or other article placed between them.

3725. SEWING MACHINES FOR STITCHING SACKS, BAGS, &c., *W. Webster.—Dated 13th September, 1880.* 6d.

Fig. 1 represents a front elevation of the machine, and Fig. 2 is a plan partly in section. B B[1] are the

3725

FIG 2

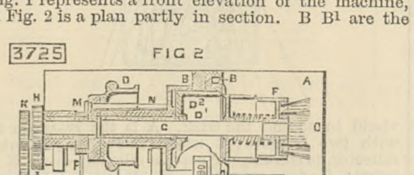
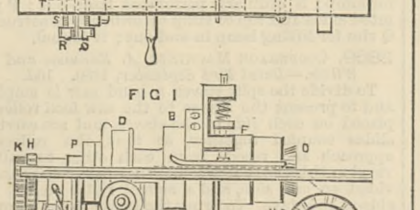


FIG I



needle carriage or disc and the fixed face cam, having a horizontal sliding movement upon the bed A and the shaft C; D is the driving pulley mounted upon and fixed to the sleeve D[1], which carries the driving disc D[2], in which disc are mounted arms, dogs, or drivers, the hooked ends of which engage with the notches or shoulders of the curved needle, and give to it a continuous rotary motion in the groove or track of the needle carriage or disc. Each of the said arms, dogs, or drivers, is furnished at its hooked end with a pin and roller. These rollers take into and are guided by the fixed face cam, and by it are respectively in turn withdrawn from contact with their respective notches of the needle, previously to each notch passing through the material operated upon, and by the said fixed face cam are caused to re-engage with the needle soon after it has passed through the said material, so that there is imparted a positive and continuous rotary motion to the needle. F is a telescopic cylindrical take up, its extension being effected by a spiral spring. The relative surface speed of this take-up to that of the needle is effected by the train of gearing H I J K. The wheel H is fixed or connected to the excentric M and revolves with it and the driving pulley D, the two being connected by a finger or pin N, and the wheel K is fixed to and drives the shaft C, and the cylindrical take-up in the same direction as the needle, and at each revolution as the material advances quicker than the needle carriage or disc, causes a coil of the thread or twine to be slipped off the end of the take-up, one loop at a time, which, being acted upon by the revolving brush O and again taken up by the end of the take-up cylinder, imparts a sufficient amount of tension for producing the requisite tightness of the stitch. The excentric M is for giving motion to the feeding arrangement of the material, and also to advance the needle carriage or disc, the former of which operations is effected by or through the link P, lever Q, and pawl R, acting on the ratchet wheel S on the shaft T, on the other end of which is the bevel pinion U, taking into and driving the wheel V, on the back of which is the cog wheel V[1], which gives motion to the endless serrated chain W for moving the material along at each stitch.

3720. LIQUID METERS, *H. J. Haddan.—Dated 13th September, 1880.—(A communication from P. T. y Puig.)* 6d.

This consists in measuring the quantity of water flowing through a pipe by discharging it into a balanced vessel and counting the oscillations. The water enters at E, and passing upwards enters the balanced vessel B, which is divided into two compartments alternately filled and causing the shaft on which

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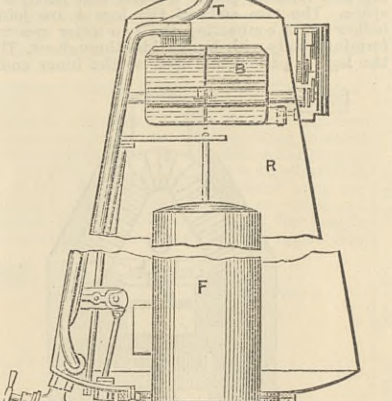

it is mounted to oscillate, and by suitable mechanism to drive a counter. The water measured accumulates in the bottom of the receiver R and causes the float F to rise, so as to shut off the supply and allow the water to be discharged by the pipe T, under the action of the air compressed in the upper part of the receiver.

3737. TOOLS FOR EXPANDING BOILER TUBES, &c., *W. Thorburn.—Dated 14th September, 1880.* 6d.

The object of the improvement is to make an expander for uniformly fitting the tube to any thickness of boiler plate to avoid the use of hammering or driving tapering, and consequently all concussion and jarring of the tube in the process of expanding and fitting it to the plate is obviated. According to one mode of carrying the invention into effect three or more conical expanding rollers B are made to

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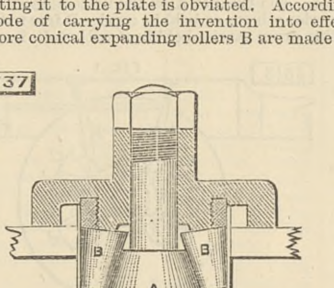


work in a cylindrical mandril or stock E for inserting in the end of the tube C to be expanded. The rollers B are acted upon by a central expanding mandril A, the stem of which passes out and is screw-threaded to receive a nut, so as to cause the mandril A to act on the rollers B and bring them in contact with the end of the tube, when the whole apparatus is turned round by means of a ratchet lever.

3749. CARDING AND PREPARING WOOL, &c., *E. Wilkinson.—Dated 15th September, 1880.* 6d.

This consists in dispensing with the workers and strippers now used, and employing instead a series of combs of iron or hardened and tempered steel. Fig. 1

3749

FIG. I

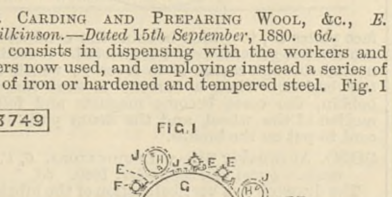
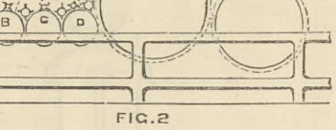


FIG. 2



shows the manner of employing the combs, and Fig. 2 is a detail of the comb. A is the licker-in, and B, C, and D Garnett toothed rollers, with combs E mounted over them and brushes F to strip or brush the material retained by the comb teeth back to the rollers until all the hard or felted material is opened before arriving on the card cylinder or swift G, over which four combs are mounted and two "fancies" H with cleaning reeds J. The combs E are fixed to a bar of angle iron carried by brackets attached to the ordinary "bends," the same brackets also supporting the brushes F. The reed J is made from continuous lengths of drawn wire woven between strips of wood, leather, cloth, felt, or gutta-percha.

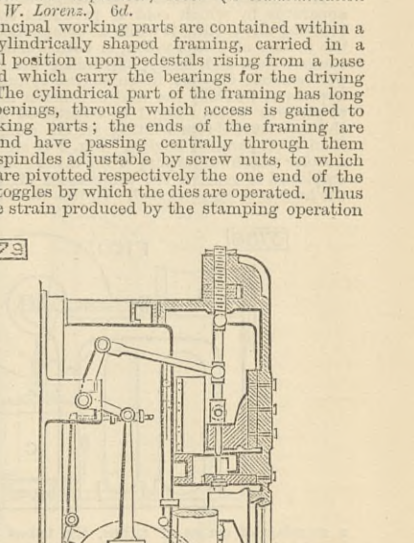
3763. PLATES, *F. H. L. Stelling and G. T. Harrap.—Dated 16th September, 1880.—(Provisional protection not allowed.)* 2d.

This consists in forming recesses in the rims of plates to receive the condiments used.

3779. PRESSES FOR STAMPING WITH DIES, *C. D. Abel.—Dated 17th September, 1880.—(A communication from W. Lorenz.)* 6d.

The principal working parts are contained within a hollow cylindrically shaped framing, carried in a horizontal position upon pedestals rising from a base plate, and which carry the bearings for the driving shafts. The cylindrical part of the framing has long lateral openings, through which access is gained to the working parts; the ends of the framing are closed, and have passing centrally through them screwed spindles adjustable by screw nuts, to which spindles are pivotted respectively the one end of the opposite toggles by which the dies are operated. Thus the entire strain produced by the stamping operation

3779



is transmitted through the axial line of the cylindrical framing from one end to the other thereof; so that this form of framing offers the greatest possible strength to resist such strains. There are two opposite sets of toggles, each of which actuates one of two opposite dies, to each of which a to-and-fro motion is imparted by the action of a rod in a transverse direction upon the elbow of the toggle. The rod of the one set of toggles is actuated directly from a crank on the driving shaft, while the other is actuated by a cam on the same shaft acting on adjustable rollers in a sliding frame on the end of a rod, which is connected by a bell crank to the said rod of the toggle.

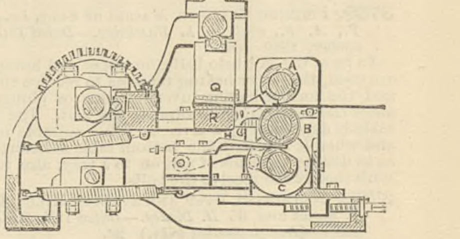
3780. ROSES OF DOOR-KNOBS, *F. R. Meeson and J. T. Hopkinson.—Dated 17th September, 1880.* 6d.

This relates, First, to improvements on patent No. 740, A.D. 1868, and consists in means for facilitating the fixing of the rose to the door, for which purpose a washer is formed with an external screw thread, and is secured to the door before the knob is fastened to the spindle. The rose is screwed on to this washer, and is carried on the neck of the knob. The Second part of the invention relates to knobs fixed to the spindles by neck screws, and consists in fitting a collar round the neck of the knob, such collar having a flange at its ends, which can turn within the rose, and so prevent the fastening screw acting on the latter and forcing it off.

3781. NAILS AND SPIKES, *H. Sharrow and T. King.—Dated 17th September, 1880.* 6d.

The drawing shows the rolls about to feed forward and shape a length of nail rod to form a nail, a headed nail being represented in the act of being removed from the lower shaping and gripping die by the

3781

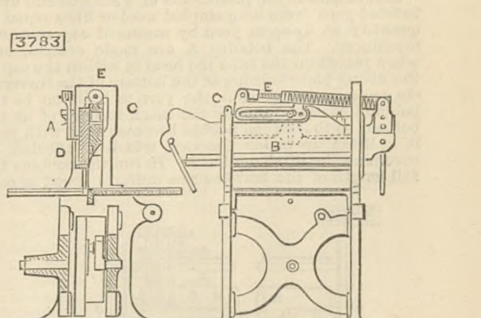


length of rod last shaped by the rolls. A, B, and C are the rolls, the two former serving to feed forward and taper and point the heated length of rod, and the latter for driving the roll B and closing it upon the upper roll A for giving the taper to the nail rod. The upward movement of the roll B is effected by means of the arm H, which passes through the rolls B and C. The tapered length of rod then passes between the dies Q and R, which form the head and separate the complete nail from the rod.

3783. PAPER-CUTTING MACHINES, *J. Salmon and J Capper.—Dated 18th September, 1880.* 6d.

This refers to machines where the paper is clamped by self-acting means. According to one modification, a slotted link C is jointed to the upper edge of the knife bar B, and in the slot a bowl works, which is carried upon a stud in the clamping plate D, which

3783



stud also carries another bowl at the back of the plate D, working in a vertical slot in a cross bar A. To a projection on the link C one end of a screwed rod E is jointed, the other end passing or sliding through a hole in a swivel piece carried by brackets bolted to the knife bar. Upon this rod a spring is placed. On the underside of the link is a pin that rests on the upper edge of the knife bar B. When the knife descends, and the clamp D comes upon the paper, the bowl in the clamp acts upon the slotted link C, and causes it to assume a greater or less angle, according to the thickness of the paper being cut.

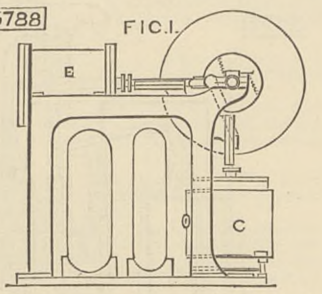
3784. ELECTRIC TYPE PRINTING TELEGRAPH APPARATUS, *G. J. Droste.—Dated 18th September*, 1880. 10d.

This apparatus belongs to that class of type printing telegraphs in which by continuous contact closings and interruptions of the line current passing through the electro-magnets of the instrument in connection, the type disc is moved round from letter to letter, until the type of the letter to be telegraphed stands opposite the printing appliance, which, when put into action, prints it on a paper band. The inventor makes eighteen claims and illustrates by intricate drawings

3788. COOLING AND DRYING AIR, *A. M. Clark.—Dated 18th September*, 1880.—(*A communication from L. Allen.*) 10d.

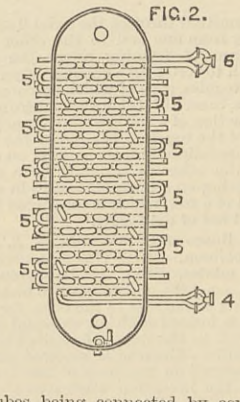
This relates to that class of cooling or refrigerating apparatus in which cold is produced by first compressing air, cooling it while so compressed, or during the process of compression, or both during and after compression, and, lastly, expanding the same in the performance of work in an engine cylinder or other appliance, whereby the said expansion may be made to perform work. Fig. 1 is a sectional side view of the apparatus C representing an air compressor, and E an air expanding engine. Fig. 2 is an end view of a cooler which forms part of the invention. A shell is employed to receive the compressed air from which the heat is to be extracted. In this shell are inserted

3788 FIG.1.



a number of series of tubes, the tubes of the first series being arranged in a series one above the other, in such manner that each tube of each series lies below a space between two adjacent tubes in the next series above or below it, lying in the same direction. The tubes of the second series are placed at right angles to the first series. Water enters the lower tubes of the first series through a branch 4, and passes alternately back and forward through the tubes of the lower series, until it reaches the last one of the

3788 FIG.2.



series, these tubes being connected by connectors. Upon reaching the last tube of the lower series it rises through one of these connectors 5 to one of the tubes in the next series above it; thence it passes forward and backward through the tubes of this series till it reaches the last of the tubes of that series; thence it passes through another connector 5 into the series above it, and so on until it is passed through all the series of tubes, and finally emerges at a branch discharge pipe 6. Water enters one of the tubes of the lower series of tubes of the second series through the branch pipe 4, and passes in a similar manner through all the tubes of each of the series of tubes till it reaches the branch discharge pipe 6, whence it flows out.

3789. FORMING BALLS OR MASSES OF SALT, &c., *R. J. T., A. F., and H. L. Hawksley.—Dated 18th September*, 1880. 6d.

To form the salt into balls, an upper and lower table are used, the latter having recesses to receive the salt, and the former having inverted cups or plungers to enter the recesses and compress the salt. The upper table is depressed by a lever or other suitable means, and when it is raised the bottom table is inverted, so as to deliver the balls of salt on to a tray, also formed with recesses to receive the balls.

3790. COLLECTING DUST AND STIVE IN MILLS, &c., *G. T. Smith and W. H. Dickey.—Dated 18th September*, 1880.—(*Not proceeded with.*) 2d.

The air and dust from milling machinery is forced into a chamber covered with wire cloth, which acts as a filter to separate the dust from the air in its passage through the cloth, and as the dust collects on its surface it is removed and discharged from the apparatus by blast or suction fans.

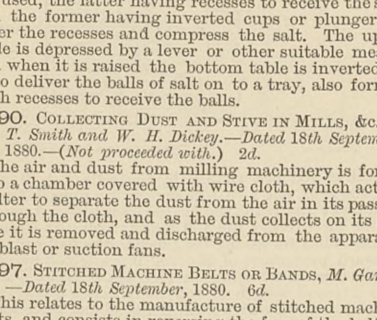
3797. STITCHED MACHINE BELTS OR BANDS, *M. Gandy.—Dated 18th September*, 1880. 6d.

This relates to the manufacture of stitched machine belts, and consists in reversing the face of the belt for each alternate row of stitching, so that the belt is sewn on both sides, whereby a better effect is obtained, special appliances being employed so as to present alternately the opposite sides of the belt to the action of the sewing machine.

3798. SPINNING MACHINERY, *W. Jennings and T. Whitaker.—Dated 18th September*, 1880. 6d.

This relates to the production of a smooth and even twisted yarn from long stapled wool or fibre equal in quantity to fly-spun yarn by means of cap spinning machinery. The bobbins A are made conical, and when placed on the tube the head is within the cap C, the lifting plate D being at the bottom of the traverse. On commencing to spin, the yarn is built on to the bobbins at the top near the head, instead of at the bottom, so that as the bobbin becomes filled with yarn it is lifted up inside the cap, which is effected by reversing the lifter motion E. To run the bobbins the full length of the traverse at a uniform speed in rela-

3798



tion to the other parts of the machine driven with gearing, and to obtain the same twist and smoothness in the yarn throughout, the cylinder H is raised at such a speed that the centre of the cylinder retains the same relative position in height to the tube wharls J as they are raised by the lifter plate D, by which means the bands which drive them keep at the same tension the full length of the traverse.

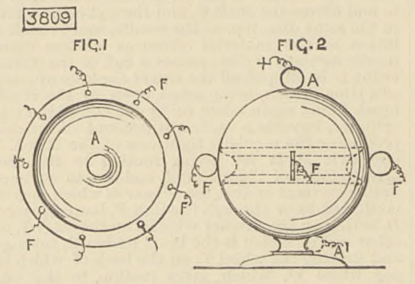
3802. PENCIL SHARPENER AND PROTECTOR, *B. S. Cohen.—Dated 18th September*, 1880.—(*A communication from C. J. Cohen.*—(*Not proceeded with.*) 2d.

A piece of steel is bent to a tubular form, one end of which is conical, and one edge formed into a knife edge, by which the end of the pencil is sharpened, such conical part also acting as a protector by drawing the point of the pencil within it.

3809. DIVIDING AND SUBDIVIDING THE ELECTRIC CURRENT FOR LIGHTING, *J. B. Rogers.—Dated 20th September*, 1880. 6d.

The idea embodied in this invention will be best understood by reference to a specific example. Fig. 1 represents a metallic disc, with central bending screw at A and peripheral bending screw at F F F. The current from the machine coming to A divides itself equally in all directions over the disc, and is led from

3809 FIG.1 FIG.2

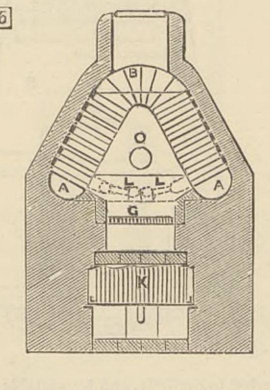


the binding screws F F F to the point required. In Fig. 2 the distributing apparatus is globular, the current being brought to the globe by A or A1, and taken away at F F F as before. Each of these currents at F F F can be taken to another disc and similarly divided.

3816. STEAM GENERATOR, *H. E. Newton.—Dated 21st September*, 1880.—(*A communication from D. Davison.*) 6d.

The section of the primary generator is that of a saddle, and consists of two horizontal water legs A set wide apart at the bottom and inclining upwardly and inwardly, a hollow arch B uniting them at the top and forming partly a water and partly a steam space. The two ends of the legs A are joined by hollow parts connecting the two water spaces, thus forming a body with double sides throughout. Through the legs A pass tubes, open at the inner ends, and

3816



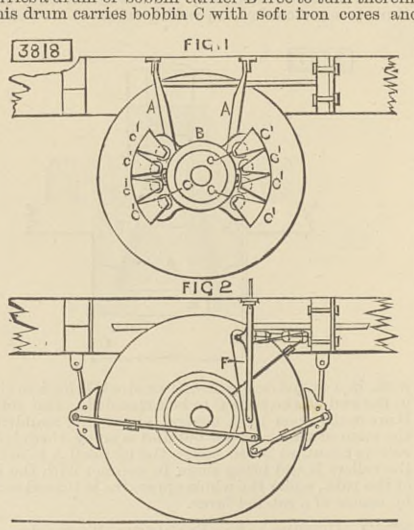
closed at their outer ends. Across the interior of the legs near the middle are partition plates. Between the legs is the fireplace G, behind which is placed the secondary generator K, consisting of an upright cylinder, containing a series of upright tubes, through which the gaseous products of combustion pass downwards. The feed enters K at the lower end, and the upper part of K is connected by pipes L to the lower ends of the legs A. Below the secondary generator K is a pit leading to the main flue.

3818. CONTINUOUS RAILWAY BRAKES, *G. A. C. Boothby.—Dated 21st September*, 1880. 6d.

This patent relates to modifications of a previous one. The bracket A on the underside of the carriage carries a drum or bobbin carrier B free to turn therein. This drum carries bobbin C with soft iron cores and

3818 FIG.1

FIG.2

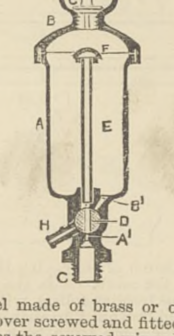


face plates C1, to which bobbins the conductors from the electric generators are connected. A cord is connected through tackle E to lever F, which operates the brakes. When a current is sent through the bobbin, the cores become magnets and follow the motion of the wheel, and the drum pulls upon the cord to put on the brakes.

3820. AUTOMATIC STEAM LUBRICATORS, *C. C. Braithwaite.—Dated 21st September*, 1880. 6d.

The drawing is a vertical section of the lubricator, in

3820

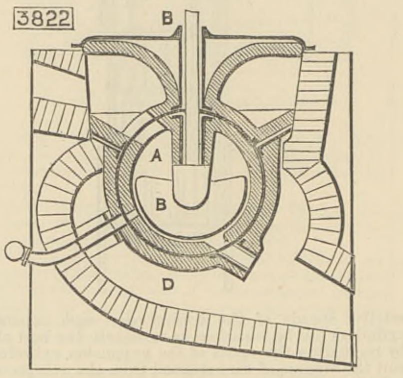


which A is a vessel made of brass or other suitable material; B is a cover screwed and fitted steam-tight to A, which receives the screwed winged valve C, and forms a cup through which the lubricant is admitted when the valve C is opened; D is a cock or plug valve having a hole A1 and being fitted steam-tight into a corresponding recess formed in the lower part of the vessel A; E is a pipe made of brass or copper, one end of which is screwed steam-tight into a projection B1 at the lower ends of the vessel A, the other end has screwed thereon a perforated cap F made hexagon; G is a threaded projection at the lower end of the lubricator, which is connected to the steam pipe from the boiler to valves, cylinders, and spindles; H is a nozzle or pipe attached to the lower end of the vessel A, and opposite to the valve D for the purpose of letting off condensed steam.

3822. IRON AND STEEL, *W. J. Clapp.—Dated 21st September*, 1880. 6d.

The molten crude or re-melted metal is run directly from the blast or other furnace into the puddling, refining, or mixing chamber, where it is puddled or agitated by a rotating stirrer or agitator fixed to a vertical shaft; A is the puddling, refining, or mixing

3822

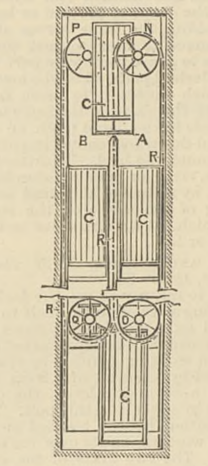


chamber; B the stirrer or agitator; D is a flue or heating chamber around the chamber A. The stirrer is fixed on a shaft or axis B1, which at its upper end is provided with a bevelled toothed wheel, to which rotary motion is given by a bevelled pinion fixed on a rotating axis.

3824. LIFTS OR ELEVATORS, *J. M. Day, W. R. Green, and H. C. Walker.—Dated 21st September*, 1880. 6d.

This relates to lifts in which a series of cages are continuously raised on one side and lowered on the other, and consists principally in the arrangement of a pair of endless chains R at the front and back of the up and down shafts A and B, and working round

3824

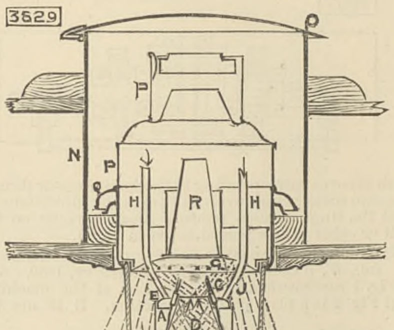


sprocket wheels N, O, P, and Q, secured at the top and bottom of each shaft. These chains carry the cages C up and down the shafts, suitable guides T being arranged on either side and between the cages to guide and steady them whilst travelling in either direction.

3829. OIL LAMPS, *W. P. Thompson.—Dated 22nd September*, 1880.—(*A communication from J. Scrafton.*) 6d.

In the centre of the reservoir is a conical or other aperture widening out below, so as to allow the light from the wick to fall and be reflected downward through the glass bottom of the lamp, thus eliminating that shadow beneath the lamp so annoying in ordinary railway carriage lamps. This passage of rays through the reservoir is also advantageous in that it warms the oil and keeps it from freezing in cold weather while the lamp is burning, and also that it enables oils to be burned that would otherwise be too thick or

3829



viscid to ascend the wick. A is the reservoir fitted with two burners; C wick tube plate; D internal reflector, preferably of copper silvered over; E wick tubes; G top reflector; H air pipes; J holes for supplying air to the burners; K glass bottom or cover for lamp; N ordinary perforated lamp-box; P perforated sides and top of lamp of ordinary construction; Q rim for lifting lamp in and out; R funnel.

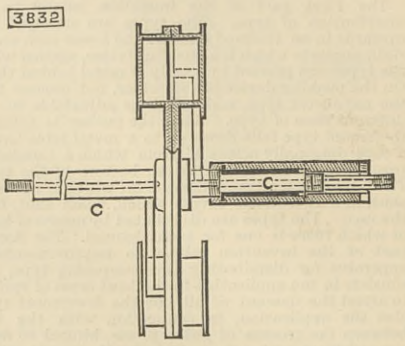
3859. COOPERAGE MACHINES, *A. Ransome and T. J. Wilkie.—Dated 23rd September*, 1880. 10d.

To divide the split staves a band saw is employed, and to present the staves to the saw feed rollers are placed on each side of the staves, and are carried on slides coupled together, so that the rollers can approach and recede from each other to suit the varying thickness of wood. Two feed rollers are provided on one side, and a central roller on the other side of the stave. To bring the staves to the form they are required to take in the cask, they are steamed and then submitted to pressure between metal plates, an hydraulic press being employed with curved platen and head. To reduce the back to the proper curvature the staves are passed beneath and subjected to the action of knives of suitable form mounted on a horizontal axis driven at a high speed. To joint or form the edge of the stave a disc carrying cutters is employed, and to truss the cask the staves when set in suitable hoops are taken to a trussing press, and are forced through a cone with movable segments.

3832. DYNAMO ELECTRIC MACHINES, *W. Elmore.—Dated 22nd September*, 1880. 6d.

These refer to improvements in the machine described in patent No. 3565, granted in 1879. In the new machine the armature cylinder and the magnet cores are made hollow for air, water, or other refrigerating material to pass through. The commutator has

3832

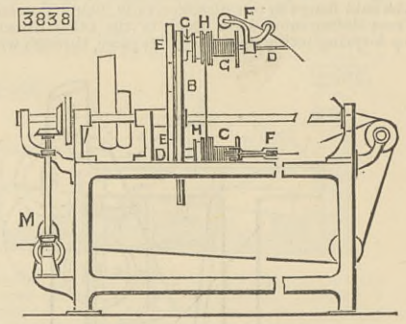


been improved. On one end of main shaft is metal barrel piece C insulated from shaft, carrying on inner side standard terminals led to ends of one half of the wires of the magnets of the armature. The outer end of barrel piece forms sections of commutator, and is provided with screw thread to engage with a nut.

3838. MAKING BAND OR ROPE, *S. Hirst, C. Earnshaw, and A. Holroyd.—Dated 22nd September*, 1880. 6d.

The machine employed consists of a face plate B mounted on the main shaft and carrying three or more elongated bosses C, through which passes a spindle D, upon one end of which is keyed a spur wheel E, and on the other a bracket F carrying two grooved pulleys. At the end of each spindle is a hole

3838



for the strand or yarn to pass through, such strands passing from the bobbins G mounted on the bosses C, and connected by a pin with a pulley H, also on the boss C. Over the pulleys passes an endless cord. The strands pass through holes in the end of the main shaft, and are thereby twisted into a rope, which passes over guide pulleys and back through drawing rollers M.

3848. SEWING MACHINES FOR LEATHER WORK, &c., *H. Mills.—Dated 22nd September*, 1880.—(*A communication from D. Mills.*) 10d.

Fig. 1 shows an elevation of one side of the machine, and Fig. 2 is a vertical section. A represents the main frame of the machine, which has a projecting arm D, and is provided at the rear with bearings for a transverse shaft B. This shaft carries a driving wheel, and is furnished with two cam discs, from

3848 FIG 1

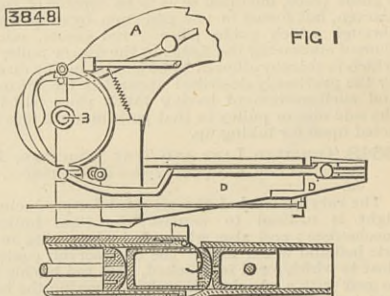
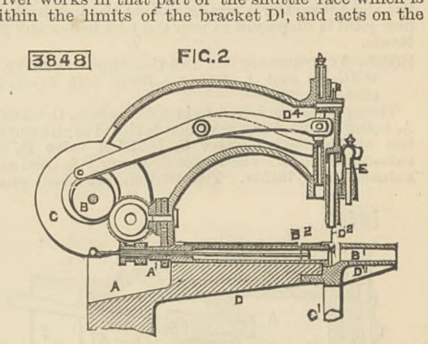


FIG 3

which several operating parts of the machine derive their movements. The shuttle is cylindrical, and works in the shuttle race B1 formed partly in the tubular shaft A1, and partly in a bracket secured to the front end of the arm D of the frame. The reciprocation of this shuttle is effected by means of two drivers, one of which, B2, works in the tubular shaft A1, and acts on one end of the shuttle, and the other driver works in that part of the shuttle race which is within the limits of the bracket D1, and acts on the

3848 FIG.2



opposite side of the shuttle. An ordinary barbed needle is used, which is secured to the upper end of the needle bar C1. The awl D2 is secured by means of a tapered chuck or otherwise to the lower end of a stem, which is adapted to a bearing in a plate or slide E, and is connected by means of a link to a bar, which reciprocates in bearings in the front end of frame A, the operation of the said bar being effected by a cam groove in disc C on the driving shaft, through the medium of a lever D4 pivotted to the frame A.

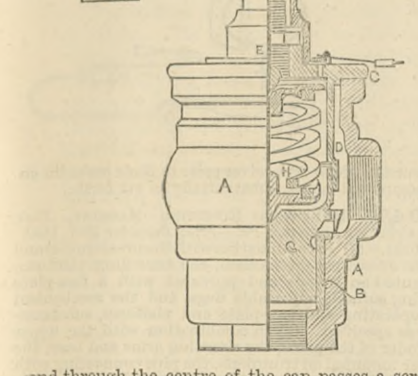
3867. OLEINE AND BUTTERINE, *B. Hofmann.—Dated 24th September*, 1880. 4d.

Beef and veal suet is cleaned, and then melted in a tank containing 60 gallons of water at a temperature of 60 deg. or 70 deg. Cent., to which is added 25 lb. salt, $1\frac{1}{4}$ lb. to 2 lb. carbonate of potash, $\frac{1}{2}$ lb. chlorate of potassa, and $1\frac{1}{4}$ lb. of nitrate of soda. The melted fat is then pumped into an iron tank placed in a wooden tank containing water at 35 deg. Cent., and 4 lb. of fine salt is added. The fat is afterwards placed in a hot room for ten or twelve hours at a temperature of from 25 deg. to 30 deg. Cent., and finally pressed into cakes by a suitable press. To give butterine a nutty flavour from 25 per cent. to 30 per cent. of best ground nut or sesame is added to it.

3849. SAFETY VALVES, *W. R. Lake.—Dated 22nd September, 1880.—(A communication from H. G. Ashton.)* 6d.

The shell A of the valve is tapped at its lower end for connection with the boiler, and at one side for connection with a pipe through which the waste steam passes. The lower part of A is bored out to receive a bushing B. The cap C and cylinder D are cast in one,

3849



and through the centre of the cap passes a screw F. The valve G is turned true, so that its guides will fit the bushing, and its upper part the cylinder D. The spring H is supported between two discs, the lower one pivotted directly upon the centre of the valve, and the upper one directly upon the centre of the adjusting screw.

3851. COMBINED PLOUGHS AND PULVERISERS, *P. M. Justice.—Dated 23rd September, 1880.—(A communication from C. E. Sackett.)* 8d.

This relates to a plough of ordinary construction combined with a revolving harrow or pulverising

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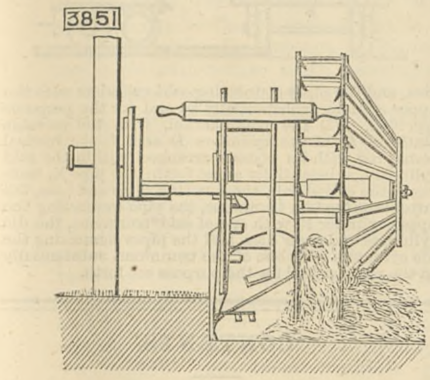
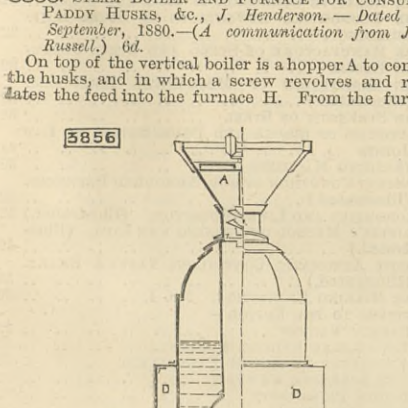


device so arranged that the earth is turned into the pulveriser, by which it is finely comminuted and then dropped into the furrow previously made.

3856. STEAM BOILER AND FURNACE FOR CONSUMING PADDY HUSKS, &c., *J. Henderson.—Dated 23rd September, 1880.—(A communication from J. R. Russell.)* 6d.

On top of the vertical boiler is a hopper A to contain the husks, and in which a screw revolves and regulates the feed into the furnace H. From the furnace

3856



flues C into the casing D, so as to increase the heating surface, and the flue E leads to the chimney. The fire bars G are arranged in a circle converging downwards, and from the centre a pipe passes and leads the ashes to a worm J, by which they are conveyed away.

3863. DAMPING TABLES OF LITHOGRAPHIC PRINTING MACHINES, *J. Harper.—Dated 23rd September, 1880.* 6d.

The bed of the table consists of a slab of slate B mounted in a cast iron frame A and covered with moleskin C, which is stretched over the slate by means

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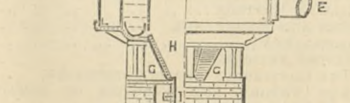


of attaching it at one end to pins D, and rolling the other end round a roller F under the frame, a ratchet and pawl being fitted to the roller to prevent it unwinding.

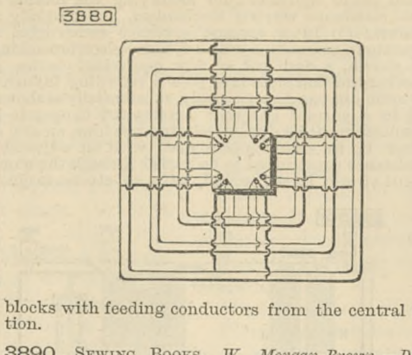
3892. VELOCIPEDES, &c., *C. F. Wood.—Dated 25th September, 1880.* 8d.

The rider sits between two large wheels, behind which is a small wheel, carried by a backbone attached to the main axle, and capable of being permanently used as a running wheel, or may be raised out of and brought into action as required. The large wheels serve both as driving and steering wheels, for which latter purpose a small wheel is arranged close to each driving wheel, and can be forced down in contact with the ground so as to lift one of the large wheels off, and thus steer the vehicle.

3880. CONDUCTORS OF ELECTRICITY, *P. Jensen.—Dated 24th September, 1880.—(A communication from T. A. Edison.)* 6d.

This relates to the arrangement of conductors so that an equal electro-motive force or pressure is maintained in all parts of the system. To accomplish this the conductors from the source have no lamps in circuit, the lamps being placed upon service circuits, and also the sectional area of the conductor is varied with its position relatively to the source. The figure shows method of laying service conductors around

3880

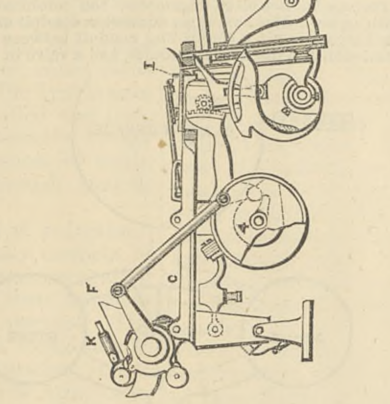


blocks with feeding conductors from the central station.

3890. SEWING BOOKS, *W. Morgan-Brown.—Dated 25th September, 1880.—(A communication from E. S. Boynton.)* 8d.

The drawing shows a partial left-hand end view of the machine. C is the table or framework; F the presser arm; D work-supporting plate; K connecting rod for operating wire feeding devices; I needles. The cam shaft 4 has secured to it a hollow hub, upon which is pivotted a pawl having a lug that by a spring is kept in engagement with one of the notches in a toothed ratchet fast on a sleeve loose on the shaft 4. The outer or longer end of the pawl projects through a slot in the hub, just at that stage when needles I are

3890



most elevated, and in position to have applied to them a new signature to be united to the book pile; a dog of an arm projected from a rock shaft meets the pawl, throws its longer end partially within the hub, and releases the ratchet and worm tooth gear, leaving the shaft 4 at rest while the signature is applied to the needles. The needles are attached to carriers forked and grooved to embrace a longitudinal spline on a long bar which extends substantially the length of the machine, and upon which the carriers are adjustably attached by means of a clamping device.

3896. CLOCKS, *J. Mezbach.—Dated 25th September, 1880.—(A communication from E. and J. Junghaus.)—(Not proceeded with.)* 2d.

According to one arrangement the mechanism consists of a drum containing the spring, which by its rotation imparts motion to three wheels. The drum is wound by means of the square axle. This axle has a pinion on it which gears with a wheel on the axle carrying the spring drum. The main frame has a second plate connected to it at its upper part by distance pegs or screws. Between this plate and the main plate is another train of wheels. There is also a box containing an ordinary spring; on the back of the said box there is a star wheel mounted concentrically on the axis of the said box. The star wheel engages with a ratchet which impels the mechanism. The said ratchet rotates on its axis, and at a point of its revolution comes in a tooth on the star wheel, which operation takes place, according to arrangement of mechanism, once every minute, or it may be more or less as required, thus serving to quicken the speed of the larger works or mechanism.

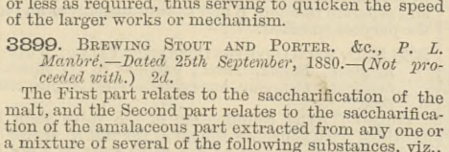
3899. BREWING STOUT AND PORTER, &c., *P. L. Manbré.—Dated 25th September, 1880.—(Not proceeded with.)* 2d.

The First part relates to the saccharification of the malt, and the Second part relates to the saccharification of the amalaceous part extracted from any one or a mixture of several of the following substances, viz., maize, rice, barley, oats, wheat, darn, millet, sago, mandioca, potato, arrowroot, and the like.

3900. RAILWAY FROG, *G. F. Redfern.—Dated 25th September, 1880.—(A communication from F. G. Smith.)* 6d.

A metallic bed-plate A extends the length and breadth of the frog, and to its upper face a plank B of equal size is secured. C are iron plates forming chairs for the rails to rest on, and D is an upper plank, transversely across the face of which are secured the iron end plates E, to which the outer ends of the wing

3900



or guard rails I and the V part H of the frog are secured by rivets. F and G are iron plates or keys bolted across the plank D and passing through the holder of the frog to hold it in place, while allowing it some degree of elasticity. The V part H of the frog and the wing or guard rails have downwardly projecting loops or keepers through which the keys F and G pass.

3901. WATCH CASES, *W. R. Lake.—Dated 25th September, 1880.—(A communication from G. F. Mertz.)—(Not proceeded with.)* 2d.

Close by the bow or pendant of the watch is placed the fastening spring, which is fixed on the outside of the case containing the works, but so arranged that it is covered by the outer case when the latter is closed, and this spring has a hook-shaped head, which is slightly bent, so as to economise space as much as possible by making the said spring capable of adapting itself to the form of the recessed ring which serves to hold the glass; in this ring is provided a small recess or space, allowing the spring to recede. An arrangement for causing the lid or cover to fly open when the fastening spring releases the same is described.

3904. CASES FOR JEWELS, &c., *T. Heath—Dated 27th September, 1880.* 2d.

This relates to improvements on patent No. 5100, dated 12th December, 1879, and consists in a means of covering, ornamenting, and tooling (or finishing) the cases at one and the same time.

3907. HOT AIR ENGINES, *H. Simon.—Dated 27th September, 1880.—(A communication from C. Amthauer.)—(Not proceeded with.)* 2d.

According to one of the improvements there are provided in the heating chamber two passages, one communicating with the hot end, and the other with the cold end of the chamber, which passages lead to ports on a surface, against which works a surface on the side of the cylinder, which is an oscillating one. This surface has a port from which a passage leads to the closed end of the cylinder, and by the oscillation of the latter the said port and passage are made to communicate alternately with the two passages in the heating chamber, so that as the piston performs its outstroke, due to the expansion of the air in the hot end of the chamber, the cylinder communicates with such hot end, while when the piston is performing its instroke, due to the contraction of the air in the cool end of the chamber, the cylinder communicates with such cool end. Motion is imparted to the displacing plunger in this arrangement by means of a crank, rotated by the piston of the cylinder, working with its pin in the slot of a lever fixed on a transverse rocking shaft, having at the middle of its length an arm, to which the rod of the displacing plunger is connected, so that as the said crank pin revolves the required up-and-down motion is imparted to the plunger by the rocking lever.

3908. SOAP, *P. M. Justice.—Dated 27th September, 1880.—(A communication from L. Bastet.)* 4d.

This relates to the process of forming a saponaceous compound, consisting of combining mineral oil with animal and vegetable fatty matter, or either boracic acid and an alkali.

3910. VELOCIPEDES, &c., *H. J. Lawson.—Dated 27th September, 1880.—(Not proceeded with.)* 2d.

This consists of certain improvements in velocipedes which are partly or completely propelled by motors, and machinery connected therewith, having for their principal object the construction and arrangement of these machine in such a manner that the carriage of an engine or motor for self-propulsion, with its necessary accompanying machinery, may be rendered practicable with less inconvenience to the rider, by the application and use of compressed gas for fuel and motive purposes.

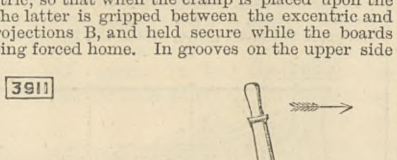
3910. KNIFE CLEANING AND SHARPENING MACHINE, *H. Woodward.—Dated 27th September, 1880.* 6d.

On a base plate a piece of leather is secured, and hinged to one end of this plate is a second plate, also covered with leather, a strong spring causing the two to be pressed tightly together. The knife to be cleaned is inserted between the two plates and moved to and fro, polishing powder being supplied through a hole in the top plate. To sharpen the knives, a file, steel or other sharpener is attached to the bottom plate.

3911. FLOORING CRAMPS, *W. Riley.—Dated 27th September, 1880.* 6d.

This relates to cramps for forcing flooring together when laid upon the joists, and firmly holding them in position until nailed down. A bed plate A has projections B on one side, and on the other is an adjustable excentric, so that when the cramp is placed upon the joist the latter is gripped between the excentric and the projections B, and held secure while the boards are being forced home. In grooves on the upper side

3911



of the plate A slides a ram or cramp head D, with ratchet teeth on its top surface, with which gear the pawls J and K, the former being attached to a lever H, which when forced in one direction drives the ram D forwards, the other pawl holding it in this position while the lever and pawl are moved back for a fresh stroke.

3912. ROVING FRAMES FOR MANIPULATING WOOL, &c., *T. E. Smith.—Dated 27th September, 1880.* 2d.

To the top spindle rail in roving frames is secured a series of stationary spindles. On to each of these spindles is placed a rotating collar or tube; resting upon the said collar or tube is the bobbin, which revolves at the same rate of speed. At the top of each stationary spindle is placed a cap which projects downward, and partly covers the rotating bobbin, which rises and falls within the said cap for the purpose of having the fibre built upon the same.

3914. RECOVERING PRUSSIATE OF POTASH, &c., FROM NITROGENOUS SUBSTANCES, *W. Brierley.—Dated 27th September, 1880.—(A communication from T. Richters.)* 4d.

This consists, First, in the process of gaining prussiate of potash, ammonia, gas, and tar from nitrogenous substances which are moistened with a solution of carbonate of potash or with one which contains carbonate of potash, caustic potash, sulpho-cyanide, and cyanide of potash, &c., and then dried in presence of carbonic acid; by gasification the so prepared substances are transformed into prussiate of potash, ammonia, tar, and gas, without friction of the nitrogenous substances. Secondly, in the separation of sand from the nitrogenous substances by washing them in a solution of carbonate of potassium.

3915. BLACKING BRUSHES, *A. M. Clark—Dated 27th September, 1880.—(A communication from E. L. Wood.)* 6d.

This consists in securing together a blacking brush and a blacking box, and in making the brush rotary, so that the bristles wear alike and the blacking is evenly distributed. The body of the brush has a recess in its back to receive the blacking box, and hinged to a post on the back is the blacking brush. When the brush is brought over the blacking box it is rotated by a handle, so as to take up the blacking when it is swung back, and secured by a spring catch its position for use.

3918. PREPARATION FOR THE CURE OF DIPHTHERIA, &c., *F. Van Sandau.—Dated 27th September, 1880.—(A communication from S. H. Longard.)* 2d.

This consists in a composition resulting from the combination of and the operation upon the following: Myrrh, sulphuric acid, rectified spirits of wine, and pure water.

3919. INCREASING THE ILLUMINATING POWER OF GASES, *J. Macdonald.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

The gas is caused to pass over a carburetted material, such as gasoline, whereby the illuminating power is increased.

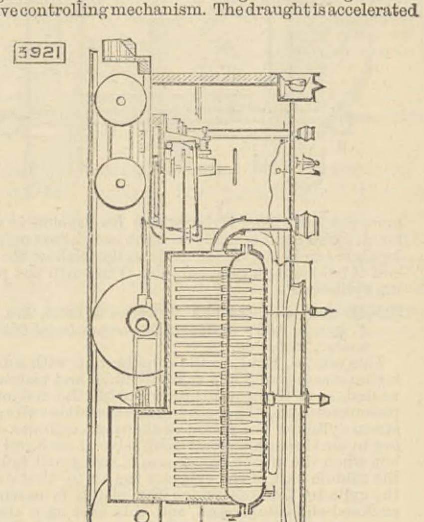
3920. LATHES, TOOL-HOLDERS, &c., *W. F. Smith and A. Coventry.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

This relates to improvements on patent No. 1101, A.D. 1877, and consists of arrangements to enable the lathes to be almost instantly changed to chase screw threads of two or more different pitches, and also for chasing taper or cone screws. The invention further relates to swivel tool-holders used in lathes and other tools, and consists in making the face of the collar and shank which come in contact with corresponding teeth to prevent the cutter twisting round and giving way under heavy cuts; and, lastly, to mechanism for reducing the thickness of the cutting edges of twist drills when the central part is too thick.

3921. LOCOMOTIVE ENGINES, &c., *W. Morgan-Brown.—Dated 28th September, 1880.—(A communication from F. M. Stevens, and J. H. and C. C. Pearson.)—(Complete.)* 10d.

One feature consists in a structure or housing having within it a boiler or steam generator, so arranged within it as to leave an apartment for the fireman at the rear of the structure, and an apartment or housing cab at its front end for the engineer, the said engineer's apartment containing the valve gear and valve controlling mechanism. The draught is accelerated

3921



by a jet of live steam taken from the boiler. Separate inlet and exhaust valves are employed, as it is desired that the exhaust valves be held open or nearly so, under certain conditions, while the inlet ports or valves are closed or nearly closed, and this while the engine is in motion on the track.

3922. BREAD MAKING, *C. Escourt.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

This consists in the addition of a small quantity of free phosphoric acid to the flour or yeast, so as to give the bread a good colour.

3924. HARNESS OF JACQUARDS, *W. L. and S. A. Ellis.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

This relates to means whereby the sets can be altered without casting ends out, and which allow of weaving any fine or course sets.

3929. TYPOGRAPHIC PRESS, *F. Uytterelst.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

This relates to treadle printing presses, and consists of a bed or travelling table, on which the type is placed, and which runs on eight rollers. The to-and-fro movement of the feed board is effected on slides by means of an excentric guided by two connecting rods, and the feed board delivers the sheet to the nippers. The cylinder carries the sheet forward on the lower side, so as to shorten the space required for the machine. An excentric gear, connecting rod, catch, and ratchet actuate the inking cylinder. An automatically-acting receiver formed of laths or strips receives the sheet, and places it on the table, and a pointer beneath the feed board ensures the proper registering of the sheets in relaying the same.

3930. PROPULSION OF CARRIAGES, *W. J. Edwards.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

A receiver of compressed air is fixed on the carriage and is admitted by valves to an engine cylinder, so as to actuate a piston, and thus drive the carriage. From the cylinder the exhaust air escapes through other valves into a waste air reservoir, whence it passes to side chambers with air-tight compressible sides. To the outer side of these chambers hydraulic pressure is applied so as to compress the air and drive it back to the air reservoir.

3931. OMNIBUSES, *H. W. Hart.—Dated 28th September, 1880.—(Not proceeded with.)* 2d.

The inside seats are arranged back to back. The vehicle is supported much nearer the ground by cranking the axles, the fore carriage being arranged in front. The roof is formed with a well in the centre, the rows of roof seats being placed opposite one another and over the passage ways inside. The box seats are carried by brackets and are reached from the roof only. Trumpet-shaped mouths collect air, and direct it to the interior of the vehicle.

3933. RAIL FOR RAILWAYS, *E. Rider.—Dated 28th September, 1880.* 4d.

The object of the invention is to prevent or stifle the noise on railways caused by the contact of the wheels of the rolling stock with the rails, and it consists in covering the rail A with the exception of the

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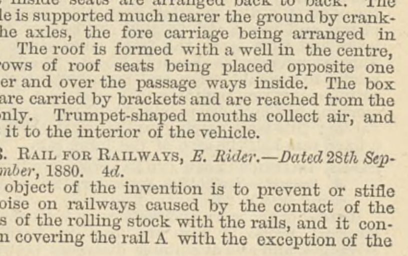

head with a soft metal non-sonorous jacket B, which is made longitudinally continuous around the rail below the head or top of the same.

3939. COLOURING ALCOHOL FOR THERMOMETERS, *E. H. T. Liveing.—Dated 29th September, 1880.* 2d.

Fluorescein—phthalein of resorcin—is, with the addition of a small quantity of some alkali, dissolved in alcohol, and when inserted in a thermometer tube, and attached to a blackened scale as a background, it reflects an intense and beautiful green light.

3940. VENTILATION OF SEWERS AND DRAINS, *J. S., T. A., and E. R. Walker.—Dated 29th September, 1880.—(Not proceeded with.)* 2d.

This consists in the use of fans to draw off gas and air from sewers, suitable openings being formed therein to admit fresh air.

3935. TYPE WRITING MACHINES, *A. M. Clark.—Dated 28th September, 1880.—(A communication from A. M. Da Costa.)* 6d.

This relates to means for enabling the operator to write more rapidly than at present, to avoid the clashing of two or more type levers, and blurred impressions of the type, and to obtain an uniform spacing of the letters. The key levers A are provided with staples or lengthened eyes B which may be attached to the upper or lower edge of the levers. Between every two levers A a like staple or eye K is attached to the underside of a transverse frame D directly above the key levers. A band G is alternately passed through the staple on the key levers and those on the transverse rail, so that their cross pieces are alternately above and below the band which is attached to one or

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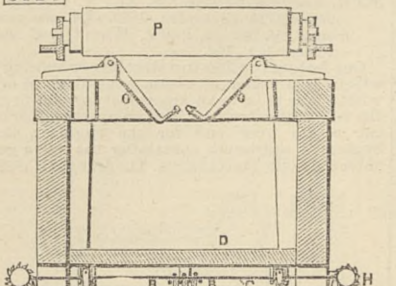

more ratchet rollers H by which its tension is regulated. The band is made so tight as to allow only one key lever to be depressed sufficiently to allow the type end of but a single type hammer O to touch the printing cylinder P.

3942. STEAM PUMPS FOR PUMPING WATER, AIR, &c., *F. and S. Pearn and T. Addyman.—Dated 29th September, 1880.* 6d.

This relates, First, to the combination with a direct-acting steam pump of a small cylinder and piston connected, so as to move to and fro with the rod of the pistons actuating the main and exhaust slide valve of the steam cylinder, the piston in the small cylinder drawing in air through a small inlet valve at each end of it, but when the piston passes one of two small holes in the middle part of the cylinder the air in that end of the cylinder towards which the piston is moving is enclosed and compressed, and this acts as a cushion against the sudden shock of the reversal of the said pistons and steam valve for the main steam cylinder. Fig. 1 shows a side elevation of a steam pump, having applied to it these improvements. A is the pump; B, the pump and piston rod; B^1, the piston; C, the main steam cylinder; D, the levers for actuating the small valves; C^1, the main valve for the steam cylinder; E, the pistons; E^1, the piston rod; E^2 the cylinders; and D^1, the small valves for actuating the main valve C^1. The piston rod E^1 is extended through a gland and is coupled with the piston rod F^1 of a small piston F^2 and cylinder F, which is or may be secured to any part of the framing. The Second part relates to direct-acting steam pumps similar to those above described, and consists in dispensing with the levers or tappets within the steam cylinder for working the small steam valves, which admit to and

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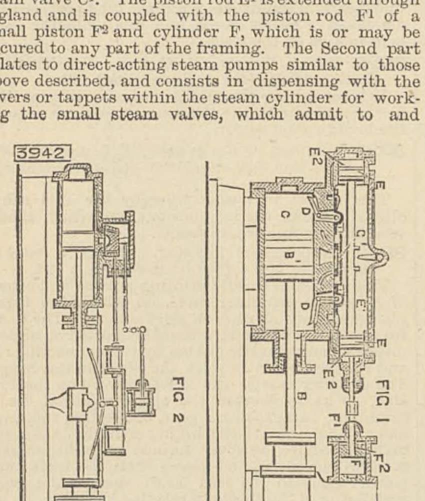

exhaust the steam from the cylinder of the pistons that actuate the main steam slide valve, and in bringing a piston rod from these small valves through a gland from the steam chest, and connecting it by a rod with one arm of an inverted T lever, two arms of which can be cam shaped, so as to be acted upon by the edge of a disc or other projection on the main piston, and pump rod to give oscillations to the T lever, and thus work the small slide steam valves. This arrangement is shown in Fig. 2. The Third part relates to a combination and arrangement of direct-acting steam ram pumps, and consists in a large ram working in a cylinder provided with inlet and outlet valves; this large moving ram forms the cylinder for a fixed ram half the area of the large ram.

3943. BRATTICE CLOTH AND BRATTICE AIR TUBES, &c., *A. Forrest.—Dated 29th September, 1880.—(Not proceeded with.)* 2d.

Instead of the warp and weft being both of a textile material, warps of wire are used in forming the selvedges, and also at suitable distances between the selvedges wire warps are introduced. The same mode may be adopted in manufacturing air tubes, and the lengths of tubes may be connected by spigot and faucet socket joints with self-locking spring catches.

3945. SPINDLE BEARINGS OF TEXTILE MACHINERY, *J. Elce.—Dated 29th September, 1880.* 6d.

The object of the invention is to render spindle bearings much more durable and less liable to break. The spindle S works in the steel tube T, fitted with a

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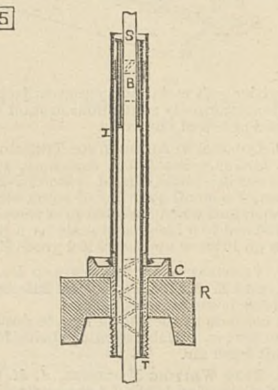

bush B, on which the spindle bears. The tube is firmly fixed in the socket C, which is secured to the lifting rail R. L is the bobbin shell working on the tube T and carrying the bobbin.

3949. CONSUMING SMOKE IN FURNACES, *J. Teer.—Dated 29th September, 1880.—(Not proceeded with.)* 2d.

A continuous current of air is carried through the dead plate and fire-bars to a perforated hollow bridge, from whence it is withdrawn in a rarefied state through the perforation in the bridge, and there meeting the smoke converts it into flame.

3951. COG WHEELS, LOOSE PULLEYS, ROLLERS, &c., *A. B. Childs.—Dated 29th September, 1880.—(A communication from F. Wegmann.)* 6d.

The object of the invention is to prevent the noise or jar resulting from the rotation of bodies used in machinery, more particularly where they work against

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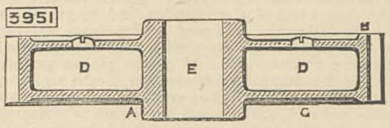

or into each other, such as cog or gear wheels. For this purpose the wheel or roller A is formed with a solid rim B and an interior annular cavity D, a solid hub E, and an intermediate web or set of arms G. Within the annular cavity D sand, shot, or a liquid body is introduced.

3993. CENTRIFUGAL DRESSING AND PURIFYING MACHINERY FOR TREATING FLOUR, &c., *H. Simon.—Dated 2nd October, 1880.—(A communication from G. Daverio.)* 6d.

So as to reduce the space occupied under the screening cylinder for the passage and removal of the screened material, the screening cylinder A, within which the beaters B revolve, is mounted so as to revolve within a casing which in its lower portion is

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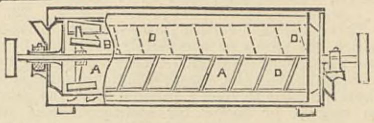

cylindrical. To the outer surface of the cylinder A are attached helical or oblique scrapers D, which in revolving in contact with the surface of the casing detach the flour deposited thereon and cause it to travel towards the delivery end, whence it is discharged.

3997. GAMES, *T. Smelt.—Dated 2nd October, 1880.—(Provisional protection not allowed.)* 2d.

This relates to certain improvements in the game representing a race-course, and consists in forming channels in the course and employing foxes, dogs, and huntsmen as figures to move over the course.

4001. ROLLING MILLS, *T. Nicholls.—Dated 2nd October, 1880.—(Not proceeded with.)* 2d.

Two pairs of rolls are used, one vertical and the other horizontal, each pair placed in its frame as near as possible to the other, and all the four rolls connected by gearing so as to revolve at the same speed.

4002. FURNACES FOR STEAM GENERATORS, &c., *J. Salter.—Dated 2nd October, 1880.* 6d.

In the drawing, which represents a vertical longitudinal section, A is the ordinary dead plate, B the bridge, C the front grate, and D the back grate. The

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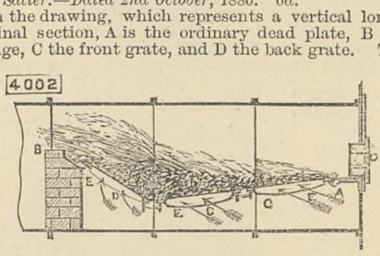

front grate slopes downwards from the dead plate towards the bridge, and the back grate slopes downwards from the bridge towards the rear end of the front grate. The bars are kept at their proper distances by diamond-shaped studs or projections E cast upon the bars.

4004. WARMING AND HEATING, *H. Boxall.—Dated 2nd October, 1880.—(Not proceeded with.)* 2d.

This consists of a portable metallic heater or case filled with earth or other substance to retain heat. The heater is placed in an oven until hot, when it will retain its heat for hours.

4009. MOTIVE POWER, *J. G. Lorrain.—Dated 2nd October, 1880. — (A communication from G. Trouvé.)* 6d.

In this machine the Siemens armature, instead of revolving concentrically to the exciter, is constructed

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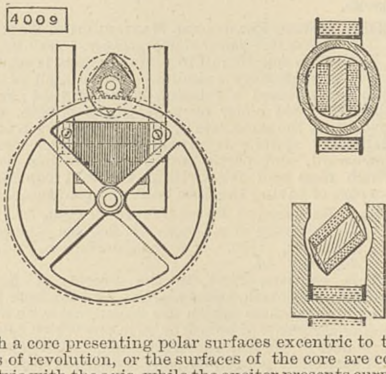

with a core presenting polar surfaces excentric to the axis of revolution, or the surfaces of the core are concentric with the axis, while the exciter presents curved surfaces excentric to the said axis. Figs. 1, 2, and 3 show modified methods of constructing the machine.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

239,312. REFLECTOR, *Charles F. Brush, Cleveland, Ohio.—Filed August 6th, 1880.*

Claim.—The combination, with a concave reflector, of a cut-off tube having a non-reflecting inner surface,

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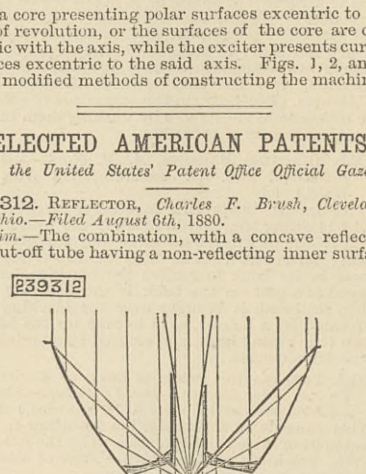

said tube located in such proximity to the light or frame as to intercept and cut off the direct rays of light, substantially as shown and described.

239,313. CURRENT GOVERNOR FOR DYNAMO-ELECTRIC MACHINES, *Charles F. Brush, Cleveland, Ohio.—Filed May 26th, 1880.*

Claim.—(1) In a current governor constructed to operate in connection with a dynamo-electric machine, an electro-magnet excited by two helices, one helix included within the main circuit and the other within a shunt circuit, within which said shunt circuit is placed an adjustable resistance, substantially as shown. (2) The combination, in an electric current governor, of an adjustable or variable resistance, mechanism to vary said resistance, substantially as specified, and a dash pot or equivalent for modifying the motion of said resistance varying mechanism, substantially as shown. (3) In a current governor constructed to operate in connection with a dynamo-electric machine, as shown, a dash pot or any equivalent device or mechanism that shall interpose a retarding influence or action in one direction only, substantially as shown. (4) In a current governor constructed to operate in connection with a dynamo-electric machine, an arm or lever D, in combination, first, with an adjustable resistance constructed to be varied through the movement of said lever; second, with an electro-magnet,

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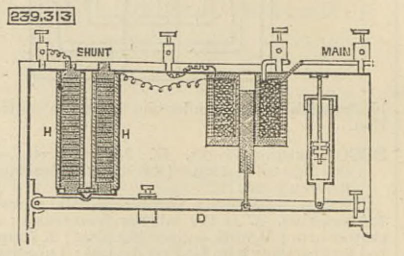

through the influence of which motion is imparted to said arm or lever; and third, with any suitable mechanism (such as the dash-pot or its equivalent) for governing or modifying the movements of said arm or lever, substantially as shown. (5) In a current governor constructed to operate in connection with a dynamo-electric machine, two or more resistance piles H, or their equivalents, electrically connected in series, and a device associated with each pile for varying its electrical resistance, substantially as shown.

239,325. HOT BLAST REGULATOR, *Frederick W. Gordon, Pittsburg, Pa.—Filed August 27th, 1880.*

Claim.—In hot-blast regulators, the combination, with an air-heater having an admission conduit and a discharge conduit, a connecting conduit between said admission and discharge conduits, and a valve in said

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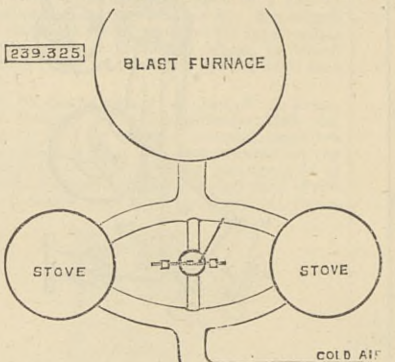

connecting conduit, of a means for adjusting the weight upon said valve, a pressure surface opposed to the opening of said valve, and an independent conduit connecting said pressure surface with said discharge conduit, substantially as set forth.

239,326. VALVE FOR INJECTORS, *John T. Hancock, Boston, Mass., assignor to the Hancock Inspirator Company, same place.—Filed August 16th, 1880.*

Claim.—(1) The combination of two or more separate valves, one of which is a seated valve and the other a piston valve, rigidly attached together, substantially as described, and arranged, in relation to the orifices

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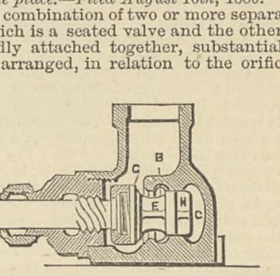

which they successively open or close, substantially as and for the purpose set forth. (2) The seated valve G and piston valve H, connected together by a stem E, in combination, respectively, with the independent and separate passages B and C, substantially as and for the purpose specified.

239,336. MECHANISM FOR OPERATING VALVES, *William R. Park, Boston, Mass., assignor to the Hancock Inspirator Company, same place.—Filed August 25th, 1880.*

Claim.—(1) The combination of the valve stem F, provided with the screw thread J, the nut K, sleeve N, and lever M, connected to the valve stem by a pin P, and arm O, substantially as and for the purpose set forth. (2) The combination of the lever M, the adjustable pin P, the slotted arm O, and the valve stem F, substantially as specified. (3) The combination, with a valve stem and nut operating one or more valves, of an actuating lever, and an adjustable pin and a sleeve, substantially as set forth.

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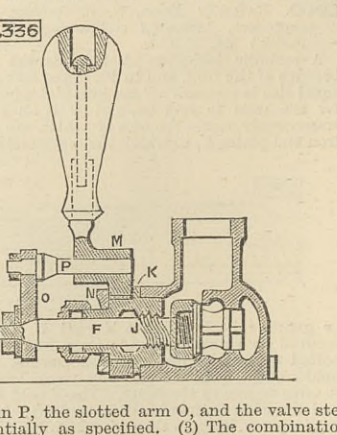

239,372. TESTING ELECTRIC LIGHT CARBONS, *Thomas A. Edison and Charles Batchelor, Menlo Park, N. J.—Filed August 9th, 1880.*

Claim.—(1) The combination, with a globe or chamber, of a much larger chamber or reservoir connected to air-exhausting apparatus, which maintains therein a high degree of exhaustion, substantially as set forth. (2) The combination of a proving chamber or globe, a mercury reservoir for sealing the same, and exhaust reservoir or chamber and means for exhausting the same, substantially as set forth. (3) The combination of a globe or chamber, a second and much larger globe, chamber, or reservoir, a valved tube connecting them, means for maintaining a high degree of exhaustion in the larger reservoir or chamber, and connected thereto, and a gauge for determining the degree of exhaustion, substantially as set forth. (4) The combination, with the globe or chamber of a proving lamp, of a mercury reservoir connected to the globe or chamber, so that the stopper thereof may at will be covered or not covered by mercury, substantially as set forth. (5) The method of testing carbons consisting in subjecting them to the action of a current in a temporarily

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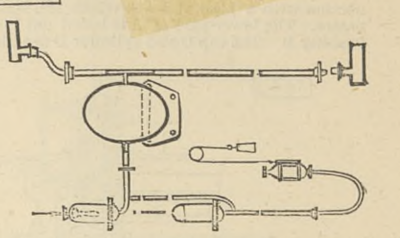

exhausted globe or receiver prior to their embodiment in completed lamps, substantially as set forth.

239,454. HYDRAULIC RIVETTING MACHINE, *Thos. Critchlow, Steelton, Pa.—Filed December 29th, 1880.*

Claim.—(1) In combination with the pressure dies and their operating mechanism, the travelling platform, mounted on wheels and provided with a face-plate having suitable adjustable dogs, and the mechanism for operating said face-plate and platform, substantially as specified. (2) In combination with the upper cylinder of the press, the rivetting arms and base, the latter mounted on trunnions, the pipe connecting with one of the trunnions, the die cylinders and their

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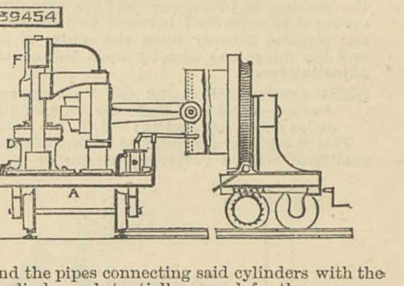

dies, and the pipes connecting said cylinders with the upper cylinder, substantially as and for the purposes specified. (3) The combination, with the movable platform A, of the cylinders D and F, the vertical piston rod with its pistons arranged within the said cylinders, substantially as set forth, the pipe K, leading to the cylinder D, the rivetting arms and base, the latter mounted on trunnions, the pipe connecting the upper cylinder F, with one of said trunnions, the die cylinders and their dies, and the pipes connecting the die cylinders with one of the trunnions, substantially in the manner and for the purpose set forth.

CONTENTS.

THE ENGINEER, May 6th, 1881.

FIVE years ago not a building had been erected in Emerson, Manitoba, and now because there are congregated several thousand people they are going to start a daily paper.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending April 30th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 6 p.m., Museum, 11,170; mercantile marine, building materials, and other collections, 5259. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2680; mercantile marine, building materials, and other collections, 599. Total, 19,708. Average of corresponding week in former years, 16,585. Total from the opening of the Museum, 19,916,533.