BREWING IN ENGLAND.

No. II.

AT pages 102 and 106 we give illustrations of a small modern brewery, which contains features of interest to many of our readers. Before describing this, however, we must, in continuation of our article on page 33 of the present volume, make some further reference to the proposed use of raw instead of malted grain. Several well known chemists interested in the application of chemistry to brewing have occupied their time with the object of successfully producing worts from raw grain, and among these Mr. S. H. Johnson, F.C.S., has achieved considerable success. His inventions in this direction have been taken up by the Johnson's Saccharum Company, of Carpenters-road, Stratford, and the necessary apparatus for carrying out his process was exhibited in the Brewery Exhibition at Islington last autumn. The process has for some time been employed on a small scale, but the new fiscal arrangements make its wide employment possible on grounds of economy. The chief feature of the process is the formation of saccharine substances by the action of dilute acids on the starchy matters in various kinds of grain, without the preliminary separation of that starch, and without the prolonged action of heat in the presence of the acids on the albumenoid and oily matters contained in the grain with the starch. This Mr. Johnson effects by means of the apparatus which we shall presently describe, the conversion of the starchy matter of the grain into saccharine being very rapid. By the avoidance of the long-continued action of heat empyreumatic matters previously produced are not made.

The material can, it seems, be produced in such a form as closely to correspond, in its characteristics, with the wort produced by malting and mashing. The starchy matters are converted not wholly into glucose, but into a material composed of glucose, dextrine, and maltose. This process thus not only produces the right kind of material for beer wort; but it produces it directly from the whole grain, and is thus the simplest and cheapest process that can be devised. It may also be mentioned that in conducting the process the production of starch paste is avoided by effecting the initial stages of the conversion in the absence of free liquid. The mass of grain is thus maintained, during the early stages of the process, in a porous condition permeable to steam. Under these circumstances, the change from starch to the soluble dextrine, in the presence of steam and acid, is very rapid. Starch paste being avoided, the requisite water for further conversion can afterwards be introduced with impunity. The mash thus produced is neutralised and filtered, and a wort run off in the condition for brewing. The rapidity of the process enables a large quantity of work to be accomplished within a small compass. The process is said to be applicable to all kinds of grain, so that the brewer who successfully employs it, is not only independent of the costly and more delicate process of malting, but he is practically able to command the cheapest market for his raw material. Many varieties of grain have been successfully converted by this process, and in view of the choice of materials that the new law confers on brewers, the following particulars of experiments, as given by Mr. Johnson, are of interest:—

Description of grain.	Weight per quarter.	Weight of water for rumbling.	Weight of acid 3 %.	Sp. Gr. of extract in lb. per barrel.	Current price per quarter.	Cost of 1 lb. per brl. extract.
	lb.	lb.	lb. oz.		s. d.	d.
Maize	480	192	14 7	133·77	24 0	2·15
Malt	324	324	9 12	95·29	54 0	6·80
Wheat (English)	476	250	14 6	148·32	48 0	3·88
Wheat (American)	462	240	13 14	144·43	45 0	3·74
Barley (English)	394	250	11 14	117·2	45 0	4·60
Barley (Danubian)	363	250	10 15	95·06	26 0	3·28
Oats (English)	326	200	9 13	90·86	28 0	3·69
Oats (Archangel)	309½	220	9 5	74·59	20 6	3·31
Rice (Madras)	556	160	16 10	159·08	47 2	3·56
Malt	by ordinary mashing process.			86·	54 0	7·53

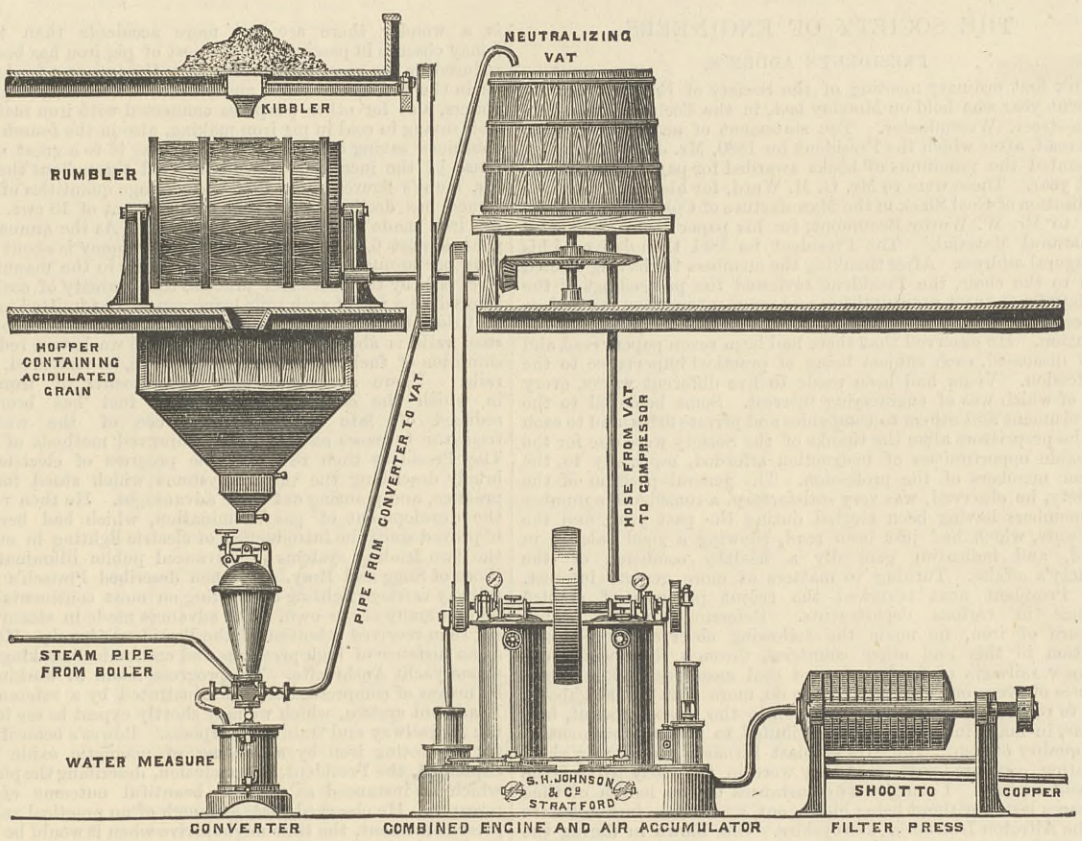
Malt is taken at 76s. with allowance of 22s. for duty.

From these results the following comparative costs of the different kinds of grain are calculated by Mr. Johnson, taking malt as the standard at 100, viz.:—

Malt, converted by the ordinary process	100·00
Ditto, ,, Johnson's process	90·30
Maize ,, ,,	28·42
Wheat, English, converted by ,,	51·52
Ditto, American ,, ,,	49·67
Barley, English ,, ,,	61·09
Ditto, Danubian ,, ,,	43·56
Oats, English ,, ,,	47·67
Ditto, Archangel ,, ,,	43·85
Rice, Madras ,, ,,	47·27

In other words, according to a paper by the inventor of the process, the amount of extract which costs the brewer who uses malt by the ordinary process £100 may be obtained from English barley direct, by Mr. Johnson's process, for £61, and from American maize, by same process, for £28. The flavour of each grain is traceable in the worts, and in the case of maize it has been found necessary to refine the liquor by filtering it through animal charcoal. With the other kinds of grain such treatment is not, it is said, necessary; but maize, as a source of starch, is relatively so much cheaper than other raw materials that it can afford the additional cost of a refining process. Filtered under high-pressure a residual cake is obtained, composed of the cellular tissues, the albumenoid matters and the oily substances of the grain forming a good material for feeding cattle. This cake is obtained in a concentrated and portable form, and so far it contrasts favourably with brewers' grains.

The accompanying engraving illustrates the plant necessary for the practical application of Mr. Johnson's process. The grain is first of all passed through a kibbling mill, or rolls, in order to disintegrate the husks and cellular tissues, and thus render it more amenable to the action of weak acid. A charge of the broken or crushed granular mass is allowed to fall into the apparatus called the rumbler—a cylindrical vessel of wood, revolving on a central shaft. An ascertained proportion of sulphuric acid and water is added, and the rumbler is then closed, and set in motion for a certain time, calculated to allow for the complete absorption of all the liquid. When this point is reached, the rumbler lid is opened, and the grain is discharged into a large hopper or on to a floor. Thence it flows or falls into the converter, an egg-shaped or conical vessel, made of gun metal, and so constructed that, when charged with the prepared grain, a jet of steam, entering at the bottom can, by following the lines of the vessel, permeate with facility the porous masses of grain contained therein. The conversion is effected by the action of the steam alone; but as it is desirable, for the purpose of neutralising and filtering, to further liquefy the mass, a certain quantity of water is injected into the converter from the water measure, a vessel which is supplied with water under pressure direct from the steam boiler. The practice in conversion is to turn on the steam to the converter one minute before injection of water and three minutes after, the whole time occupied in the treatment of each charge being about eight minutes. The grain has then become a liquid mash, and in this form



JOHNSON'S BREWING APPARATUS.

is ejected by the pressure in the converter, and conveyed by a pipe to the neutraliser. In the neutraliser a known small quantity of reagent, such as limestone or carbonate of lime is added to neutralise the acid, and the neutralised mash is then allowed to flow into the apparatus called the air-accumulators, which consists of a pair of receivers, combined with an air-compressing engine. The receivers, being alternately charged with the mash, are connected with the air-compressing engine, and the accumulated pressure forces the contents into the apparatus called the filter press. The filter press is of the well-known form of filter press composed of a number of metal plates, corrugated and slotted on each side, and covered with suitable filtering cloth. The plates are so arranged that, when brought together by means of a strong screw, they fit closely, and prevent the escape of any liquor, except through the filter cloths, by way of the corrugations. The resulting liquor is a bright wort, ready to be run off to the copper or the hop back. The nitrogenous and fibrous residue of the grain, together with the oil, is retained in the press in the form of cakes, which make good food for cattle, containing, as they do, the nutritive and flesh-forming constituents of grain. It may be interesting here to reproduce an analysis, by Dr. Voelcker, showing the comparative value of cake made under the process from maize and that of other well-known feeding stuffs.

Analyses of feeding materials.

	Water.	Starch.	Dextrine and sugar.	Albuminoids.	Oil.	Fibre.	Ash.
Saccharated maize feeding cake	5·85	37·54		24·01	17·8	50·1	9·79
Linseed cake	11·5	30·00		28·5	11·5	12·5	6·0
Cotton cake	11·46	32·52		22·94	6·07	20·99	6·02
Clover hay	16·60	34·42		15·81	3·18	22·47	7·52
Meadow hay	14·61	41·07		8·44	2·56	27·16	7·24
Maize	17·1	59·0	1·5	12·8	7·0	1·5	1·1
Wheat	13·6	60·8	10·5	12·5	1·1	1·5	—
Oatmeal	12·8	56·89	5·76	16·29	4·74	1·03	2·49

The following table gives the results of a series of experiments upon equal weights of amylaceous substances, made by Mr. Johnson since the malt tax has been repealed. The table marked A, which will be found on the next page, is of much interest, though the values may not quite coincide with those prevalent previous to the recent fiscal changes.

The cost of the necessary plant for the working of this process depends naturally upon the quantity of grain to be treated within a given time.

The estimated cost of the whole of the apparatus as shown, is however for plant to convert 25 quarters per week £378; for 50 quarters £506; and for 300 quarters £1786. We may now turn to the small brewery illustrated on pages 102 and 106. We must premise that excellent as the arrangement is, it is one which was in a small degree subservient to the adaptation of an existing building. It is an eight quarter brewery, designed by Mr. Arthur Kinder, engineer, of 11, Queen Victoria-street, E.C. Before entering on a description of the illustrations, it should be stated that these buildings contain simply the brewing plant, and consist of a tower, copper-house, boiler-house, cooler room, and fermenting room. The buildings required for stores, &c., are not shown in our illustrations as a previous existing brewery has been cleared of its plant and altered to suit this purpose. To make our illustrations complete the house containing the boiler should be extended and fitted with troughs and nozzles necessary for scalding, steaming, and washing the casks, and the building containing the fermenting rounds should be double the length shown, and excavated to form cellarage, the room beyond the round room being used for storage of hops and malt. The engine was taken from the old plant, and is shown on the ground floor. This, however, is contrary to Mr. Kinder's usual practice, which is to use a wall engine fixed in the mash tun room, where also the brewers' room is situated, and from which floor he can control the wort and liquor pumps, and have the whole of the machinery and vessels under his command. In the arrangement of plant shown by our illustrations the wort is pumped once only, this being necessary in passing from the hop-back to the cooler. The boiler-house adjoining the tower contains an ordinary Cornish boiler, carrying a working pressure of 45 lb. per square inch. Steam services from this are carried to the direct-acting well pump, the engine, the boiler copper, and the copper coil placed in the hot liquor back. The water of condensation from these vessels is brought to a water tank, and the whole of this water is returned as feed-water to the boiler. The malt is raised in sacks to the top floor of the tower by means of a hoisting tackle, and thrown into the mill hopper on this floor. It is then screened of stones and dust while falling from this hopper to the crushing rolls, which are so placed as to deliver direct into the grist hopper. The cold and hot liquor backs are made of iron—the latter of cast iron, and fitted with cast iron cover, having a lid for rousing and taking the temperatures. The water in the hot liquor back, when raised to the required temperature, is ready for mashing purposes, and is conveyed to a Steele's mashing machine attached to the bottom of the grist hopper, and containing revolving rakes. A given quantity of ground malt, or grist, and hot water being admitted to this machine, is effectively mashed before reaching the mash tun. This vessel, which may be made either in wood or iron, is fitted with a perforated false bottom, and in many breweries revolving and rotating rakes are also used in the tun. After the usual period of rest, the wort is run from the tun into the steam boiling copper, in which vessel the hops are introduced during the boiling. The boiling is effected by means of a steam jacket round the copper pan, to which steam is conveyed direct from the boiler, as mentioned above. The boiling having proceeded for the required time, the contents of the copper are discharged through a sluice valve into the hop back, which is shown immediately beneath the copper. The hop back is fitted with a perforated bottom, similar to the mash tun, and may be also made in either wood or iron. A set of three-throw pumps is connected to the outlet of the hop back, and the wort is pumped, as stated, into a shallow wooden vessel named a cooler, situated in the ventilated portion of the building to the left of the tower. A Lawrence's refrigerator is situated at a lower level in this building, and is served with a continuous supply of cold water running through it. The wort from the cooler, in passing over the corrugations of the refrigerator, is reduced in temperature, and is then ready for transmission to the fermenting rounds where the yeast is added. These rounds are fitted with Turnock's patent attemperators, through which vessels either warm or cold water can be run for the purpose of assisting or retarding the fermentation. The skimming process almost universally adopted is also used in this brewery, and the beer, when the cleansing process is completed, is racked into the casks for delivery.

Returning again to the mash tun, the hot liquor for the second mash is passed into the mash tun by means of a revolving sparger, and as soon as the boiling copper is emptied of the first wort the second wort is run into it, and the sparger process is repeated in the mash tun until the required quantity of wort is obtained; the hops from the hop back used in the first boiling are returned to the copper for the second wort, and the after processes carried out as previously described. The arrangement of the small brewery we have here described is very compact and efficient, and the cost of the buildings and plant, inclusive of erection and completion, ready for work, did not exceed £2300.

Table A.

Variety of grain.	Percentage of acid.	Time in converter after water injection.	Time in converter before water injection.	Gravity of extract in lbs.; 1 lb. grain in 1 gallon.	Pounds per Imperial quarter.	Gravity of extract from 1 qr., in lbs., per barrel.	Percentage of moisture in grain before treatment.	Weight of cake from 1 lb. grain.	Percentage of moisture in cake as weighed.	Time of filtration.	Price per imperial quarter at weights named.	Cost of material per barrel for 1 lb gravity, brewers' standard.
		Min.	Mins.					Grains.		Hours.	s. d.	Pence.
Barley, fine Saale	3	3	1	12·4	448	154·2	13·1	1092	2·2	5	45 0	3·5
Malt, very fine	3	3	1	12·3	330	112·7	8·8	1376	3·5	7	54 0	5·75
Red Wheat, spring American	3	3	1	12·5	480	166·7	11·6	1312	6·0	36	45 0	3·24
Barley, Danubian	3	3	1	11·45	400	127·2	12·3	1531	4·2	5	26 0	2·45
Barley, good Chilian	3	3	1	12·00	420	140·0	12·6	1346	5·3	2·5	35 0	3·0
Malt, Stanbridge's pale	3	4	1	12·25	320	108·7	8·2	1294	3·2	3	48 0	5·3
Oats, Archangel	3	3	1	10·0	304	84·4	10·9	2250	1·9	1	20 6	2·91
Rice, Siam, Rangoon, and Coconada	3	3	1	13·6	532	201·0	12·3	450	2·3	2	38 0	2·27
Oats, Archangel, White wheat, Californian, mixture of equal parts by weight	3	4	1	11·0	378	115·5	10·4	1620	1·2	2	30 8	3·19
Maize	3	4	1	12·85	480	171·3	13·8	1190	3·2	1	24 0	1·68
Malt, yields by ordinary process	—	—	—	—	—	86·0	—	—	—	—	48 0	6·69

THE SOCIETY OF ENGINEERS.

PRESIDENT'S ADDRESS.

The first ordinary meeting of the Society of Engineers for the present year was held on Monday last, in the Society's Hall, Victoria-street, Westminster. The statement of accounts for 1880 was read, after which the President for 1880, Mr. Joseph Bernays, presented the premiums of books awarded for papers read during that year. These were to Mr. G. M. Ward, for his paper "On the Utilisation of Coal Slack in the Manufacture of Coke for Smelting," and to Mr. W. Worby Beaumont, for his paper "On Steel as a Structural Material." The President for 1881 then delivered his inaugural address. After thanking the members for having elected him to the chair, the President reviewed the proceedings of the Society for the past year, noticing and commenting upon the various papers read during the session, and the visits made during the vacation. He observed that there had been seven papers read and well discussed, each subject being of practical importance to the profession. Visits had been made to five different works, every one of which was of engineering interest. Some belonged to the Government and others to companies and private firms, and to each of the proprietors alike the thanks of the Society were due for the valuable opportunities of instruction afforded, especially to the junior members of the profession. The general position of the Society, he observed, was very satisfactory, a considerable number of members having been elected during the past year, and the accounts, which had just been read, showing a good balance in hand, and indicating generally a healthy condition of the Society's affairs. Turning to matters of more general interest, the President next reviewed the recent progress of applied science in various departments. Referring to the manufacture of iron, he made the following observations:—Competition in this and other countries, through the opening out by new railways of fresh iron and coal measures, and in consequence of every one endeavouring to do more than his neighbour, and to reduce the cost of smelting iron to the lowest amount, has, I fear, in many instances not contributed to the improvement in the quality of iron. The lives of blast furnaces are of very short duration, compared with what they were in the early part of the present century. I can give two instances of the length of time furnaces lasted without being blown out, and which furnaces were at the Alfreton Ironworks, Derbyshire. One blown in during the year 1812 was in blast until 1873, whilst another blown in during 1821 was not blown out until 1866. This latter furnace was visited by the members of the British Association during their meeting at Nottingham. After the furnace was blown out, an examination showed that there had been formed a partial lining of plumbago which protected the fire-brick lining, which I think you will admit was a very remarkable incident in blast furnace practice. I do not find charcoal had been used in smelting during the earlier period of the life of these furnaces. Coke alone was used up to 1829, when equal parts of coal and coke were substituted. The introduction of the hot blast was the cause of all coal being used; at that time the furnace or Tipton coal mixed with a lower hard coal was the fuel used. The ironstone used was the argillaceous of the coal series, containing from 25 to 37 per cent. of metallic iron. The iron in the raw stone exists as a carbonate, and requires calcining at a cherry red heat, to convert the carbonate into a peroxide of iron for melting. Iron made from this ore is very strong indeed. The bands of ironstone, technically called "rakes," are some of them found with the coal seams; the blue rake lies above the lower hard coal; the kernel rake lies above the yard coal. Nine different rakes have been worked at the Alfreton Ironworks, and it was found that the greater the variety used, the better and stronger was the iron produced; I find Durham coke the best for smelting purposes. The demand for iron being greater, and the oolitic formation being used, ironmaking took a new form. Blast furnaces were constructed to produce very large quantities of pig iron, and works were erected for the purpose of using the oolitic ores alone. In consequence of not having any of the old strong argillaceous ores mixed with them, iron sometimes gets into bad repute, and makers of strong iron are sometimes to their disadvantage classed with others who do not so mix the iron ores. I find also that the hard coal of Derbyshire gives the iron a better quality than coke as used in the north. Furnaces using coal do not require to be built more than 50ft. high, but those using coke are best at 70ft. or upwards. Low furnaces are undoubtedly the best for the iron ores lying in the Midland counties, and are about 48ft. high, 3in. to 3½in. tuyeres, pressure of blast, 4 lb. to 4½ lb., and blast heated to about 750 deg. A furnace of this description makes a good tenacious iron, from a mixture of ores from Lincolnshire, Leicestershire, Northamptonshire and the argillaceous ore of Derbyshire, and smelted with the best hard coal, clean and free from pyrites. Re-melting iron in the cupola should be very carefully performed. The iron should consist of a mixture of three or four kinds of pig, and the coke should be very clean and free from sulphur, or, however good the pig iron may be, the re-melting will ruin the iron; make it tender, and it will not sustain nearly the strain it should do, hence some of the best founders do not sell pig iron. The metal from the blast furnaces requires testing every day, and if the re-melting be carefully carried out, and the castings allowed to remain in the sand long enough to prevent them being chilled, there need then be no fear of the iron not standing the required test, which generally is as follows:—That a bar of 1in. square and 38in. long, and weighing not more than 10 lb., will, when supported at points 36in. apart and loaded in the middle, sustain a weight of not less 7 cwt. I think it would be well for every one entering our profession to go first for a time into a foundry and see for himself the varying contraction which goes on in different kinds of iron; afterwards he should go into the pattern shop. He would afterwards remember to design his work so that the iron should contract as far as possible uniformly, and so that one part should not fracture another during cooling, which is very often the case. I think, too, that engineers are often asked to produce a certain amount of work, and the cost not to exceed a certain sum. This causes the thicknesses of metal to be so cut down that it really is a wonder there are not more accidents than there are. I may observe in passing that the cost of pig iron has been greatly reduced by the gases being taken from the furnaces for heating the air in the hot-blast stoves, and also for the blowing engine steam boilers, and for other purposes connected with iron manufacture. This saving in coal in pig iron making, also in the foundry, and the enormous saving of fuel in steel making is to a great extent the cause of the increasing surplus of coal throughout the country. Mr. Hunt's figures show that the average quantities of coal consumed has declined since 1871 to the extent of 16 cwt. per ton of pig iron made in the United Kingdom. As the annual make of pig is almost 6,000,000 tons, the total economy is about 4,800,000 tons per annum. Another saving occurs in the manufacture of steel rails by the Bessemer process, the quantity of coal required to produce a ton of such rails being generally admitted to be 65 per cent. less than required for iron rails. The annual production of steel rails is about 650,000 tons, so that we have a reduced consumption of fuel of about 1,166,500 tons, as compared with iron rails. There are also other departments of iron making in which the consumption of solid fuel has been greatly reduced of late years by the use of the waste gases from the furnaces as well as by improved methods of workings. The President then reviewed the progress of electric lighting, briefly describing the various systems which stood foremost in practice, and pointing out their advantages. He then referred to the development of gas illumination, which had been greatly improved since the introduction of electric lighting in our streets, the two leading systems of advanced public illumination being those of Sugg and Bray. He then described Pintsch's system of railway carriage lighting as working on most continental railways and on many of our own. The advances made in steam engineering then received attention at the President's hands. He adduced, as an instance of high pressures and economical working, the little steam yacht Anthracite. The progress made in working engines by means of compressed air was illustrated by a reference to the Beaumont system, which we may shortly expect to see in practical use for railway and tramway purposes. Bower's beautiful process for protecting iron by a coating of magnetic oxide was then explained, the President, in conclusion, describing the photophone, which he instanced as another beautiful outcome of scientific research. He observed that, although of no practical value at the present moment, the time might arrive when it would be before the world as an instrument of practical utility adapted to the every-day wants of man. The address, which was very interesting, was attentively listened to by an appreciative audience, and at its close a cordial vote of thanks was given to the President, who acknowledged the same in a few appropriate words, and the proceedings terminated.

THE INSTITUTION OF CIVIL ENGINEERS.

PORTSMOUTH DOCKYARD EXTENSION WORKS.

At the ordinary meeting on Tuesday, the 1st of February, Mr. Abernethy, F.R.S.E., president in the chair, the paper read was on the "Portsmouth Dockyard Extension Works," by Mr. Charles Colson, Assoc. M. Inst. C.E.

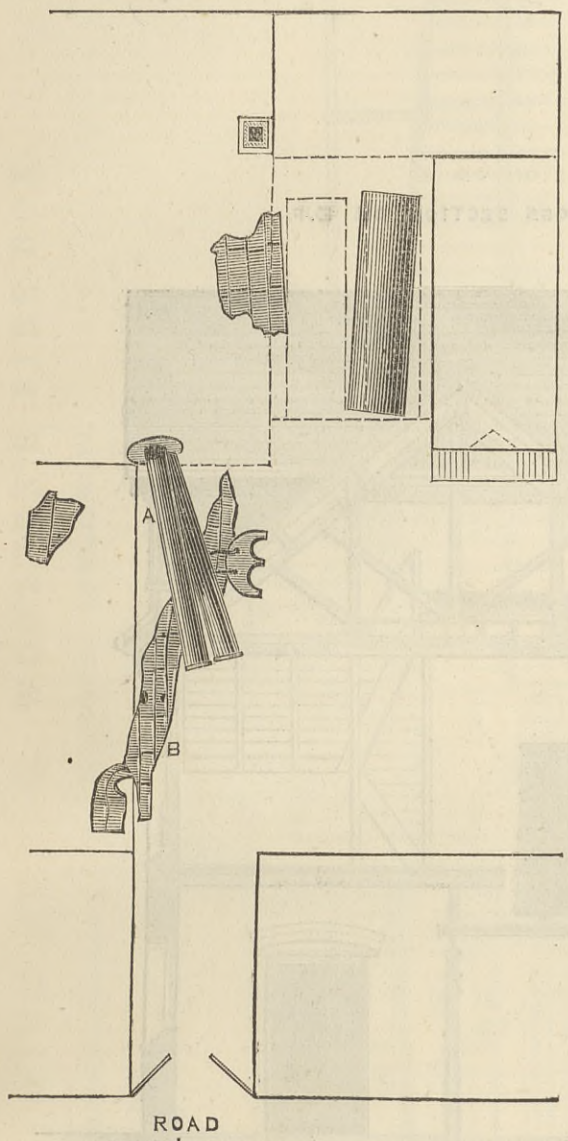
It was observed that the great changes during the last few years in the science and practice of naval architecture had rendered necessary additional accommodation, adapted to the requirements of the modern class of ships, at the principal naval ports of the kingdom, particularly at Chatham and at Portsmouth. In 1540 the Royal Dockyard at Portsmouth covered only 8 acres; by gradual additions it had increased in 1790 to 95 acres, at which it remained until steam began to be the motive agent. In 1843 the present steam basin and four large docks, covering an area of 20 acres, were commenced, and were completed in 1848. When the iron clads of the modern navy came into being, docks and basins with special features were required, and in the session of 1864 parliamentary powers were obtained for the construction of new basins and docks. These works were on the north side of the island of Portsea, somewhat to the east of the old dockyard. The area enclosed was about 180 acres, of which 95 acres had been reclaimed from the mudlands of the harbour. These works were designed by Colonel Sir A. Clarke, K.C.M.G., C.B.R.E., Assoc. Inst. C.E., and were carried out under the superintendence of Mr. H. Wood, M. Inst. C.E., Mr. J. Macdonnell, and the author. The geological formation exposed during the execution of the works was the lower tertiary or eocene series; on the south side the London clay was from 10ft. to 40ft. thick, and cropped out a short distance from the shore line; above was a recent deposit of sand and gravel. The bed of the harbour had at some remote period been denuded of the London clay, the surface being covered with mud varying from 2ft. thick on the south side to 35ft. and 40ft. on the North side. Beneath the mud were the beds subordinate to the London clay of a dark, greenish sand, containing masses of hard shell rock. Before the works could be commenced it was necessary to enclose the site. This was done by constructing a shallow dam on the highest part of the mud and an outer dam enclosing the harbour wall. The inner dam was completed in October, 1868, and 1200ft. of the outer dam were closed at the same time. The additional water area or basin accommodation consisted of the tidal basin, 9 acres in area, with a depth of 43ft. 6in. at H.W.O.S.T., and 30ft. at L.W.O.S.T., and about 1600ft. of wharfage; the repairing basin, having an area of 21 acres, and 34ft. 10in. in depth at H.W.O.S.T., and 21ft. 4in. at L.W.O.S.T.; the rigging and fitting basins, each having an area of 15½ acres, with 34ft. 10in. depth of water at H.W.O.S.T., and 21ft. 4in. at L.W.O.S.T.; the wharfage accommodation in the three latter basins was equal to about 8200ft. The whole of the works were constructed in Portland cement, more than 100,000 tons having been used. The retaining walls for the basin and harbour wharves varied in sectional area according to the position and depth from the level of the coping. The tidal basin wall was 48ft. 10in. in height, and the width at the base was 22ft. 6in., diminishing to 6ft. at the top. The harbour wall was 44ft. 6in. high by 20ft. wide at the base, and the basin walls were 38ft. 6in. high and 16ft. wide at the base. The materials used were brick and concrete, with Portland stone for facing at the top and granite coping. The foundations were laid upon piles ordinarily spaced 5ft. and 4ft. apart from centre to centre. The size of the piles varied from 11in. to 15in. in diameter, and their length from 14ft. to 19ft. for beech, and 20ft. to 30ft. for fir; transverse and longitudinal sleepers were fitted over the pile heads; on the outside was a continuous row of sheet piling. The pile shoes were of a composite character, the plug being of cast iron with wrought iron straps; all the piles, with the exception of the back row, were driven to the same batter as the wall, viz., 1 in 8. The toes of the walls were protected by a concrete foreshore about 10ft. wide. The docks contemplated were five in number; of these only three had been constructed, viz., two communicating with the repairing basin, and the deep dock which was entered from the tidal basin. The entrances only of the two others had been constructed, the docks being left for future consideration. The foundation of one of the docks on the south side of the repairing basin was partly on the London clay and partly on the sandy beds below, and was constructed of beech piles from 14ft. to 16ft. in length spaced generally 5ft. by 4ft. apart, except near the head, where the lines of piles were altered to suit the curve. Considerable difficulty was at times experienced in driving these piles, in consequence of meeting with isolated beds of stone. When these stones were near the excavation level they were removed, and the pile was driven in its proper position and the hole filled with cement. The foundations for the broad altar, and all works above, were also on piles, but at a higher level than the foundation for the floors and lower altars. The spaces between the sleepers on the top of the piles, and to a depth of 2ft. 6in. from the top, were filled with Portland cement concrete. The floor was constructed of Portland stone and granite, and was 7ft. 6in. thick. The length from within the entrance to the broad altar at the head was 410ft.; the width between the copings was 110ft., and mean depth 42ft. The entrance to this dock was constructed for an ordinary ship caisson; the width between the copings was 80ft., and the depth of water at H.W.O.S.T. 38ft. 6in. The other dock was parallel with the one just described; the width of the wharf between the two being 100ft. The foundation of this dock was somewhat different, as the piling at a higher level for the broad altar was omitted, and the excavation was continued to the same level as the foundation of the floor of the dock. The length of the floor from the inside of the entrance to the broad altar at the head was 406ft. 6in., and the mean depth 42ft. 3in. The entrance was constructed for a ship caisson, and was 82ft. wide at the level of the coping; the depth of water at H.W.O.S.T. was 33ft. 10in. The culverts for filling and emptying both these docks were arranged on each side of the entrance. The two docks yet to be constructed would also be on the south side of the repairing basin. The piling in the foundations of the entrances had been omitted, the sheet piles only being retained. The deep dock on the east side of the tidal basin was so designed that ships could enter at low water of spring tides. In the foundations, the ground having proved more satisfactory than had been anticipated, the piles were omitted, and an extra depth of concrete substituted. The total length of the floor of this dock, from the inner face of the entrance to the back of the recess at the head, was 415ft., and the mean depth 46ft. 8in. The culvert for emptying this dock was 7ft. in diameter. The entrance was 82ft. wide at the level of the coping, and the depth of water at high and low water of spring tides 41ft. 6in. and 28ft. respectively. The north and south locks were abreast, to the north of the deep dock, and formed with the tidal basin the grand entrance to the system of docks and basins constituting the extension of the dockyard. The length of the floor inside the entrances was 438ft., and the width at the level of the coping 100ft. The west entrance of the deep dock and lock was closed by a sliding caisson, which could be hauled into a camber by engines and gear placed in chambers beneath the roadways. The depth of water over the sills of these entrances was such that ships could enter at low water. The east entrance was closed by a ship caisson, and had the same depth of water as the other docks. All the docks and basins were drained by a 7ft. culvert, communicating with the two main pump wells. These were situated at the south-west corner of the repairing basin, and were 55ft. 6in. deep below the level of the coping. All the sluices were of cast iron faced with gun-metal, and the arrangement of the machinery was such that the valves could be raised either by hand or by shafts and gearing in connection with the capstan or caisson engines. Each penstock was provided with an arrangement for throwing the clutch out of gear by the action of the valve, when it was either completely raised or lowered. The whole of the penstocks, capstans, and sliding caissons were worked by compressed air. The main pumps were on the plunger principle, with plungers 6ft. in diameter and of 6ft. stroke, constructed by Messrs. James Watt and Company, of Birmingham. In the smaller drainage chamber of the well there were three single-acting pumps, each 16in. in diameter, and having a stroke of 2ft. 6in. The engines for working these small drainage pumps were of the ordinary type, having two inverted vertical cylinders, 16in. in diameter, and 2ft. length of stroke. The main pumping engines were of the compound type, with two inverted cylinders, the high-pressure being 40in. and the low-pressure 64in. in diameter. These pumps were capable of clearing two of the largest docks containing together about 90,000 tons of water, in about four hours.

At the above meeting it was announced that the Council had recently admitted Messrs. Baldwin Harry Bent, Edward Robert Birch, B.A., Selwyn Alfred Cutler, Henry Joseph Hamp, Hugh Rowland Jackson, Thomas Cassinet Palmer, Allan Booth Rome, Walter Douglas Seaton, and Archibald William Willet, as Students. The monthly ballot resulted in the election of Messrs. John George Barton, West Donegal Railway; Francis Collingwood, Resident Engineer New York Approach, Brooklyn Bridge; Josiah Easton Cornish, Resident Engineer and Manager; Alexandria Waterworks; Casimir Stanislaus Gzowski, Toronto, Canada; Robert Searles Lindley, Frankfort-on-the-Maine; Charles Sandiford, Locomotive Superintendent, Scinde, Punjâb, and Delhi Railway, and Richard Flint Welby, Rio de Janeiro, as Members; of Messrs. James Thomas Arrow, Westminster; John Audley Frederick Aspinall, Great Southern and Western Railway, Dublin; John Barker, Resident Engineer, Sao Paulo Railway, Brazil; Edward Golding Barton, Dundalk; Arthur Irvine Beaufort Bedford, Assistant Resident Engineer, Port Trust, Bombay; Thomas Blair, Stud. Inst. C.E., St. Mary Axe; John Holmes Blakesley, M.A., Earl's Court; Charles John Ennor, Wadebridge; Charles Farquhar Findlay, M.A., Dockyard, Liverpool; George Frederick Lee Giles, Kimberley, South Africa; Malcolm Grant-Dalton, Stud. Inst. C.E., Westminster; Charles Frederick Hughes-Hallett, M.A., Westminster; William Inglis, Stud. Inst. C.E., North British Railway, Montrose; George Arthur Jones, Stud. Inst. C.E., Westminster; Jorgen Daniel Larsen, Poultry; John Linacre, Assistant Engineer, Brecon and Merthyr Railway; Henry Hare Manwaring, Stud. Inst. C.E., Assistant Engineer, South Metropolitan Gas Company: Walter Sery Nicholson, Westminster; John Perry, West Kensington; Richard Read, City Surveyor, Gloucester; Edward Brough Taylor, Stud. Inst. C.E., Westminster; Charles Henry Thomas, Chief Resident Engineer, Brecon and Merthyr Tydfil Junction Railway; Alfred Edward White, Town Hall, Hull; John Henry Williams, Stud. Inst. C.E., Westminster; and John Edward Worth, Borough Engineer, Burslem, as Associate Members; and of Messrs. William Robert Bousfield, M.A., Barrister-at-Law, Temple; and Richard Boughey Monk Lingard-Monk, Solicitor, Manchester, as Associates.

It has been found necessary to limit the load which may pass over Telford's fine bridge over the Clyde at Glasgow to 12 tons. Signs of weakness under the heavy modern traffic have made this limitation necessary.

THE BOILER EXPLOSION AT BATLEY.

A BOILER explosion of a very disastrous character occurred on the afternoon of Wednesday, the 19th ult., at Messrs. Graham and Hirst's mills, near Batley, whereby sixteen persons were killed, several others severely injured, and much damage was done to the premises. The exploded boiler was the left-hand one of two which supplied steam to the engines and works. It was of the ordinary Lancashire type, 27ft. 4in. long and 7ft. 4in. diameter, with flue tubes 3ft. 1in. diameter; the plates of the shell were originally $\frac{3}{8}$in. thick with $\frac{1}{2}$in. ends, and those of the flue tubes were $\frac{7}{16}$in.; the seams were single rivetted by machine. The external flue arrangement was the same as that generally adopted for boilers of this class. The boiler was evidently of considerable age, but the firm do not know when it was made as they bought it second-hand. It appears to have been fitted with the usual mountings, though most of these, including the safety valve, was carried away by the force of the explosion. The maximum pressure at which it was worked was said to be 35 lb. per square inch, and it is stated that this was observed to be the pressure a few minutes before the explosion took place.



From the position of the fragments as shown in the sketch, it would appear that rupture commenced near to the back end over the right seating wall, and on examining the plates which rested on the brickwork at this part our correspondent found them deeply corroded. The front end plate of the shell—the bottom half of which was torn away from the upper portion—is also corroded completely through, at what has evidently been the level of the stokehole floor. The flue tubes with the back end-plate attached—marked A in the sketch—are comparatively uninjured, and a peculiar feature in the explosion is the manner in which the shell has rent the main fragment B, which is about 60ft. in length and from 4ft. to 8ft. in width, having unwrapped itself in a spiral form. The dome C was projected about 50 yards, and several of the fittings were thrown a still greater distance. The adjoining boiler was moved a little from its former position as shown in the sketch, where the dotted lines indicate their position previous to the explosion. The boilers were not under the inspection of any of the boiler insurance companies.

"STREET'S INDIAN AND COLONIAL MERCANTILE DIRECTORY FOR 1880-1."—We have received from Messrs. G. Street and Co., Cornhill, a copy of their Indian and Colonial Mercantile Directory for 1881. This directory, as published in previous years, we have been able to notice favourably for its completeness. This year its value is enhanced by revision and additions, and it is remarkable of this directory that some additional feature is added each year. In addition to the trade returns, tariffs, populations, &c., the present volume contains full particulars, with rates and times of transit, of the steam and other communications with the various places treated of, wherever anything like a regular mode of conveyance or correspondence exists; and the average time of transit by sailing vessels is also given. The leading merchants and traders of every class, likely to be of any use to manufacturers and all engaged in commerce, are fully enumerated, together with the leading professional men—*e.g.*, physicians, surgeons, solicitors, &c. Concise descriptions of each country and town, and the principal products and details as to the articles of which the trade returns chiefly consist, are also given. All the London agents to each of the colonial banks are named, so that a merchant is enabled to see to whom to apply, where financial information or assistance is needed in connection with any particular town or city. Wherever possible, the principal Government officials and consuls in each town are given. Particulars of the various railways in operation, or in course of construction, are also supplied where practicable. The number of towns and cities described has again been increased. Maps are again given of all the principal countries of which particulars are furnished in the letterpress. These have been specially revised. In the present edition the names of the chief towns, the principal products of the different countries, and similar information, have been alphabetically arranged, so as to facilitate reference. The directory is well printed, and must be of high value in every office having foreign relations.

LEGAL INTELLIGENCE.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

February 5th.

(*Present:* SIR BARNES PEACOCK, SIR MONTAGUE SMITH, SIR ROBERT COLLIER, *and* SIR RICHARD COUCH.)

Re REECE'S PATENT.

THIS was an application, on behalf of the petitioner, to admit the filing of supplementary particulars in a petition to prolong a patent, which has been fixed for hearing on the 1st of March next.

Mr. ASTON, Q.C., appeared for the petitioner.

In a recent case their Lordships made some comments on the omission, from a similar petition, by another inventor, of any reference to the existence of foreign patents for the invention, and the remuneration earned from that source, which they thought were important ingredients in the consideration of the desirability of its prolongation. In this instance it was found, after their Lordships' observations, that in ignorance of the procedure of the court, a like omission had been made in the applicant's petition, and he now asked to be allowed to give the necessary information in regard to his foreign patents in a supplementary paper.

Their LORDSHIPS, pointing out the importance of having all the facts before them, granted the application.

Solicitors for the petitioner: Messrs. Collis and Mallam.

HIGH COURT OF JUSTICE.

(CHANCERY DIVISION.—*Before* VICE-CHANCELLOR BACON.)

January 27th, 28th. February 1st, 2nd, 3rd, and 4th.

SIMMONS *v.* HITCHMAN.

This action, which lasted many days and terminated on Friday in last week, was brought by Mr. Frederick Simmons, the patentee of an invention for "An improved button-hole sewing machine, which machine may also be employed for other sewing purposes," under Letters Patent dated the 8th June, 1878, No. 2302. The defendants were, Messrs. Hitchman and Felton, who carry on business at City Garden-row, City-road, London. The plaintiff alleged that the defendants had infringed his invention by selling button-hole machines which were only colourably different from his. The defendants disputed the plaintiff's patent. They alleged that his invention had been anticipated by prior inventors and makers, such as Messrs. Dowling and Young, Messrs. Judkins and Gosling, Mr. Thomas Rose, Mr. George Frederick Redfern, Mr. William M'Intyre Cranston and others, and they further denied that they had infringed. They claimed the right to make the machines sold by them, as patentees under Letters Patent granted to them and dated 21st June, 1878, No. 2471, for "Improvements in button-hole attachments to sewing machines." The defendants, moreover, counterclaimed against the plaintiff for an injunction to restrain him from cautioning the defendants' customers from buying their machines, and for damages in respect of such warnings already given.

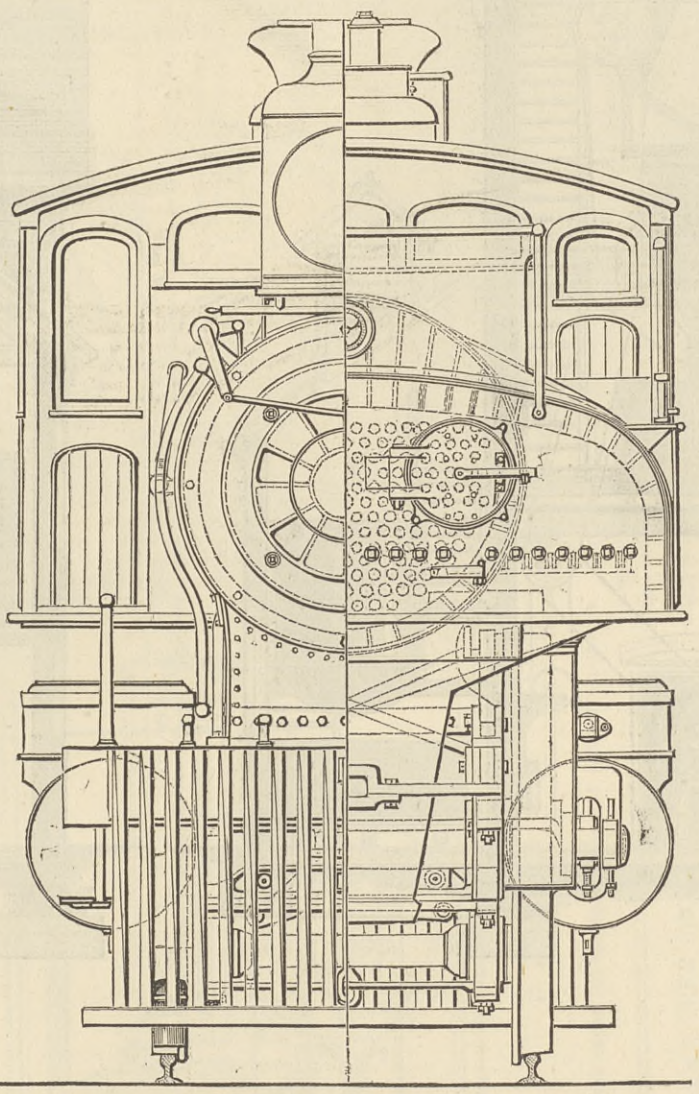
The machines of the respective parties differed chiefly in the mechanical means employed for working the feed. It is obvious that corresponding motions of the cloth are required in each case, the only difference was how these motions were produced. It would be impossible to give anything like an intelligible description of these machines without the aid of drawings—and here we must again enter our protest against the discreditable manner in which the drawings published with specifications are now issued by the Patent-office. The drawings attached to the specifications of the above-mentioned patents, and especially to that of the defendants, are so badly done as to be almost worthless for any purpose of description. Indeed they are almost unintelligible. To add to this sufficiently serious difficulty, the specifications are themselves badly drawn, and had it not been for the actual machines produced in court, it would have been impossible to have tried the case properly, if at all.

Mr. Aston, Q.C., and Mr. Lawson appeared for the plaintiff, and Mr. Hemming, Q.C., and Mr. G. I. Foster Cooke for the defendants.

For both sides expert witnesses were called. Mr. Imray carefully dealt with the two machines, illustrating his opinions by diagrams, and Mr. Gray gave evidence of similar kind for the defendants. Evidence was also given as to the utility of the two inventions. But a strong fight was made upon the allegation of the defendants that the plaintiff had borrowed his ideas from others, notably Messrs. Dowling and Young. It was said that the plaintiff had seen the machine of the latter invented in 1877, and had carefully mastered its details, but it will be seen from the judgment that the Court did not consider that the defendants made out their case as to this.

The VICE-CHANCELLOR, after commenting upon the particulars of breaches and objections delivered between the parties, and especially upon the objection put forward by the defendant as to want of novelty in the plaintiff's invention, observed that they raised very clear and distinct issues, and the first thing he had to consider was whether the objections were sustained. The defendant sought to sustain such objections by referring to a quantity of printed specifications of former patents. In his opinion they of themselves were no evidence whatever in support of what was the defendant's contention at the bar, and certainly did not apply to the objection that the objects accomplished by the plaintiff were accomplished also by the preceding patents. It was not enough to read to the Court a specification which, in its general terms, spoke of a machine for making button-holes, and the machinery which was employed to accomplish that object, unless there was produced the machine which was made, or at least some man who would say that a machine was made according to the specification No. 1 or 2, or any other that Cranston, Redfern, or Dowling had made, was usefully made, was adopted by the public, and did accomplish the object mentioned in the specification. There had not been one word of evidence on the subject in all the hours that had been consumed in this discussion from the beginning to the end. Upon Cranston's patent there had not been a particle of evidence; nor upon Redfern's, and Dowling's was open to the most pointed contradiction in several important parts." He then proceeded to comment in detail upon the evidence as to anticipations which had been also before him, and proceeded to repeat that, in his judgment, there had been no particle of evidence which he could with any propriety apply to any of the terms in the specification before him, although he quite admitted that it was unnecessary that he should decide it, for it was very plainly decided by Lord Westbury in the passage which was quoted from *Betts v. Menzies* and elsewhere—that a specification was a publication to the whole British world of the manner in which the invention was to be performed. But then, he said, to that, when it was called in question, must be added proof that the specification did truly describe the manufacture or the invention, and that it had been found to be practical and useful. If it were true that Cranston's was a machine which could make button-holes and did—and in the specification for it the mode of making button-holes was very distinctly explained and manifested to the public interested in it—then he should have to consider this case from a totally different point of view. Upon the first part of the case the learned judge entertained no doubt. He thought that the defendant had failed to prove that at the time that the plaintiff's Letters Patent were taken out it was unlawful for him to obtain those Letters Patent, because of the previous use by the inventors, whose specifications have been referred to. He then proceeded to deal with the further point, namely, infringement, and went on to consider the construction of the respective specifications. He said that there was not a single particle of novelty in any one portion of the machine of either the plaintiff or the defendant. The making of button-holes was an object accomplished by various means, and the plaintiff desiring to make a machine for that purpose, had combined together a quantity of things well known before, to no one of which could he lay any exclusive claim. But what the plaintiff said was that by putting these things together thus, which he described in his specification, and which he was ready to prove the existence of, he had acquired a title as the inventor of that combination and nothing else. It is for the construction, the arrangement, and the combination. The "construction" does not mean the making of a screw cam, or any other particular thing, but the construction of the machine which, when it is twisted in whatever way you will, ends in that one word "combination." The question then was whether the defendant had infringed that combination. Upon that the learned judge had heard an abundance of evidence. "The defendant's machine was not as the plaintiff's was, a substantive original machine for making button-holes, but an adaptation to the common sewing machine, with the machinery which the plaintiff said he had invented. The defendant, on the other hand, made what was called an attachment, and he attached that to any well-known sewing machine. Beyond all doubt, if he had copied the plaintiff's machine—if he had arranged or combined in such a way as the plaintiff claimed for his invention, the making of an attachment would have been no excuse for the infringement which had been imputed to him. He had done nothing of the sort. He had the whole wide world of button-hole machines open to him to take whatever he could find, including what the plaintiff had done. He made an arrangement, construction, and combination, which the learned judge was satisfied upon the evidence was different from that of the plaintiff. With respect to the counterclaim there was not a particle of evidence which would induce the Court to believe that any damage had been sustained by the defendant. All that was proved was that the plaintiff, visiting a customer of his after the action had been commenced, said to him 'I am going to dispute,' the witness says, 'get an injunction,' and the plaintiff said, 'I did not know what an injunction was and used no such word.' But they both agreed that there was a conversation, the result of which was, 'I, the plaintiff, dispute the defendant's right, and I am going to take,' or 'I have begun to take proceedings against him for the purpose of having that dispute settled.' That counterclaim, in the learned judge's opinion, must, therefore, be dismissed with costs. In his opinion the plaintiff had failed to make out his case for an injunction, and his action must be dismissed with costs. The defendant must pay the costs of the issue of want of novelty upon which he had failed and of his counterclaim."

Solicitor for the plaintiff: Mr. J. Henry Johnson; solicitor for the defendant: Mr. Richard Chandler.



AMERICAN EXPRESS LOCOMOTIVE.—(*For description see page* 103.)

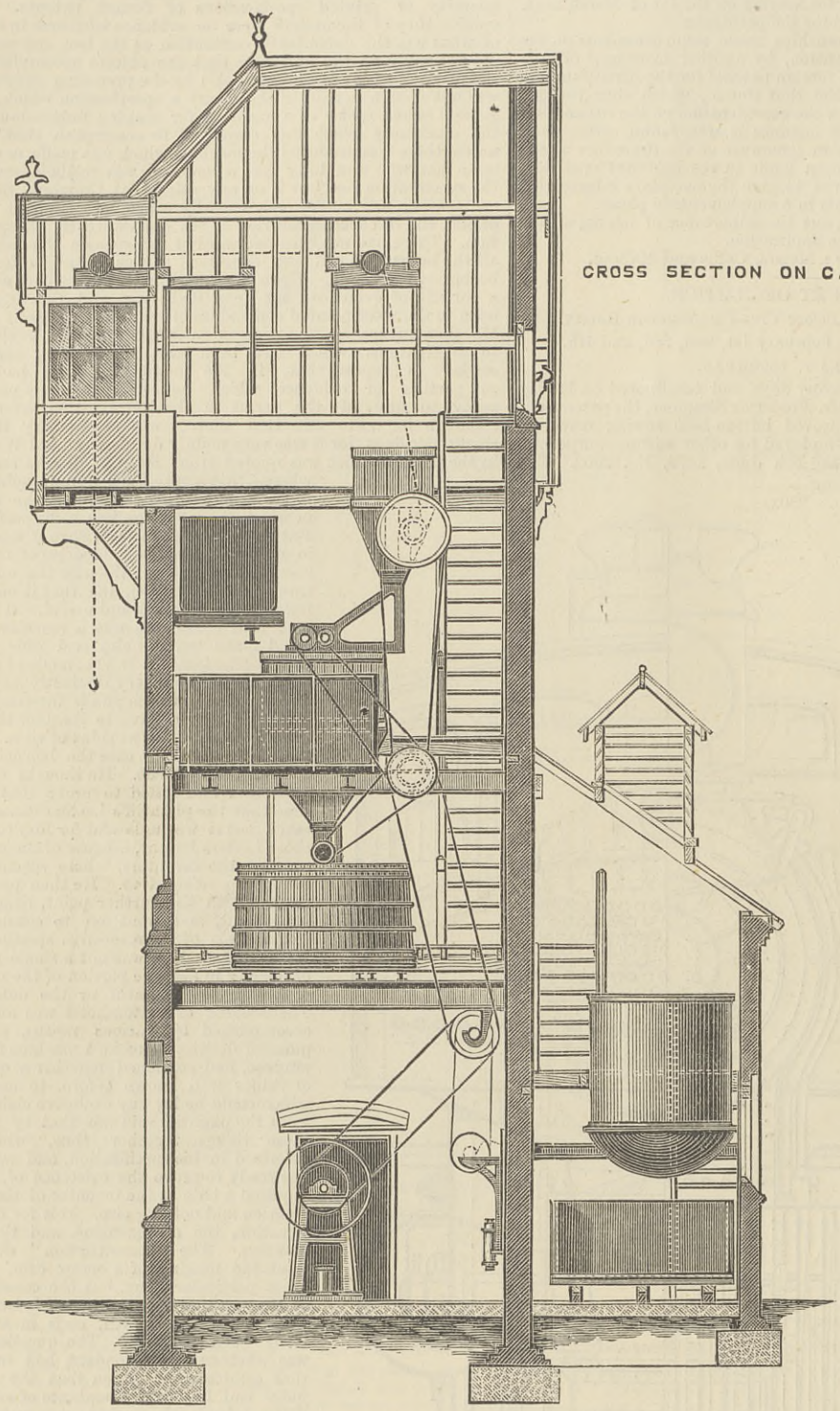
THE LIVADIA.—From Berlin comes the story that a detachment of Russian sailors has gone to Ferrol to take part in the extensive repairs of the Livadia, after her first short voyage. It is contended by M. Verchovski and other shipbuilders that, owing to the pressure of the water against the circular hull, and the vibration of the monster engines required for her propulsion, the Livadia will never be a seaworthy vessel. We shall be pleased to hear what Messrs. Elder and Sir E. J. Reed will have to say on this subject. The whole history of the career of this ship since she left our shores is shrouded in mystery; which is a pity, seeing that the ship is such an important experiment.

EIGHT QUARTER TOWER STEAM BREWERY.

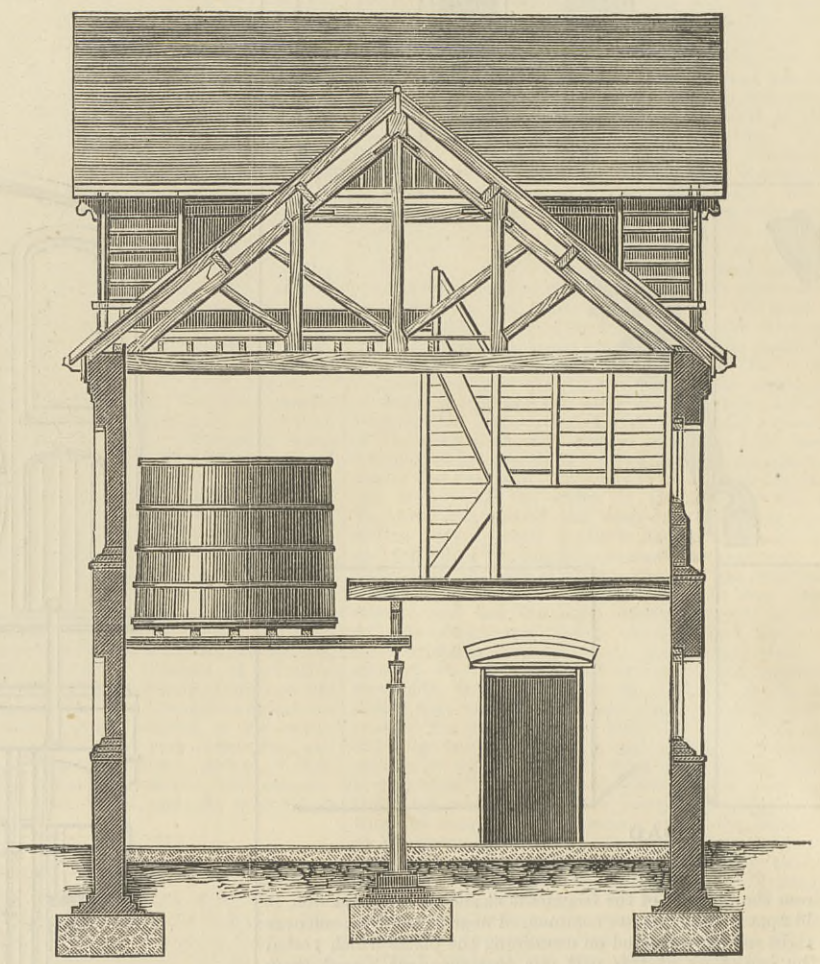
MR. ARTHUR KINDER, C.E., LONDON, ENGINEER AND ARCHITECT.

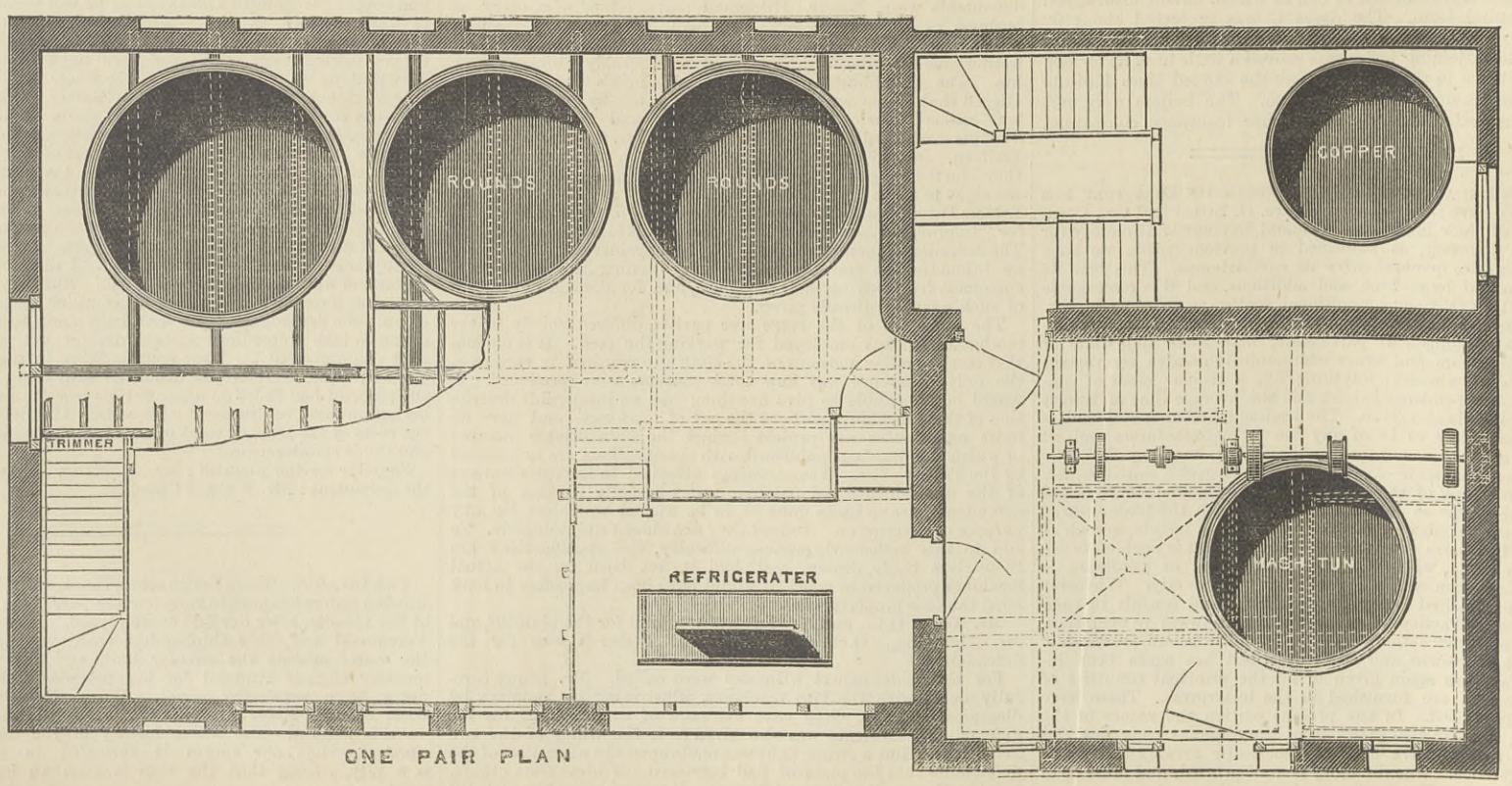
(*For description see next page* 99.)

CROSS SECTION ON C.D.



CROSS SECTION ON E.F.

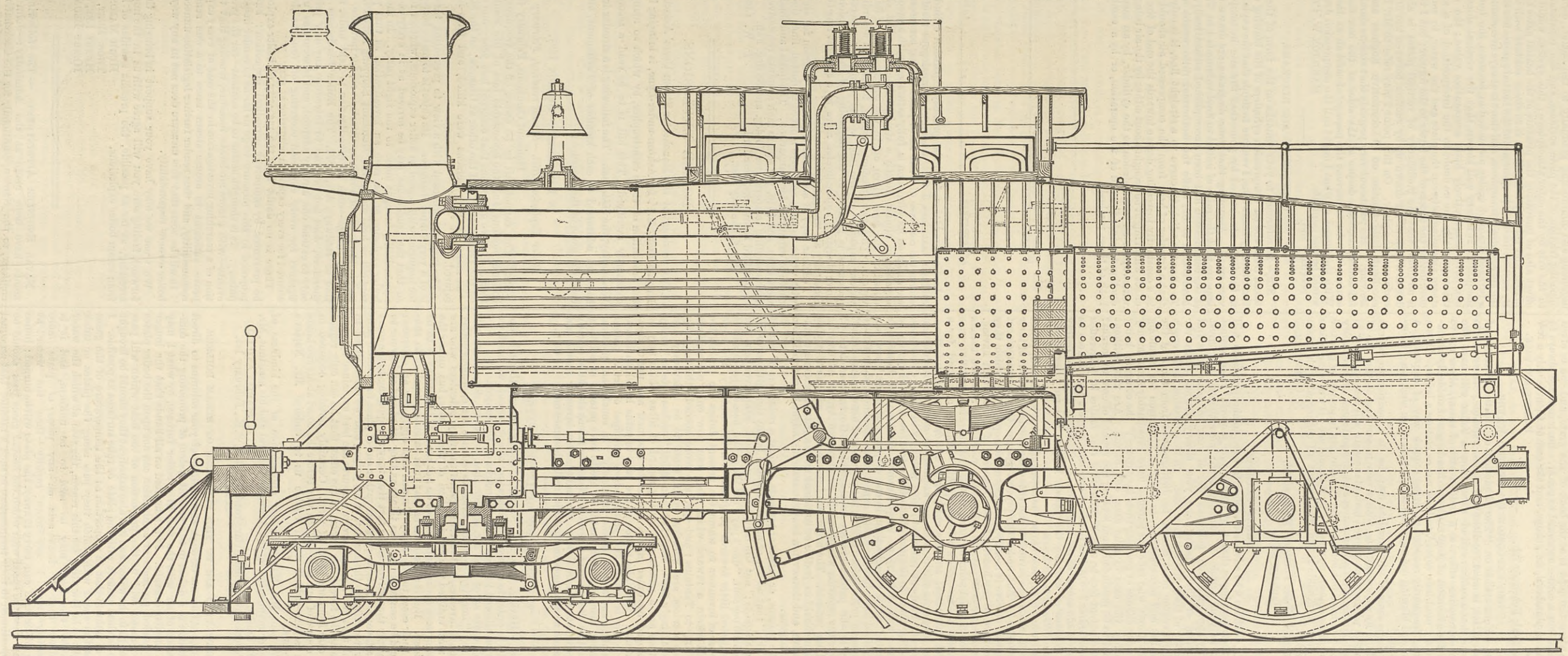




ONE PAIR PLAN

EXPRESS LOCOMOTIVE, WITH MR. J. E. WOOTTEN'S FIRE-BOX.

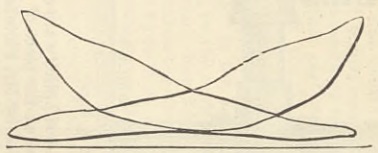
BUILT BY THE PHILADELPHIA AND READING RAILWAY COMPANY, AT READING, PA.



SCALE OF FEET

0 6 12 1 2 3 4 5 6 7 8 9

We give above a longitudinal section, and on page 101, two combined cross-sections and an end view of Mr. Wootten's high-speed engine, an elevation and description of which we published last week. Our engravings are copied from engravings published in the *American Rail-*

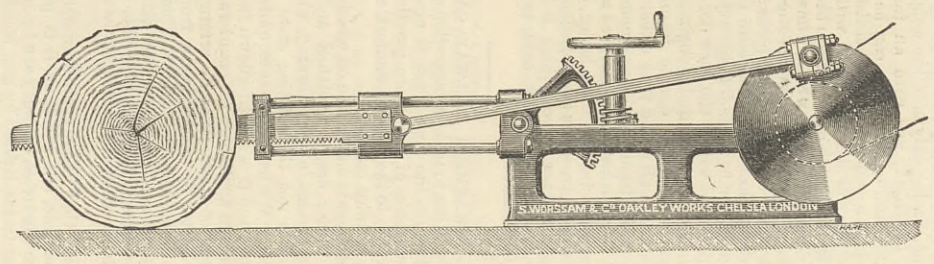


road Gazette. We have criticised Mr. Wootten's designs in another page, and consequently have little to add here to what we have already said. We may repeat, however, that the cylinders are 21in. diameter and 22in. stroke, the driving wheels being 5ft. 8in. high. The weight of the engine is nearly 43 tons, which is greater than that of any English passenger tender engine; although we believe there are some goods engines on the North British Railway which weigh nearly as much. The tender is said to hold 4500 gallons, but these are American gallons, equivalent to about 3600 English gallons. This is, it would appear, only enough for a run of about ninety miles; so that the engine apparently uses 40 gallons or 400 lb. of water per mile, which is a very heavy consumption considering the speed and load.

We give two reduced copies of diagrams taken at sixty-five miles an hour.

WORSSAM'S TREE CROSS-CUT SAW.

In a former impression we have described a new tree-felling machine, made by Messrs. S. Worssam and Co., to be worked by hand



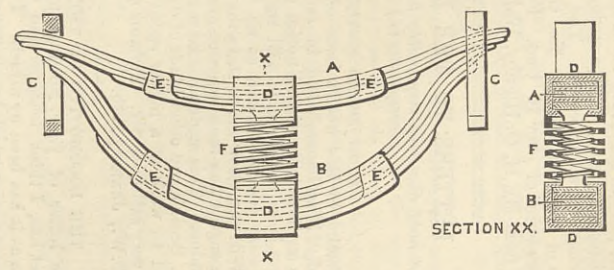
or power, and we mentioned that a modification of the machine is necessary when it is to be used for cross-cutting the felled trees. The machine as arranged for this purpose is illustrated by the annexed engraving, which is self-explanatory.

JENKINS' LOCOMOTIVE SPRINGS.

Figs. 1 and 2 represent a locomotive spring, side elevation and section, the invention of Mr. James Jenkins, of Cornwall. In place of the ordinary massive spring used, this spring is divided into two parts A and B connected in the centre by a compound spiral spring F. The two spiral springs—right and left hand—rest on the lower buckle D held fast by a stud let into the buckle and projecting $\frac{3}{4}$in. or more; there is also a stud let into the upper buckle D as shown in sketch, the studs being fixed in the buckles before the plates are put in. The bottom plate in each spring is turned up at the ends forming clips, which are of iron welded on the steel plate, these clips being shown at E, and hold the spring from all side motion. There are no tits nor holes in the steel to weaken the spring, thereby decreasing its liability to break. The ends of the hangers C C may be attached in any suitable manner to the locomotive.

By the peculiar arrangement of this spring all dead weight and inert material is removed from the centre of the spring; when the weight is applied the lower spring B slides independently backwards and forwards on the underneath surface of the upper spring A. This spring has been tested on the Union Pacific Railroad, and has given, we understand, much satisfaction. As shown in the sketch, the lower spring

FIG. 1 FIG. 2



B has six leaves, and the upper A five leaves, this arrangement being suitable for an American locomotive, but can be altered to suit an English engine. These springs can be used for the leading, driving or trailing wheels. The spring complete weighs 75 lb., made of steel 3in. wide by ⅝in. thick, and withstands a hydraulic pressure of over 10 tons. Further information can be obtained from Mr. H. G. Humby, Walthamstow.

LETTERS TO THE EDITOR.

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

HIGH SPEED ENGINES.

Sir,—Referring to this week's issue of The Engineer, under the head of "Miscellanea," and in reference to Mr. Edison's experiments on electric lighting, I notice you say that "no steam engine has yet been made which will run continuously and quite steadily for long periods of time at six hundred revolutions per minute." Will you allow me to state that I am under the impression such an engine has been invented and made by Mr. Brotherhood, of London. This engine has been in use for some time for working Mr. Brush's and other kinds of dynamo-electric machines, and is found to work at a higher speed even than six hundred revolutions very satisfactorily. *Palmam qui meruit ferat.*

Chelsea, S.W., January 29th. Sam. Worssam.

THE LOCOMOTIVE OF THE FUTURE.

Sir,—The letter of your Nottingham correspondent on the above subject has, I think, been perused with interest by many of your readers as it has been by myself. I cannot, however, quite endorse the conclusion which he arrives at, that outside cylinders will characterise the locomotive of the future. In my opinion the outside cylinder engine can never be made equal to those with inside cylinders in steadiness at high speeds, nor are they quite so economical in fuel, other things being equal. With outside cylinders there is a very undesirable overhang at the leading end, which can only be avoided by the use of a bogie, and this implies a heavy and expensive engine with a great deal of dead weight. It admits of little doubt, however, that larger cylinders than are now generally used will ere long be employed, but with the double frame arrangement these can be placed inside without embarrassment.

When there is a bearing outside as well as inside the wheel, the inside bearing, having only half the weight to carry, can of course be reduced in length, and with an inside bearing 6in. long a distance of 2ft. 6in. or 2ft. 6½in. can be secured from centres of cylinders, which is sufficient to give satisfactory accommodation to cylinders of 18in. in diameter, and with a further reduction of ¼in. or ½in. in the length of the inside bearings, cylinders of 18½in. or even 19in. may be got in, which, I imagine, will be equal to any requirements of the future. On the Northern Railway of France, referred to by your correspondent, perhaps more experience of the various types of locomotives has been gained than on any other line. Its engineers have had large experience with the outside cylinder engine, and within the last dozen years they have given the three types of inside cylinder engines a fair and impartial trial, with the result that the double frame arrangement has given greater satisfaction all round than either the single inside frame or the single outside frame, and consequently inside cylinders with the "mixed" frame have been adopted as the standard type of the line for passenger traffic. The latter kind of frame for inside cylinders doubtless possesses several advantages over any arrangement of single frames, one of which is that it reduces the consequences of a broken crank axle to a minimum—a fact of paramount importance. X.

January 20th.

WARMING RAILWAY CARRIAGES.

Sir,—Permit me to make a suggestion evoked by the late severity of the weather, in the hope that it may be thought worthy of attention by some of the more practical of your readers. It is with reference to the present comfortless and insufficient manner of warming railway carriages.

The compartments on the line on which I have travelled regularly during this winter are as wretched and cold as icehouses, especially the first trains in the morning, which stand in the open air all night. Does not the existing state of things admit of some improvement? We have a climate quite as severe as that of the United States, and it is a well-known fact that we are far behind the Americans in appliances for counteracting this severity. Could not a system of steam-pipes be arranged running through the train, to be heated by exhaust steam from the engine or part of it, or by steam direct from the boiler? There is often plenty to spare, and I am sure it would be much more satisfactory to the passengers if the surplus steam were used for this purpose, instead of being allowed to blow off at the valves, as we often see it doing, entirely wasted.

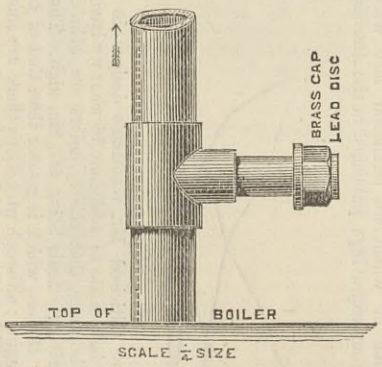
I cannot say that I have gone thoroughly into this matter, as I have not the time, but I believe it is perfectly feasible. I know there will be obstacles, but they are by no means insurmountable. We have our trains lighted by gas, fitted with continuous vacuum brakes and signal alarms, why not with a continuous steam-heating apparatus? The man who introduces such a system will, I am sure, earn the heartfelt gratitude of thousands of railway passengers, by supplying a real comfort, which is very much needed, and which cannot fail to be appreciated. G. H. J.

Walton, February 1st.

KITCHEN BOILER EXPLOSIONS.

Sir,—The arrangement of open end pipe bending over the cistern, as explained in "Correspondent's" letter in your issue of the 4th inst., is one that has been in use for a number of years by the firm of Benham and Sons, of London, who adopt it in the public buildings they fit up. I believe it has been found by them to answer well.

I beg to enclose sketch of a safety disc that I have in several



cases fitted where cheapness and simplicity are considerations, and which answers the same purpose as the piece of lead soldered over the hole in the pipe, as suggested by Mr. Fletcher in his letter. In the hot water return pipe, a few inches above the boiler top, I fix a T-piece, with a ½in. outlet, and into this is screwed a short piece of pipe, or a nipple. Next I take a brass union cap, or the cap from a fitting termed a "cap and lining," and over the hole in the top of this I solder a piece of sheet lead, and then screw the cap on to the short piece of pipe in the T-piece. The cap should be fixed sideways, and not pointing towards the kitchen, for obvious reasons; or a bend can be used, pointing it up the chimney.

This plan has the following advantages over Mr. Fletcher's method:—In the event of the lead blowing out, it is easier to take off the cap and solder on a fresh piece of lead, and then replace the cap, than for a man to solder a piece of lead over a hole in the pipe, when the pipe is at the back of the grate, and—as is often the case—in a corner awkward to get at. Such caps are always to be had at plumbers', &c., shops, and the cost of them is only a few pence. Robert Renwick.

Watford, February 7th.

THE EXPLOSION OF HEATED WATER.

Sir,—Your article on "The Explosion of Heated Water," of January 21st, is most excellent and no less valuable. If we are to suppose that a sudden exit of water from a boiler will have the same destructive effect as a sudden exit of steam, allow me to draw the attention of your readers to the danger of suddenly knocking in a "mud-hole cover" to blow out or cleanse a boiler. It is a practice frequently resorted to, being a quick way of emptying a boiler and blowing out mud and scale which often chokes a "blow-off cock."

Perhaps some of your readers may be in a position to benefit mankind by experimenting, with a view to arriving at the size of an outlet which when opened instantaneously will cause a boiler to explode under different pressures and circumstances. If the theory which you have put before us for thought can be proved by practice—and there appears no reason why it should not—it will bring before us a most invaluable lesson, and benefit all connected with steam boilers. N. Chandler.

Cannock Chase Foundry, Hednesford,
January 28th.

CHEAP PATENTS.

Sir,—Those who advocate or look forward to cheap patents will feel their best hopes shaken by finding your powerful voice against them in your article of January 28th; nevertheless they must greatly appreciate your generous offer of your columns for a full discussion of their claims, and your clearly setting forth the necessity of their proving their case. In this question the interests of the inventor must clearly be distinguished from those of the capitalist and manufacturer, as there is no reason for assuming "that those who take out patents have presumably some money and some chance of pushing their inventions;" the contrary being probably the case in nine cases out of ten. Are men without capital to be precluded from seeking the reward offered to genius? Should patent fees be a tariff protecting rich brains in preference to poor brains? Or does political economy suggest patent fees as an advisable source of public revenue? Certainly not. To defray the expense of working the patent laws is the only legitimate *raison d'être* of these taxes.

And what is supposed to be the object of patent legislation, unless it be to encourage inventors and stimulate the development of their discoveries? But under the present system the encouragement inventors receive is merely a precarious monopoly, for which they are obliged to pay heavily before knowing if it be worth having. That of some 5000 patents applied for every year 3000 are useless in a commercial point of view, proves that there is a vast difference between an inventor's advancing his claim to a reward for a useful invention, and his enjoying a monopoly of manufacture. Many inventors neither wish nor are able to carry out their inventions, and take out patents to give publicity to their discoveries, and offer them to the manufacturing world for what they may be worth; and if many of Stephenson's, Watt's, and Bessemer's patents "never brought them in one sixpence of profit," how can less gifted inventors be justly expected to foreknow their future balance of profit before risking the payment of heavy stamp duties? Why is the patent system to resemble a Government lottery? This is the question which should be answered by the adversaries of cheap patents. The minimum fee compatible with a self-paying system should in justice be sufficient until a patent becomes remunerative, and then even a heavy income tax might be charged from year to year.

The reasons, or rather arguments, against a reduction of patent fees are "that no one of necessity would be any the better save the patent agents;" not the inventors, because of 5000 inventions per annum 60 per cent. "don't pay;" not the public, because patents have contributed little towards progress. On the contrary, the large number of inventors to whom the present duties are prohibitive would attain a reward which they can now only contemplate similarly to Tantalus; and—perhaps more needed—the majority whose devices are unlucky would cease to be grievously and undeservingly fined. Nor are the so-called "useless patents" really so, they are a public and lasting record of ideas which may be developed by other minds, and enter into new and useful combinations. They also represent the vast impetus by which inventive genius is revived and prompted—a principal object of patent legislation and a vast benefit to society. In conclusion, political economy seems to teach that if we are to have patents at all they should be cheap; that a reward offered to talent should be equally accessible to all who deserve it; and that the inventor should not be taxed as a monopolist until he really becomes one. G. S.

THE EXTENSION OF LETTERS PATENT.

Sir,—Having, like Mr. Napier, "lately passed through the mill" in order to secure a prolongation of our patent, we trust we may be allowed to make a few remarks on the subject.

We quite agree with Mr. Napier that the chief defect—we will not say "iniquity"—of the present system is the enormous outlay which it involves, as this tells against the very patentees who are the most entitled to a consideration of their cases, but unless the system were entirely altered we do not see how the outlay is to be avoided. But it appears to us that such patentees as elect to submit their cases to the Privy Council and apply for an extension should be contented to take things as they stand and endeavour to reconcile themselves to the fact that they are applying to the court for a favour. It is we presume rather out of place for a suitor publicly to criticise the conduct of his judges, and we are inclined to think that Mr. Napier's severe censures are best explained by your note at the foot of his letter, to the effect that he can only regard the case from one point of view. Certainly nothing occurred in the course of our case—which was before the court about two hours and a-half—which would enable us to endorse Mr. Napier's opinions.

We join Mr. Napier in our appreciation of the kindness of manner manifested by the Attorney-General and his assistant, Mr. A. L. Smith. W. A. Martin and Co.

Pocock-street, Blackfriars-road, London, S.E., February 1st.

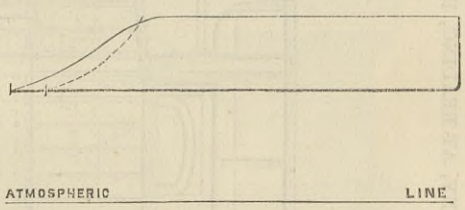
SUPPLYING AIR TO THE FURNACES OF STEAM BOILERS.

Sir,—Allow me through the medium of your columns to direct attention to a defect in the present system of promoting the combination of air with the fuel in a boiler furnace, by what I may call suction draught. It is admitted on all hands that the longer the heated products of combustion can act upon the boiler plates the greater will be the proportion of the heat which will pass through to the water, and it is also expedient they should be brought into as close contact with the plate or tube surfaces as possible. I am of opinion that in proportion as the temperature of the gases falls the speed with which they pass along the plates or tubes ought to be low also; for this reason, the rate at which the water absorbs the heat may be said to be uniform, and it is evident that if heat acts on any piece of plate more intensely—may I say more rapidly—than the water at the other side can carry it away, the plate will be burned; hence I say that the speed with which the heated gases pass should be proportioned to their temperature in such a manner that an equal quantity of water may be evaporated if possible at all points over which the heated gases pass. In suction draught the very reverse of this action takes place, the gases moving with increasing velocity, from the furnace bars to the foot of the chimney, where their speed is highest, and then diminishing gradually, as they ascend the chimney. In my opinion the products of combustion should be pushed or blown through the tubes or flues, which would have the double effect of making the speed greatest at the beginning and diminishing gradually to the outlet, owing to the opposing friction of the plate surfaces, and the resistance opposed to the exit by the outer atmosphere; this system would have the effect also of increasing the pressure of the heated gases against the plates, and thereby bring them into closer contact with the plates. By suction draught the pressure of the heated gases is less than that of the surrounding atmosphere, and there is always in certain corners of a furnace strata of colder air sucked in between the hot gas and the plate. It is very well known that the vertical sides of a fire-box have comparatively little evaporative value; the reason for this is partially due no doubt to the interposition of a stratum of steam ascending between the plate and the water, to some extent obstructing the access of the latter to the former; but I think there is no doubt that the inefficiency of vertical plates is also greatly due to a rush of air drawn up by suction between the fire and the surface of the plate. On this point I may refer to Mr. Reynolds's excellent little treatise on "Locomotive Engines and Engine Driving." He points out very properly that stokers should be careful to keep the fire deeper at the sides of the box than in the centre, in order to prevent the passage of cold air at these points. With the forced, or what I might call the compression draught, this would be less requisite. Hamilton W. Pendred.

February 2nd.

COMPRESSED AIR DIAGRAMS.

Sir,—In reference to your remarks on the form of the diagrams taken from the air compression cylinders of the blowing engines at the Staveley Ironworks, I venture to think that the explanation lies in the fact—also stated by you—that the rise in temperature is very small. Assuming that your diagrams are drawn to scale, it appears that the ratio of initial to final volume is 1 to ·77, whereas if the compression had been accomplished adiabatically, it should have been 1 to ·82, while the isothermal ratio would be 1 to ·72. To alter the adiabatic curve to a straight line, it is only necessary that a transfer of heat from the compressed air should take place in a constantly increasing degree towards the end of the stroke, an effect which might be brought about either by the air being saturated with vapour on its admission to the cylinder, by an increased conduction towards the end of the operation, or by a combination of both of these methods.



In diagrams taken from the primary expansion cylinders of my cold air machines I find a somewhat analogous result, only of course the converse of what takes place during compression. The air which on its admission is fully saturated with aqueous vapour, expands in almost exactly a straight line, an effect chiefly produced by the heat given off in the condensation of its contained vapour. This condensation varying in amount according to the vapour capacity of the air at its various temperatures and pressures, is greater at the beginning of the expansion, and the curve therefore approximates more to a straight line than if perfectly dry air was expanded.

I enclose copy of an actual expansion diagram for air saturated with water vapour, and have marked in dotted lines the adiabatic curve of expansion for comparison. The initial and final pressures were 62 lb. and 43 lb. per square inch absolute respectively, and the corresponding temperatures 75 deg. and 38 deg. Fah.

Dartford Ironworks, Dartford, T. W. Lightfoot.
Kent, January 31st.

BOILER EXPLOSIONS.

The president of the Manchester Steam Users' Association, Mr. Hugh Mason, M.P. for Ashton-under-Lyne, is bringing in a bill for the prevention of these catastrophes, by which so many lives are constantly sacrificed. This bill is to be read a second time on Wednesday, the 16th inst. The following is a circular letter which has been addressed to each member of Parliament, and gives in brief the scope of the measure:—

In Parliament.—Session 1881.

Boiler Explosions Bill.—Second reading, February 16th.

House of Commons, February 4th, 1881.

Sir,—You cannot fail to be aware of the frequency of steam boiler explosions, and the lamentable loss of life resulting therefrom. By two explosions that occurred last year—one at Walsall, on the 15th of May, and the other at Glasgow, on the 5th of March—as many as fifty persons were killed, and forty-nine others injured.

The measure proposed with a view to preventing these disasters is of a very simple character. Its object is to make better provision for inquiries with regard to boiler explosions, whether fatal or not, so that the true cause may be arrived at in every case, and the responsibility brought home to the right party. In the event of a boiler explosion at sea, such an investigation as that proposed in this bill is held under the Merchant Shipping Acts 1874 to 1876; and in the event of a railway disaster—as, for instance, the fall of the Tay Bridge—such an investigation is held under the Regulation of Railways Act, 1871. The Boiler Explosions Bill, 1881, therefore, does not propose to introduce any new principle, but only to extend one already adopted, and to secure as full an investigation for every explosion occurring on *land* as that already secured for every explosion occurring at *sea*.

There is no doubt that the majority of boiler explosions could be prevented by competent periodical inspection; but it is not proposed in this measure to go so far as to render inspection compulsory. It is thought better to be content—for the present, at all events—with a more moderate measure, trusting that the institution of a searching investigation in the case of every explosion will prove sufficient to arouse steam users to a due sense of their responsibility, and thus render further legislation unnecessary.

It will be seen that this measure does not in any way lessen the boiler owners' responsibliity.

We trust we may have your support in bringing this measure forward, feeling sure you will agree with us in the importance o arresting, as far as possible, the present sacrifice of human life from steam boiler explosions.

Hugh Mason,
Thos. Burt,
Henry Lee,
Henry Broadhurst.

Naval Engineer Appointments. — The following appointments have been made at the Admiralty:—John E. Chase, engineer, to the Nankin, additional, for the Cockchafer; Thomas Osborne, engineer, to the Victoria and Albert, additional, for the Elfin; J. M. C. Bennett, engineer, to the Victoria and Albert, vice Osborne; W. H. Moon, engineer, to the Tweed; and C. Allsop, engineer, to the Esk.

RAILWAY MATTERS.

AMONG the signs of returning business prosperity in Switzerland may be noted the fact that the receipts of the railways for the past year exceed those of 1879 by 2,000,000f.

A SMALL electric railway which was temporarily laid at the Calcutta Zoological Gardens for exhibition purposes, was extensively used, and regret is expressed at its removal.

MUCH objection is made to the proposed railway to Wimbledon Common, but as the railway goes under and not through the common, the objection as generally urged has no ground.

THERE are about 2000 miles of railway in Brazil, and 1200 more in construction. We do not know how much of this road has been paid for, nor can we say how much the original shareholders have got out of it.

ACCORDING to advices from Belgrade, a preliminary agreement as to the construction of the Servian railways has been come to between the Servian Government and the representatives of the Laenderbank, in Vienna.

THE piercing of another of the tunnels of the St. Gothard Railway—that of Wattingen, 1090 metres long,—has just been completed. It is anticipated that within a few months all the minor tunnels on the lines of access will be finished.

IT is stated that from 1852 to June, 1880, there has been expended upon public works in South Australia nearly £14,000,000 sterling, and the expenditure during last year exceeded £1,000,000. The railways show an increase in the aggregate both of passengers and goods, and yield a net profit of £2 18s. 3d. per cent. towards payment of interest.

WE are informed that out of about 40,000 employés on the London and North-Western system who are affected by last session's Liability Bill, somewhere near 37,000 have at once agreed to the proposals of the company for mutual insurance, and under 1000 have declined. There has been no compulsion employed, the men having acted under a sense of what is their own interest.

A TERRIBLE accident recently happened on the Erie Railway, when five servants of the post-office and of the railway company were literally roasted in the vehicles from which they could not escape, and which were fired by the oil lamps after the postal and other vehicles left the rails and rolled down a small embankment. If the postal vans had been fitted with the compressed gas for lighting, this terrible result of a derailment would not have taken place.

THE New York and New England Railroad Company, in order to attract settlement along its line, announces that it will give free tickets for two years to the first occupants of any dwelling hereafter erected costing 1000 dols., and for three years for a house costing 3000 dols., along certain parts of its system. The *Colonies and India* thinks that the idea might be adopted in Canada and Australia in the construction of new railways there.

THE distance between New York and Philadelphia, in a direct line, is eighty-one miles, over a comparatively level country. In a recent paper before the Franklin Institute, Mr. W. Barnet Le Van maintained that an air line road could be constructed between the two cities, on which trains could make the distance in one hour, and that the enterprise would pay. The line he proposed would cross no roads at grade, and would have but two curves of 10,000ft. radius each.

AMONGST the vehicles that formed the train which left the rails on the South-Western Railway between Hampton and Fulwell, on the 27th of December last, owing—according to the report of Major Marindin—to the spreading of the gauge and weakness of the permanent way, there was one carriage, still called first-class, which was built in 1859. This little, low ceilinged, stuffy old thing was placed in a train largely composed of new heavy six-wheeled coaches, so that in a collision its fate would probably have been complete.

OWING to the severe weather recently prevailing, the works upon the Berlin Electric Line have been much retarded. The carriages of the Electric Railway will convey twenty passengers each, and the dynamo-electric machine will be placed between the axle-trees and the floor of each carriage. The rate of travelling is expected to reach about twenty miles an hour. Powerful brakes, combined with an arrangement acting on the electrical apparatus, will enable the conductor to bring the carriage to an almost instantaneous standstill.

COLONEL YOLLAND'S report on the collision that occurred on the 8th ult., between a passenger train and a goods train, at the Surrey canal junction of the South-Eastern Railway, concludes by saying: "The collision, in my opinion, resulted partly from the engine-driver not having been sufficiently careful in keeping a good look-out ahead, but mainly from this passenger train being sent out with an insufficient amount of brake power. Three brakes for twenty-one vehicles, exclusive of the engine, is altogether inadequate." This is certainly cutting it fine in the matter of brakes. The South-Eastern Company understands most fully the art of giving its customers the least comfort and the most danger, for the highest possible charge.

AN important change in the working of the Great Eastern main lines is, according to the *East Anglian Daily Times*, about to be made. The main route between the metropolis and Norwich will be *viâ* Ipswich instead of Cambridge, effecting a saving of ten miles in distance and about quarter of an hour in time. A new branch from Forncett to Wymondham will be opened on March 1st, which will bring Central and North Norfolk into quick communication with Suffolk and London, and will open up the important market of East Dereham to traders of the adjoining county. A service of express trains will be run from London to Norwich, stopping at Ipswich and Forncett, where the train will divide, a portion going on to Norwich, and the remainder to Wymondham, Dereham, Fakenham, and Wells.

SEVERAL electric railways are to be tried on the occasion of the forthcoming Electrical Exhibition at Paris. The most important will be built by Siemens Brothers, and will form, consequently, a prominent part of the British display. At the last sitting of the General Council of the Exhibition, M. Georges Berger announced that a steam engine of 800-horse power will be arranged for the working of the electric light, and the number of lamps in operation is estimated at 600. A number of these will be in the large hall, but a large proportion in the gardens, in the *annexe*, and in a series of saloons fitted up magnificently with tapestry-work by the Government. The *annexe* is to be the Pavilion de la Ville de Paris, which was one of the wonders of the 1878 Exhibition, and will be transported to the vicinity of the Palais de Champs Elysees.

THE effect of the late snowstorm upon the Great Western system was such that the line was more or less blocked and the traffic stopped in 141 places, principally in the counties of Berks, Oxford, Wilts, Dorset, Somerset, and Devon, and to a less extent in Gloucester, Monmouth, Brecon, and Cornwall, no stoppage being caused north of Oxford or Hereford, or on the main lines west of Plymouth or Gloucester. The lengths of the snowdrifts varied from 20 yards to 7¼ miles, the total length of the drifts which had to be cleared being equal to 111 miles 30 chains and 6 yards. The number of passenger trains which were snowed up was 51, and of goods trains 13; the longest time that elapsed before a train of empty carriages was extricated being 3 days and 22 hours. The longest time any portion of the railway was blocked and the traffic stopped was 6 days and 3 hours. One man was unfortunately killed and one injured while clearing the snow off the line, but no accident occurred to any of the passengers, who endured the inconvenience, cold, and, to some extent, almost privation, with great patience and good humour. During the week of the snowstorm, the receipts of the Great Western Company were nearly £40,000 less than usual.

NOTES AND MEMORANDA.

GLASS floorings are now being made in France, the upper surface moulded in diamonds.

THE advantages of employing telegraph wires of larger sectional area than is now usual, formed the subject of a recent paper read before the American Electrical Society. The use of large wires, it was stated, had simplified the application of the quadruplex system of telegraphy.

SOME one says that the loss of effect which has hitherto attended boat propulsion by water jets may be overcome by making the surface of the jet large as compared with its sectional area, as, for instance, by using jets from flattened tubes so that the orifice is a narrow slot. We need hardly add this some one is mistaken. The propulsive force derived from a jet of water being solely a function of the weight and velocity of the water moved in a given time.

A PAPER was read last evening before the Society of Telegraph Engineers, on a discovery which has been made by Mr. Alexander Adams, of the Post-office Telegraph Department, of the existence of electric tides in telegraph circuits. By long continued observations he has determined distinct variations of strength in those earth currents, which are invariably present on all telegraphic wires, following the different diurnal positions of the moon with respect to the earth.

IN his recent lecture at Glasgow on gas and electricity as heating agents, Dr. Siemens mentioned that in melting steel in pots in the old-fashioned way, as still practised largely at Sheffield, 2½ tons of best Durham coke are consumed per ton of cast steel produced. The latent and sensible heat really absorbed in a pound of steel in the operation, does not exceed 1800 units, whereas 2½ lb. of coke are capable of producing 13,050 × 2·5 = 32,625 units, or 18 times the amount actually utilised.

LAST month was felt by everyone to be excessively severe, and it was the coldest of three successive cold Januaries. The mean temperature was 31·1 deg., that of 1879 being 31·9 deg., and of 1880, 33·2 deg. Since the year 1779 there have, however, been six Januaries with a lower mean temperature, viz., January 1780, mean, 28·6 deg.; January 1784, 20·2 deg.; January 1795, 23·9 deg.; January 1814, 26·9 deg.; January 1830, 30·7 deg.; January 1838, 28·9 deg. The mean temperature of the ten days, January 13-22nd, 1881, was, however, as has been pointed out by Mr. G. T. Gwilliam, only 22·8 deg., or lower than the mean for any of the very cold Januaries above recorded.

THE German Government have already laid 8000 miles of underground telegraph wires, and great extensions are to be made. In order to secure perfect insulation and freedom from the ravages of insects, the plan adopted in Germany consists in enclosing in seven or more separately insulated conductors within a core of moist hemp, surrounded by a complete sheath of iron wire, which, again, is covered with a layer of hemp yarn impregnated with a protecting compound. These land cables are wound upon drums at the sheathing works and after being subjected to careful electrical tests are paid out into trenches three feet deep, and covered up. They are of great strength, some of them being about 1¼in. in diameter, and the iron wire covering of considerable thickness.

ACCORDING to the return of births and deaths in London and 19 other large English towns for the week ending Saturday, February 5th, the rate of mortality last week in 20 of the largest English towns averaged 28 per 1000 of their aggregate population, which is estimated at more than seven and a-half millions of persons in the middle of this year. The rates of mortality in the several towns, ranged in order from the lowest, were as follows:—Newcastle-on-Tyne, 20·3; Leicester, 21·7; Sheffield, 22; Bradford, 23·1; Portsmouth, 24·8; Birmingham, 25; London, 27·1; Nottingham, 27·3; Hull, 27·3; Salford, 27·4; Plymouth, 28·3; Wolverhampton, 28·5; Leeds, 28·8; Brighton, 30·1; Sunderland, 30·7; Bristol, 30·8; Norwich, 30·8; Oldham, 33·6; Liverpool, 36·5; Manchester, 37·2. The effect of the severely cold weather is thus very conspicuous. Sunshine, 10 per cent. of possible duration.

TAKING the point of departure of English, French, Norwegian, and German vessels, as from the English Channel, and comparing the distances by the Panama and Suez routes, or by the capes, we find the following interesting figures:—

	Panama. Miles.	Suez. Miles.	Cape Horn. Miles.	Cape of Good Hope. Miles.
New York to Calcutta	14,750	9,897	18,650	12,500
,, ,, Melbourne	10,260	13,162	12,900	13,030
,, ,, Hong Kong	11,238	11,796	17,680	14,701
,, ,, Valparaiso	4,700	—	8,720	—
,, ,, San Francisco ..	5,260	—	13,610	—
Liverpool ,, Calcutta	17,300	7,966	18,600	11,790
,, ,, Melbourne	12,869	11,231	13,097	12,598
,, ,, Hong Kong	14,290	9,865	17,877	13,640
,, ,, Valparaiso	7,349	—	8,917	—
,, ,, San Francisco ..	7,709	—	13,710	—

THE production of pig iron in the United States in 1880 was, there is every reason to believe, 3,300,000 gross tons; in 1879 it was 2,741,853 tons. The importation of pig iron into the States, during the year, was about 700,000 tons. These figures give the probable consumption of pig iron in 1880 as 4,000,000 gross tons. The production of rails of all kinds in the United States in 1880 was, perhaps, 1,200,000 gross tons; in 1879 it was 993,993 tons. Of the production of 1880 there were 775,000 tons of steel rails and 425,000 tons of iron rails; in 1879 were produced 610,682 gross tons of steel rails and 383,311 tons of iron rails. During 1880 the States imported about 275,000 tons of rails of all kinds, which, added to the probable production of 1,200,000 tons, gives 1,475,000 tons as the approximate consumption of the year. In 1880 were mined in the Lake Superior district about 1,950,000 tons of iron ore; in 1879 the production was 1,414,182 tons. In 1880 were imported about 400,000 tons of iron ore; in 1879 were imported 284,141 tons. In 1880 track was laid on about 6500 miles of new railroad in the United States; in 1879 the mileage was 4725 miles. The production of anthracite coal in the United States in 1880 was about 23,500,000 tons; in 1879 it was 26,142,689 tons.

AT the meeting of the Chemical Society on the 3rd inst., a paper was read "On the Estimation of Organic Carbon in Air," by Drs. Dupré and Hake. In a previous paper—"Jour. Chem. Soc.," March, 1879—the authors demonstrated the possibility of estimating gravimetrically minute quantities of carbon by burning in a current of oxygen, absorbing the carbonic acid in baryta water, converting the carbonate into sulphate, and finally weighing the barium sulphate thus obtained, the substance thus formed weighing 19·4 times as much as the original carbon. The air to be analysed was conducted by glass tubing into the laboratory, and there, after filtration through asbestos, divided by a T-piece and suitable pinchcocks into two equal currents; one of these was sucked through an absorbing apparatus containing baryta water, the other passed first through a porcelain tube containing copper oxide heated to redness, and then through an absorption tube. The result obtained with the first current obviously gives the CO_2 in the air, that with the second CO_2 in the air and the CO_2 due to the combustion of any organic carbon. Ten litres of the ordinary air round the laboratory, after filtration through asbestos, gave ·0001 to ·0002 grain of carbon present as organic carbon. The quantity of air employed in each experiment varied from 4½ to 16 litres. Details of the various experiments are given. The authors have not yet attempted to estimate the suspended organic carbon. The authors criticise the results previously obtained by Boussingault, who found in 10 litres 0·0019 grain carbon, and by Verser, who obtained in 10 litres 0·00154—more than ten times as much as the mean result obtained by the authors (0·000154). They also refer to the results obtained by Pettenkofer in his well-known experiments on the elimination of H and CH_4 by animals. Pettenkofer seems to have assumed that the air in his experiments was free from organic carbon, and thus to have laid his results, on that subject, open to a serious fallacy.

MISCELLANEA.

AT present the electric light has been but little used in the lighthouses on the French coast, but the director of the lighthouses of France has recommended that all the principal lighthouses shall be lighted by electricity.

NOTICE is given that a jubilee festival of the Technical Academy at Hanover will be held on the 2nd, 3rd, and 4th of June next, and all former students are invited to attend, and to send in their names if they have not determined to attend, to the chairman of the festival committee.

THE illumination of leads and roadways in mines by electricity is, it is proposed, to form the subject of experiment by the Royal Commission appointed to inquire into the cause of accidents in mines. No more evidence will be taken by the Commission, but several series of experiments are to be carried out on the explosive nature of coal dust, and on the best form of miner's lamp.

AT a recent meeting at Melbourne of the Australian Frozen Meat Company a report was presented stating that the company was resolved to prosecute the undertaking. The arrangements for refrigerating were acting admirably, and the shipment was not expected to result in loss. It was intended to put up a machine five times the power and capable of freezing 2500 sheep. The cost of fitting up the Protos had been about £5000.

THE undertakers of the Aire and Calder Navigation have come to the unanimous resolution to at once proceed with the construction of the new dock. It was also decided that its name should be the Aldam Dock, being named after the esteemed chairman of the Navigation. Mr. Bartholomew, C.E., intends, the *Leeds Mercury* believes, to commence operations at the opposite end of the dock to Aire-street. The work will be partly done by contract, and partly by the navigation staff.

MESSRS. CHUBB AND SON, lock and safe makers to the Queen and to the Bank of England, have just issued a new illustrated priced catalogue. It is by far the largest and most complete in the trade, and has been compiled by one of the firm. It consists of twenty-eight pages, contains nearly 150 illustrations, the prices of 700 different articles, and no less than 1100 dimensions of locks, safes, &c. It is stated that nearly one million of the patent detector locks have been made and sold.

WE understand that the s.s. Cora Maria, fitted with the De Bay propeller, has had the gearing for producing the reverse motion of the dual propellers refitted, and that she has arrived in the Thames from Cardiff. Messrs. Capper, Alexander, and Co., the owners of the Cora Maria, have placed the supervision of the whole of their steamers under Mr. Flannery's care, with a view to obtaining such reliable reports as will guide them in the possible extension of the De Bay system.

THE Lambeth Water Company is doing good public service in enforcing the adoption of the necessary fittings to permit the extension of the constant supply of water. It is notorious that the water as drawn from the company's mains is a good potable water, but that it becomes contaminated in the house cisterns. The constant supply will remove this surce of polution, and every assistance and encouragement ought to be offered to the water companies to carry out the system.

A NEW hopper dredger named Ely, built and engined by Messrs. W. Simons and Co., was launched on the 29th ult. complete from their works at Renfrew. It is the property of the Taff Vale Railway Company, and has been built under the direction of Mr. Riches, their engineer. The vessel is to dredge to 30ft. depth, and cut its own flotation in shoals. It carries its own dredgings, and also loads side barges, and tows them when required. This firm has another dredger in progress to carry 1400 tons of its own spoil. It is to steam to New Zealand, and will be the largest dredger in the world.

THE United States Consul-General at Shanghai informs the State Department at Washington that the Emperor of China has given permission for the construction of a telegraph line from Shanghai to Tientsin, a distance of 1200 miles. The route will be from Shanghai to Chinkiang, thence along the line of the Grand Canal to Tientsin. A short line of about seventy miles will also probably be constructed by the Viceroy at Nankin to connect the capital of his province with the main one at Chinkiang. The work of setting the poles and laying the wire will be begun early next spring. It is estimated that the work will cost 500,000 dols.

A LECTURE recently delivered by a Parsee milling expert, Mr. M. F. Patell, B.A., gives a good deal of information about spinning and weaving mills in the Bombay Presidency, India. The first mill was started in 1854, and that since then thirty-two in all have put in operation 10,000 looms with 1,000,000 spindles, and given employment to 30,000 persons. The total capital invested is about £7,000,000. Besides the Bombay mills there are in all India eighteen others, with some 340,000 spindles and 1800 looms, involving a capital of, say, 6,000,000 dols. The industry employs in all India an average of 1000 hands to the mill. The highest number of spindles in one mill is 100,000, the lowest 4800; average 30,000. The average number of looms is 240.

WRITING on kitchen boiler explosions in the *Contract Journal*, Mr. T. Fletcher suggests, when a good safety valve is not employed, another way of preventing an explosion. It is similar to that suggested in our recent article on the subject. It is to cut a hole in the hot water return pipe a little distance above the boiler, this hole being from ½in. to 1in. in diameter, and to solder over this a piece of sheet lead about 1-32nd inch thick just sufficient to safely stand the general water pressure, making, in fact, a weak place in the system of pipes, which will be the first to give way. This hole must be cut in such a position that the pipe is certain to be warmed from the fire, and it should be in such a direction that if the burst takes place the water will be directed on to the fire.

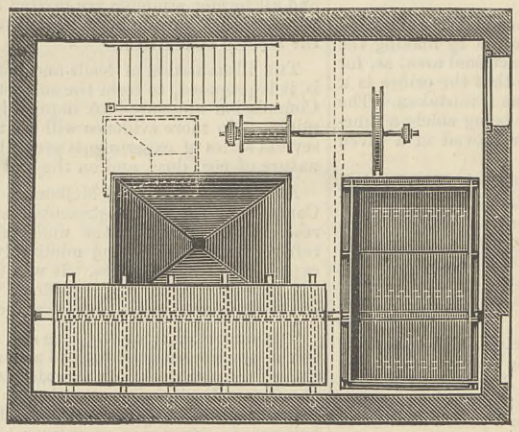
THE Société Physico Chemique Russe of the University of St. Petersburgh have made arrangements for competitive trials of lamps for burning heavy oils. A prize of 750 roubles, or 3000f., will be awarded for the best lamp, and the lamps for competition must be presented before the 1st of January, old style, or 12th January, new style, 1882. The lamps must be made capable of burning the heavy petroleum oils instead of the light oils as at present, its density being from 0·79 to 0·85 at 20 deg. Cent. The competition has been instigated by M. V. J. Ragosine, the discoverer of a fine mineral oil of an ozocerite character, uninflammable at ordinary temperatures, and clear in colour, though heavy. Further particulars relating to the competition may be obtained from the V. J. Ragosine Company, 22, Leadenhall-street, E.C.

THE paragraphs on current topics in the *Architect* are usually in good taste, but in the last issue of that journal appears a paragraph commenting on the destruction of a part of the Solway Viaduct, in a spirit which does the journal little credit. Mr. Brunlees is said to "calculate the strength of structures in his own way, and not to be guided by formulæ given in books," this being put forward in a manner which leaves it to be inferred that, in the *Architect's* opinion, those who do not follow "the book" must go wrong and hence the destruction of some of the piers of Solway Viaduct. The *Architect* forgets that the master may make, follow, or disregard the cut and dry formulæ necessary for the guidance of the boy. Very wise after the lesson taught by the results of the past exceptionally severe weather, the *Architect* says the piers should be of stronger section. If a stray iceberg had floated up the Solway and done what the ice has already done, the *Architect* would probably have rushed into print to show that Mr. Brunlees had not built a sufficiently strong viaduct, because it would not smash icebergs. The *Architect* knows so little of engineering matters or of engineers that it would not fear to suggest that a John Rennie could not have built a structure like London Bridge,

EIGHT QUARTER TOWER STEAM BREWERY.

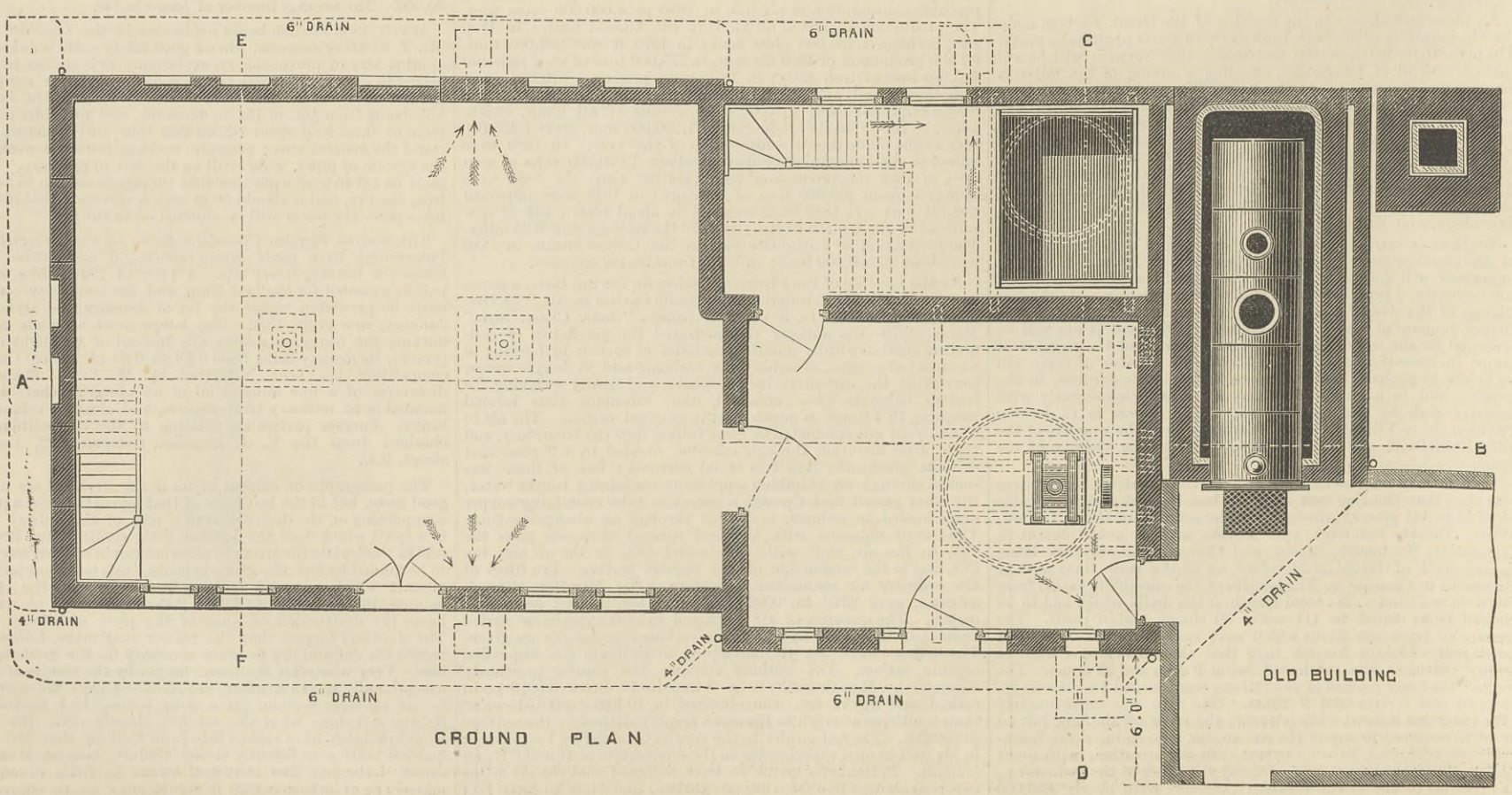
MR. ARTHUR KINDER, C.E., LONDON, ENGINEER AND ARCHITECT.

(*For description see page* 99.



PLAN AT LEVEL OF Y.Y

LONGITUDINAL SECTION ON A.B.



GROUND PLAN

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame BOYVEAU, *Rue de la Banque.*
BERLIN.—ASHER and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-Street.*

TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

B. M. A.—*Cullen "On the Turbine," published, we believe, by Spon, will answer your purpose.*

X.—*You refer to the engine which Mr. Eames proposed to bring over to this country. So far as we know it has not yet arrived, nor have we heard anything recently concerning the proposal.*

AN APPRENTICE.—*We see no reason to doubt that you could pass the examination for second engineer, after you had served a year at sea. Your practical knowledge would satisfy the examiner. You would have to attend the classes of a professional grinder for about a month before the examination.*

D. F.—*There are no special works used as text books by the Board of Trade. Goodeve "On the Steam Engine" will give you the theory, and Turnbull's "Guide to the Board of Trade Examinations" ought to supply the rest. We have given full information concerning Board of Trade examinations, life at sea, &c., in* THE ENGINEER *for Sept. 13th, 20th, and Oct. 25th,* 1878.

JOINER.—*Whether the pinion will or will not take the rack accurately on the return of the latter depends on the means used for returning it. If the rack is sent back at haphazard, no pin or tooth can be used which will prevent a risk of jamming being incurred. If, however, the rack is returned by a cam or some similar device which moves in unison with the pinion, then the end tooth of the rack may be made to fall accurately into the space in the pinion.*

DRAUGHTSMAN (Batley).—*The arrangement shown in your sketch would work, but after a time the parts would wear, then they would become loose, and the action of the gear would be very unsatisfactory. You will find, too, if you set out the groove in the cam properly to scale, that it must have what are practically two sharp corners, which add to the difficulty of making the gear work well. It is possible, however, that if any means of taking up slack could be devised, that the gear might be made to please the public.*

L. W. P.—*We are aware that for some time past scientific men have regarded Joule's equivalent as open to correction, but we have not heard that the figures arrived at at Hopkins' College are regarded as demonstrably correct. We reproduce these figures for the information of our readers. From 40 deg. to 41 deg. Fah. J. = 783·4 foot-pounds; from 60 deg. to 61 deg. J. = 778·6; 80 deg. to 81 deg. J. = 775·7; 100 deg. to 101 deg. J. = 776·3. In this country many engineers now take J. = as 774 foot-pounds instead of 772.*

B. E.—*As the crane post only passes loosely through the four-armed plate, the weight will exert no tendency to lift the plate from the foundation, but only to slide the plate along the ground, consequently the holding down bolts will be in shear, not in tension. If the crane pivotted in the plate A the case would be different, and the lifting up strain would be to the load in the inverse ratio of the distance of the bolt and the point of suspension measured in horizontal lines, from the centre of the crane post, or, according to your sketch, two tons of load would produce ten tons of tension. Each bolt should be strong enough to do the whole work unaided.*

R. G.—*It would be quite practicable to ventilate sewers with an exhaust fan as you propose, provided the air entrances were at the ends of the sewers furthest removed from the fan. But you will see that if in a sewer a mile long there were openings enough in one-half its length to admit all the air which the fan can withdraw, then the other half mile of the sewer may remain unventilated. It appears to us that if the stack pipes from the houses open into the house drains, it would be impossible to provide power enough for adequate ventilation by means of a fan. Several attempts have been made to ventilate by means of furnaces, notably at Crossness, but the results have never been quite satisfactory.*

LUX.—*We do not know why a gas flame is luminous, but we do know that Professor Balfour Stewart, and many other able men, hold that the luminosity of a coal-gas flame is due to the presence of incandescent particles of carbon, while Dr. Frankland, Professor of Chemistry at the School of Mines, denies that there are any suspended carbon particles, and maintains that luminosity is simply a function of the density of the gas, and he supplies many telling experiments to prove his thesis. It is very generally accepted that when a hydrocarbon like coal gas is ignited, the oxygen of the air siezes on the hydrogen, leaving the carbon free; each atom of the carbon then takes up two atoms of oxygen and burns to carbonic oxide, giving out light in the process. This theory is, as we have said, disputed by Dr. Frankland.*

WESTON'S FRICTION CLUTCH.

(*To the Editor of The Engineer.*)

SIR,—I shall be much obliged to any one who can tell me who are the makers of Weston's friction clutch. It is a series of circular discs.

Birmingham, February 2nd. MANAGER.

BOILER COMPOSITION.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me who are the makers of Secombe's boiler composition for the prevention of incrustation, made in blocks; also paint invented by Major Crease, and used by the Admiralty?

London, February 8th. J. M.

SEWAGE IRRIGATION.

(*To the Editor of The Engineer.*)

SIR,—Will some of your numerous readers oblige by giving the names of some towns, in England or Scotland, whose sewage has been successfully utilised by irrigating land, and if the different schemes have proved remunerative? W. J. W.

Inverness, N.B., February 3rd.

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

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Feb. 15th, at 8 p.m.: Discussion upon Messrs. Colson and Meyer's paper on "The Portsmouth Dockyard Extension Works."

THE METEOROLOGICAL SOCIETY.—Wednesday, Feb. 16th, at 7 p.m.: "Relative Humidity," by Mr. Charles Greaves, M. Inst. C.E., F.G.S., F.M.S. "The Frost of January, 1881, over the British Isles," by Mr. William Marriott, F.M.S.

CHEMICAL SOCIETY.—Thursday, Feb. 17th, at 8 p.m.: Ballot for the election of Fellows. "On a New Apparatus for Showing the Dissociation of Ammonium Salts," by Mr. D. Tommasi. "On the Estimation of Organic Carbon and Nitrogen in Water Analysis Simultaneously with the Estimation of Nitric Acid," by Mr. M. W. Williams.

SOCIETY OF ARTS.—Monday, Feb. 14th, at 8 p.m.: Cantor Lectures, "Watchmaking," by Mr. Edward Rigg, M.A. Lecture II.: The ordinary watch—Degree of accuracy required in it—Systems of manufacture in this country and abroad—Description of specimens illustrative of the various stages of construction—Comparison of the several systems. Wednesday, Feb. 16th, at 8 p.m.: Ordinary meeting, "The Participation of Labour in the Profits of Enterprise," by Mr. Sedley Taylor, M.A., late Fellow of Trinity College, Oxford. Mr. W. H. Hall will preside.

THE ENGINEER.

FEBRUARY 11, 1881.

AMERICAN HIGH SPEED LOCOMOTIVES.

So much has been said lately in the American journals which reach this country, about the high speeds now being attained on American railroads, that we feel some pleasure in being able to illustrate the most recent type of American locomotive intended for express service. We published last week an elevation of the engine in question, and on another page will be found sections of the engine and the indicator diagrams referred to in our last impression. It will be seen, of course, at a glance that the engine in question is in many respects unlike other American engines, and we propose to consider here why it is abnormal in design. The standard American passenger engine has four wheels coupled, outside cylinders, and a four-wheeled bogie in front. We have lying before us the last edition of the "Baldwin Locomotive Works Illustrated Catalogue," a book of which it is impossible to speak in terms of too much praise. This catalogue contains an admirably written summary of the history of the locomotive in the United States, and eighteen excellent photographs and many sectional drawings of the engines made by the firm. These engines may be regarded with strict accuracy as typical of United States practice. If the managers of the Baldwin Locomotive Works do not know what is good for American railways no one does. In the catalogue, at page 69, we have a photograph and particulars of passenger and freight locomotives, "American" type. These engines are wood or bituminous coal burners. They are all alike in form, varying in size. The smallest have cylinders 13in. diameter, 22in. stroke, and driving wheels 49in. or 57in. diameter. The largest have cylinders 18in. by 24in., and driving wheels 61in. to 66in. in diameter. When the engines are intended for goods work, they have the small driving wheels; when for passenger work, large wheels. The four-coupled driving wheels are pitched as much as 8ft. apart, although the wheels are but 5ft. in diameter. The normal American passenger engine has cylinders 16in. by 24in., and the weight on each driving wheel is about 4½ tons. These engines are not intended to run at more than forty miles an hour at the most, and it is evident that they could not attain a higher speed with anything worth calling a load.

Within the last four or five years competition has induced railway companies to accelerate the velocity of their trains, and American locomotive superintendents find themselves suddenly called on to design engines for high speeds. In this class of designing, however, they have had no experience whatever, and, as a consequence, various queer devices are being produced. For example, the Fontaine locomotive, in which the driving wheels are driven a little faster than the crank shaft by friction pulleys, carrying the weight of the engine. This was illustrated in our patent list last week. It is stated that it has been run at sixty miles an hour. High speeds in the States have been obtained hitherto by loading ordinary engines lightly, and letting them go as fast as they can. It was found that in this way velocities of as much as sixty miles an hour could be obtained with American rolling stock on the best roads in the United States; but it also very quickly became evident that the ordinary type of engine was not nearly powerful enough to attain a high speed with a proper load, and new engines are being designed. But it must be remembered that fast time has hardly found its way into the regular time-tables of the company, and if we put Mr. Fontaine's remarkable device on one side, the only high-speed engine yet built in the States is Mr. Wootten's. This engine is built of two classes—the one which we illustrate, and another constructed by the Baldwin Locomotive Works, the principal difference being that in the one class four-coupled drivers are used, while in the other there is only one pair of drivers. This engine the Baldwin Locomotive Works are prepared to make in three sizes; that is to say, with cylinders 16in. × 22in. or 24in.; 17in. × 22in. or 24in.; and 18in. × 22in. or 24in., the single pair of driving wheels being 5ft. 6in. or 6ft. 6in. in diameter. In the lightest engines the load on the driving wheels is 13 tons, and in the heaviest 16 tons. By the aid of an auxiliary cylinder fixed under the waist of the boiler, the bearing of the equalising levers can be changed, so as to throw about 4⅓ tons more on the driving wheels should they slip. Why, we ask ourselves, did Mr. Wootten give up in this engine the four-coupled drivers and resort to a single pair? The answer sets forth the difficulties with which the prevailing type of American locomotive besets the engineer. As anthracite coal has to be burned, it was decided that a grate 7ft. by 8ft. nearly must be used, and as the grate must overhang the trailing wheels these could not well be drivers. Thus Mr. Wootten was driven from the trailing end of his engine by the demands of the fire-box for space; but at the leading end of the engine he was met by an analogous difficulty. There the outside cylinders stood in his way, and even if they had not done so the bogie would have prevented the adoption of coupled leading wheels. Perforce Mr. Wootten was compelled to use single drivers, and this we regard as a great defect in the design. In this country the use of single driving wheels is becoming more and more rare every day. They are only to be found on the most level lines and on first-class roads, and the wheels are seldom less than 8ft. in diameter. In a climate like that of the northern portion of the United States engines with single drivers are certain to be in difficulties for about half the year, provided the trains are to be of any weight. We are quite certain that the Wootten engine would be quite incompetent to haul a train of twenty English coaches—weighing, say, 250 tons—at fifty miles an hour, save in good weather; but this is a daily performance on the London and North-Western Railway. Mr. Wootten, writing to the Baldwin Company on the 17th of May, 1880, states that the engine in question, which, be it remembered, has 18in. by 24in. cylinders, and 6ft. 6in. drivers, ran from Philadelphia to Jersey city—89·4 miles—in one hour thirty-eight minutes. The best performance was, however, a run from Jersey city to Philadelphia in one hour forty minutes, with five cars. These we may take for argument sake, as weighing 125 tons; though 25 tons is considerably over the normal weight of a loaded passenger car in the States, although the Pullman Company is running drawing-room and palace cars which weigh nearly 60 tons. The speed was anything but excessive for this load—only 53·7 miles an hour. The performance is nothing in any way remarkable, and ought, indeed, to be very easily beaten. It would be possible to go to any one of a number of railways in England and get a dozen locomotives on each, any one of which could make a run of 89·5 miles in 100 minutes with more than 125 tons behind it, assuming, as we do, that the road was level and good. It may be safely assumed that there is nothing whatever about the Wootten single engine which qualifies it to rank as an improvement on the fast passenger locomotives of this country.

Turning to the engine which we illustrate, we find many points of difference, all in favour of the Reading engine. Mr. Wootten has retained in it four driving-wheels, but to do this he has been obliged to use driving wheels only 5ft. 8in. diameter, and to use an excessively shallow fire-box, mounted high above the rails. This seems to us likely to entail many difficulties in a high-speed engine. Nothing is said concerning the distribution of the loads, but it seems to be certain that with a great overhanging weight behind, far above the rails, the engine will be unsteady and tend to jump. This can be controlled, to some extent, by tight coupling to the tender, but concerning the coupling arrangements we are left very much in the dark. Mr. Wootten has departed widely from English practice in the dimensions of his cylinders, which are 21in. diameter by 22in. stroke. In this country the tendency is to augment the length of stroke, and 26in. and 28in. are normal strokes now with us. But Mr. Wootten seems to be as much afraid of high piston speeds as our engineers were in bygone days, and he has used short cranks with the intention of preventing his coupling rods from breaking. His small driving wheels make over 300 revolutions per minute at 60 miles an hour. He forgets that the troubles which high-speed engines are heir to are caused mainly by rapid changes in the direction of motion at each end of the stroke, and not by the velocity of the piston. The tractive power of the engine is 144 lb., nearly, per pound of average pressure in the cylinders. Assuming the seven cars, which it is reported to have hauled at 70 miles an hour, to have weighed 175 tons, and the engine and tender together 68 tons—and they probably weigh more—we have a gross total of 243 tons. The road may be regarded as level, the inclines compensating one another, and the resistance at 70 miles an hour would be 35 lb. per ton. We have thus a gross resistance of 8505 lb., and the average cylinder pressure must have been 59 lb. on the square inch, so that at least 110 lb. must have been steadily maintained in the boiler, and the work done by the engine would have been over 1300-horse power. No such performance has ever been got out of a locomotive. The broad gauge Great Western engine "Great Britain" once indicated 1100-horse power, and this performance has never, so far as we are aware, been beaten. It follows, therefore, that the seven cars hauled by Mr. Wootten's engine did not weigh, loaded, 25 tons each, or else the resistance was not 35 lb. per ton, or else the speed was not so great as it is said to have been. Our own view is that we have overestimated the weight of the cars, which in all probability did not weigh more than 16 tons each. The stated velocity was, however, maintained for eight miles only, and was no doubt mainly due to a falling grade. With a full load of fifteen cars, the speed attained was but a little over 39 miles an hour. Returning to the performance of the single-driver engine, we must draw a similar deduction, and we have then in the five passenger cars a gross load of but 80 tons, corresponding to a train of about eight English coaches; and when we bear in mind that Mr. Stirling's express engines on the Great Northern Railway, with 8ft. single drivers and 18in. by 26in. cylinders, have attained a velocity of seventy miles an hour with sixteen loaded coaches, and kept it up for miles, it will be seen that the performance of the American engines is nothing to boast of. The same engines daily run from London to Grantham, a distance of 105¼ miles, in 2 hours 10 minutes, and the first thirty miles of the run is all more or less up hill, the remainder being fairly level. The trains usually consist of fourteen coaches. The average speed here is very nearly 48·5 miles an hour; but if a deduction be made for the time lost in climbing the inclines of the first portion of the run, it will be seen that much of the trip is done at a far higher speed than this.

Such a performance compares very favourably with that of Mr. Wootten's engine.

The performance of any engine, but more especially that of a high speed locomotive, must be considered from several points of view. We must regard the engine first in the light of a vehicle, and investigate its steadiness and stability—points of the last importance at excessive velocities. Next we have to consider its performance as an engine, using steam economically or otherwise; and, lastly, we must deal with its powers as a steam maker. We do not propose here to say anything concerning the Wootten locomotive, either regarded as a vehicle or as an engine; but we cannot conclude without expressing the opinion that until American engineers give up anthracite they will never attain perfection in fast locomotives. There seems to be an insuperable difficulty in burning it quickly enough. The consumption of coal in English engines is at the rate of 90 lb. or 100 lb. per square foot of grate per hour with fast trains, and this with a single 5in. blast pipe for two 18in. cylinders. This gives more than sufficient draught. Mr. Wootten's engine seems to be unable to burn more than half this quantity of anthracite in the time. Hence the colossal firebox, which spoils the whole engine. The use of anthracite for the specified purpose is all very well for the moment; but when American engineers establish services of really fast trains on all their principal lines, they will find it pay to give up anthracite in favour of coal. The extra cost cannot be much. It may be said that American engineers know their own business best. This is quite reasonable; but hitherto their business has not been to run comparatively light trains at fast velocities, but enormously heavy trains at slow speeds; and we are willing to concede that in many respects the American goods engine is the best goods engine in the world for the conditions under which it is used. American railway men if they want to run fast must not be too proud to take a lesson from these who have been running fast all their lives: and English engineers will tell them, to a man, that unless anthracite can be burned in some box of less dimentions than that used by Mr. Wootten, it had better not be burned at all in a fast locomotive. It is generally conceded that the boilers are the worst things about American locomotives; but without good boilers there can be no really express work done on a railway.

THE ANGAMOS GUN.

Under this title is known an 8in. gun supplied by Sir William Armstrong and Co. to the Chilians, which was reported to have burst, and which has actually terminated its career at all events for the present, though not exactly in the manner that was supposed. We are in the possession of some information as to the gun itself, which we propose to give in connection with the main incidents of its short and eventful history. The gun, it appears, was originally an experimental one, being, we believe, the very first 8in. gun made of the new type—of which a figure will be found in The Engineer of June 25th last. As an experimental gun it went through a very severe series of trials at Elswick, larger and larger charges being adopted, and the chamber considerably enlarged as time went on. It differs from subsequent 8in. guns of the new type pattern, being rather weaker in several respects. The one that chiefly concerns us is the fact that its trunnion ring was less firmly attached, and that the diameter of the chamber was larger than was the case with guns subsequently made. To speak more particularly, in all subsequent guns the trunnion hoop was more securely attached to the coil beneath, and abutted upon a coil in front 17in. long in place of one 10in. long only, in the case of the Angamos gun. The gun fired twenty experimental rounds at Elswick. It then went to the Chilians, who mounted it on board the Angamos, which was not a man-of-war proper, but a cattle-boat made to do duty for the occasion as a gun-boat. The Angamos was then we believe drawn up completely out of the range of the Peruvian guns, but well within the power of its own, which quickly earned celebrity by the success with which it bombarded the batteries of the town, occasionally surprising the inhabitants of the distant parts of Callao, including the American consul, it is said, who found a shell pass through his dressing room one morning. On one occasion a body of gunboats and war ships from Callao endeavoured to capture the Angamos. That vessel, however, succeeded in calling the Chili fleet to her assistance in sufficient time to prevent the advance of the enemy, except one gunboat which crept round among the neutral ships, and so endeavoured to steal upon the Angamos. The latter, however, succeeded in bursting a shrapnel so as to sweep her opponent's deck, and drive her off, and eventually to send her to the bottom by a well-directed common shell when at a long range. From this time the Angamos amused herself much as she liked with her gun. On December 9th she tried to sink the Peruvian corvette Union, firing twelve rounds of common shell, weighing 180 lb., with 90 lb. of P powder, at 8000 yards range, at 12½ deg. elevation. The accuracy of the fire is said to have been so great that the Peruvians stood in groups watching the practice at about 300 yards from the corvette. On December 10th and 11th, the same practice was repeated, the mark being in this case the Atahualpa. The gun all this time, it may be seen, was put to the most severe work. Besiegers are not very considerate to their weapons. To achieve some object it is often worth while expending cannon. The charge and shot were sufficient to test the gun fairly. Its condition, however, was specially aggravated by being fired on a carriage with great compressive power, which, coupled with the high elevation, checked recoil sharply. On the last day of its life, after firing five rounds the compressor was further tightened and the gun fired. The look-out man perceived the shot falling short, and turning round to call out this to the officer in charge saw that the gun had disappeared, leaving its trunnion hoop and trunnions only on the carcarriage. In rear lay the officer and the captain of the gun dead and mangled, and in the side of the ship was an aperture 8ft. wide, through which the gun had evidently driven itself into the sea, where, there is every reason to suppose, it now lies at a depth of 24 fathoms in a sound condition but minus its trunnion ring. We cannot say the exact number of rounds the gun has fired altogether, but we have reason to believe that it exceeds 385. In many cases 8in. projectiles intended for other guns were employed which would enter further into the chamber and considerably increase the strain on the piece by diminishing the space in which the charge was burnt.

What conclusions are to be drawn from the preceding facts? That a gun should be destroyed by some means in a siege when engaged in very heavy rough work does not in itself argue much. In this case, however, we know enough of the work to say something about it, though we, if we hazard an opinion, are more likely to underrate than overrate the stress to which the gun has been subjected, because, as we have said, men on service do not study precautions carefully, and are much more ready to commit irregularities than to report them. As far, however, as we know, the gun would have been expected to bear the strain of the discharge of the above-mentioned rounds. Tangentially it has done so, but it has yielded longitudinally by pulling away from the trunnion hoop; we have, therefore, to consider the longitudinal strain that fell upon it. Now, there is no question that the enlargement of the chamber and the increase of charge after the first trials of the piece did not produce an inordinate strain on the metal; the pressure gauges doubtless spoke as to this. It did, however, unquestionably increase the recoil in the precise measure in which it increased the velocity of the shot. This it is fair to consider in connection with the history of an altered gun. No doubt this fact was to be borne in mind, among others, in deciding on the charge that was eventually adopted. New type guns, however, whose recoil is very great, are much more affected by stopping recoil than others. To draw a gun asunder is not quite the same thing as to destroy the metal. While then a margin should be allowed sufficient to cover the contingencies liable to arise from violence done to the gun in this way, we must admit that the strain which actually pulled the gun through its trunnion is not to be measured by the bare fact of the number or magnitude of the charges fired or by the weight of shot, but by the combination of these together with increased area due to the enlargement of the powder chamber and the stoppage of recoil, which with powerful modern compressors fixed to a gun firing at high angles may be very great. The gun has yielded, but not in a way to raise the question of the merits of steel and iron guns, or of breech and muzzle-loaders, but only the details of building up. As regards breech-loading we learn that no trouble has arisen in the Chilian navy on this account. The gun in question had a vent; breech-loaders subsequently made at Elswick have none; but the vent, although enormously eaten away, and the metal forced so far up as to project at the outside end, does not appear to have given much trouble. A piece of it was knocked out when it finally went overboard. We do not know how far the Chilians will endorse the view that they undertook a certain amount of risk in the treatment to which they subjected a gun which was performing more severe work than it was originally designed for, but we shall see whether they order others, as may be expected if satisfied as to the matter.

We come now to the question of construction, about which the Gun Factories and Elswick are at variance, namely, the attachment of the trunnion hoop. We have repeatedly shown this difference, which has been specially dwelt on by Mr. Fraser, in woodcuts showing sections of Elswick and Royal Gun Factories guns. Colonel Maitland, the Superintendent of the Gun Factories, has strong views on this subject. He would, we believe, admit that the friction of the trunnion hoop and forward coil might hold the gun quite sufficiently against any pull applied without firing. On firing, however, he considers, so we have understood, that expansion of the bore and outer hoops takes place at each point as the shot passes, and when the shot has passed some distance that pressure falls and the steel lining and even the coil next it recovers itself more quickly than the wrought iron exterior, and the friction is thus materially reduced. With long new type guns this he holds is specially true, because the action of recoil is going on powerfully long after the shot has passed the trunnions. Without accepting this explanation it must be admitted that the Gun Factories can now point to two remarkable illustrations to support their judgment and practice. What is to be said on the opposite side? Not very much, we think. There can be no question, however, that, like other good things, the consolidation of breech and trunnion ring of the Gun Factory system is not obtained without some slight sacrifice. The form is nearly cylindrical from breech to trunnions. This is certainly in theory not quite the best adjustment of thickness of metal to meet the tangential strain on the interior. Some sacrifice must, therefore, be made, either in tangential strength or in increase of weight. In addition to this the adoption of the Gun Factory plan would be attended with considerable expense in the case of firms working on other systems.

Instance after instance, however, is teaching us that we must recognise the fact, that the longitudinal strain on a gun is becoming more and more serious. Increase of velocity and recoil, with the necessity of checking it, and increase of length, indirectly in other ways besides the development of wave action of powder, all seem to tend in this direction. It is hardly likely, excellent as it is, the Gun Factory system will be adopted as the only remedy by private manufacturers. Just as the Gun Factories would resent the idea that guns must be made on the Palliser system, with coils equally thick from muzzle to breech, to enable them to resist double loading, so private manufacturers would object to the conclusion that they could not provide against longitudinal weakness without adopting the consolidated breech end. Double loading is, we admit, an outrageous contingency to provide against, although we know of a case where double loading actually took place in our service, and the firing was only accidentally prevented, since the Thunderer gun accident. We only take it as an illustration, however, that casualties showing the necessity for consideration do not force any special solution of a question on us. The case, at all events from a manufacturing point of view, is not a serious question, and as a matter of credit, we fancy that the Chilians are more likely to praise a gun whose performances as to range and accuracy were in their experience unique, than to lay too much stress on its yielding under the aggravated treatment to which they subjected it.

THE VALUE OF A VACUUM.

A few months ago, when describing the performance of a compound portable engine constructed by Messrs. Richard Garrett and Sons, of Leiston, we had occasion to state our belief that if the engine in question had been fitted with a condenser its economy would not have been increased. To this statement some exception has been taken; and it is not easy to induce engineers to accept as true the assertion that a condenser can do harm. Nevertheless we have excellent reasons for adhering to what we have said, and reasserting that under certain conditions it is more economical to exhaust steam directly into the atmosphere than it is to condense it. This is a truth which is only just beginning to dawn on the minds of engineers, who are as reluctant to receive it as they were to accept the dictum that nothing is to be got by expanding steam more than about eight times, and that under most conditions a sixfold expansion is as good as any other. Within the last few days a case has come to our knowledge in which a large compound engine was fitted with a condenser. Owing to a difficulty in getting water, this engine was worked for some months non-condensing, the consumption of fuel being about 3·75 lb. of coal per horse per hour. When water was at last obtained the condenser was started, the load on the engine remaining unaltered, and the result was that the consumption of fuel went up to 5·25 lb. per horse per hour, instead of falling. We have no reason to doubt that in a very large number of cases condensers are adding little or nothing to the economical efficiency of the engines to which they are fitted. If they pay the interest on their first cost, that is about all. We propose here to consider what is the maximum value of a condenser, and to point out the conditions which render its use injurious rather than the reverse.

It is evident that no matter what the conditions under which steam is used in an engine, the work done by condensation cannot exceed in value that which would be performed by the atmosphere if it were admitted to the cylinder. Let us suppose, for example, that we gradually admit 1 lb. of steam of atmospheric pressure under a piston. It will finally occupy a volume of 26·36 cubic feet and will during its admission exert a pressure of 2116·8 lb. per square foot. Let the piston have an area of 1 square foot, then 1 lb. of steam will raise it 26·36ft. high. If now the steam be all condensed, and neglecting the space occupied by the water, the air pressing on the piston will force it down, and the work done will be $26{\cdot}36 \times 2116{\cdot}8 = 55{,}799$ foot-pounds. If we employed steam of higher pressure than what would just balance the atmosphere, then we should have to apply an additional load to the piston. But inasmuch as the condenser can only operate by relieving the piston of the opposition which would be offered to it by the air, and the air represents what for practical purposes may be regarded as a constant load, we cannot deal with the question before us on any other basis than that which we have taken. Higher pressures we may have, but an extra load we cannot have; consequently the maximum possible value of a condenser is 55,799 foot-pounds per pound of steam condensed in it, and care must be taken not to confound this quantity with that of the steam admitted to the cylinder, which is always in excess of that which enters the condenser, the difference being reduced to water in the cylinder. In practice the value of a vacuum will be less than 55,799 foot-pounds, by the back pressure in the exhaust pipe, which is seldom less than 2 lb. The value of each pound of steam condensed with this deduction is $1828{\cdot}8 \times 26{\cdot}36 = 48{,}207{\cdot}168$ foot-pounds. Neglecting fractions, for each pound of steam blown into the atmosphere, therefore, in a non-condensing engine, we lose 48,207 foot-pounds or 62·3 heat units. Let us turn now to a pound of steam at, say, 100 lb. absolute pressure admitted into the cylinder of a good engine, and worked expansively to the best advantage. This pound of steam will develope 150,000 foot-pounds of work, and will utilise as much as 195 units. For every pound of steam of the stated pressure condensed in the cylinder at the beginning of the stroke we lose then 150,000 foot-pounds of work. Now, roughly speaking, 150,000 bears to 48,207 the proportion of three to one, consequently our readers will perceive, if they have followed us so far, that the condensation of 1 lb. of steam in the cylinder will more than neutralise all that can be gained by the condensation of 3 lb. of steam in the condenser. To put this in a slightly different form, let it be supposed that an engine working without a condenser had no cylinder liquefaction, but that when working with a condenser, 1 lb. of steam was condensed in the cylinder for every 3 lb. condensed in the legitimate place—the condenser; then would the use of a condenser make that engine less economical than it was before; for the loss by cylinder condensation would be 150,000 foot-pounds, while the gain due to the vacuum would be but $48{,}207 \times 3 = 144{,}621$ lb. It may be urged that steam cannot give out 150,000 foot-pounds of work without a condenser under practical working conditions. This we are willing to admit. This does not affect our argument in any way. In a condensing engine each pound of steam condensed in the cylinder represents a loss which will more than balance what can be gained by the condensation of three times as much steam to produce a vacuum. The work done by a pound of steam in a non-condensing engine may be taken as $150{,}000 - 48{,}207 = 101{,}793$ lb., and each pound of steam condensed in the cylinder will represent an equivalent loss. We can now proceed to consider the conditions under which a condenser will do more harm than good more closely. Let us assume that we have two engines,

one condensing, the other non-condensing, and each working under such conditions that in the condensing engine each pound of steam shall do 150,000 foot-pounds of work, while in the non-condensing engine each pound of steam shall do 101,000 foot-pounds of work—then the first engine will require per horse-power per hour 13·14 lb. of steam, and the non-condensing engine will require 19·6 lb. of steam; that is to say, the condensing engine will use about two-thirds as much steam as the non-condensing engine. But it is well known that in practice both engines would use much more steam than the quantity given above. The difference between the theoretical and the actual quantity is mainly disposed of by condensation in the cylinder. Let us now suppose that the condensation in the cylinder of the condensing engine is three times as great as it is in that of the non-condensing engine, and see what will follow. It is a very good engine which gets on with 20 lb. of steam per horse per hour; subtracting 13·14 lb. from this, we have 6·86 lb. per horse-power per hour liquefied in the cylinder. If one-third of this is, say, 2·25 lb. is liquefied in the non-condensing engine, then we have for the condensing engine a consumption of 20 lb. of steam per horse-power per hour, and for the non-condensing engine a consumption of 19·6+2·25=21·85 lb., and the gain due to the presence of the condenser is thus under 2 lb. of steam per horse per hour, or say, 0·2 lb. of coal, which would hardly pay for the extra cost of the condenser and its appurtenances.

To make the comparison quite fair, we shall put it in yet another point of view. We have seen that every pound of steam in a non-condensing engine will do 101,000 foot-pounds of work, while the condensation of a pound of steam will do 48,000 foot-pounds, in round numbers. Now by adding a condenser to a non-condensing engine, we apparently augment its economical efficiency by nearly 48 per cent. Let it be supposed, however, that for every 3 lb. of steam condensed in the condenser, 1 lb. of steam is condensed in the engine which was not so condensed before, and it is clear that the whole advantage of the vacuum is swept away at one stroke. Each pound of steam so killed represents, as we have shown, 150,000 foot-pounds, while each pound of steam employed to make a vacuum represents but 48,000 foot-pounds. It only remains to be considered whether, under any circumstances, condensing engines do or do not condense in their cylinders more than one-third of all the steam passing through them. Of this we have no manner of doubt. A condensing engine which we tested not long since, when working up to about 200-horse power, was expanding 95 lb. steam—absolute—fifteen times, and using 26 lb. of steam per horse power per hour. The cylinder was well jacketted; the piston and valves quite tight. By the indicator this engine would not have required more than 13 lb. of steam per horse per hour. To all appearance the steam delivered from the boiler was quite dry and free from priming; but assuming that as much as 2 lb. of water in 26 lb. passed over as insensible priming, and allowing for the influence of clearance, we have still the fact that much more than one-third of all the steam which entered the engine was condensed in the cylinder. If by taking away the condenser this loss could have been reduced, the immediate result would have been that every pound of steam saved from cylinder condensation would have done as much good as 3 lb. making a vacuum. The total quantity condensed in the cylinder was, say, 11 lb. per horse per hour. This represents as much work as could be got by the condensation of 33 lb. of steam, but the whole gain to be had from the condenser was that due to the condensation of 13 lb. of steam,; and if this entailed the destruction in the cylinder of 4 lb. of steam then the condenser did more harm than good. With or without it the consumption of steam would still have been about 26 lb. per horse per hour, while if the extra condensation due to the presence of the condenser had reached 5 lb. per horse per hour, the engine would have been more economical if worked non-condensing.

We venture to think that it is hardly necessary to explain here at any length that the destruction of steam in a condensing engine must be greater than it is in a non-condensing engine. We have repeatedly explained the nature of the frigorific influence exerted by the condenser. We may cite here, however, a very simple and pretty experiment which will illustrate it. If one of the bulbs of the glass toy known as a cryophorus be immersed in a mixture of snow and salt, the water in the other bulb will begin to boil violently as soon as it is relieved from pressure by the condensation of vapour in the first bulb. It will thus part rapidly with its latent heat, and will freeze. In the same way vapour rapidly conducts heat to the condenser, chilling the inside of the cylinder and passages. In order that a condenser may be used with advantage, care must be taken that it shall not cause excessive cylinder condensation, and this is best done by using means to keep the cylinder quite dry inside; drain cocks should always be fitted at the lowest point, and whenever it is possible the steam ought to be moderately superheated. When, on the contrary, a cylinder is unjacketted, and, perhaps, unlagged; is badly drained, and so large that high measures of expansion must be employed to prevent it from running away with its load, then will the condenser be productive of positive waste of fuel. In other and more favourable cases it will do neither good nor harm. In all cases its value falls far below that theoretically appertaining to it.

AMERICAN FIELD IMPLEMENTS IN SOUTH RUSSIA.

ABOUT four years ago paragraphs were frequent and met one's eye in papers from all parts of the world, describing how Brother Jonathan was going to drive John Bull or his agricultural implement makers clean out of the South Russian field in a proverbially short space of time. American ploughs about that time were going to do most of this mischief, and it does seem that a few of these ploughs were really tried. This fact, taken with the supposed first low cost of the implement, afforded quite a sufficient text, for American manufacturers and the almost innumerable semi-technical American journals, upon which to hang long boasting articles and paragraphs about new outlets for American industries. English manufacturers, however, have as yet found no reason even to consider American competition in South Russia in anything save reaping machines. It is about four years ago that an agriculturist, who had been sent out by the Odessa Ouprava, returned from an American tour of two or three months, so thoroughly primed by our sharp friends across the water, as to be under the belief that he had learned all the best modes of land tillage, and could put the Russians into the right way of doing things. He, therefore, with the assistance of American manufacturers, got over to Odessa a number of wonderful American ploughs amongst other things. Some of the ploughs were sold, and the agent for the Ouprava arranged for a display of the capabilities of these ploughs before a large number of estate or farm proprietors not a great distance from Odessa. The day for the exhibition of their ploughs came, when, to the surprise of the agent, the English ploughs especially designed for Russian use, and customarily sent out by one of the oldest plough-making firms in England, were also on the ground. The agent, however, with the usual confidence, set to work with horses to show how the American "Eagle plough could lick all creation;" he performed some straight, or rather some across field ploughing, and attempted to plough round at the headlands. Most of the Russian estate proprietors seemed to hold but a very poor idea of the character of the work performed or of the implements, while others denounced both in almost every particular. After this exhibition the gentlemen present were asked by the representative of the English firm just to look at the work which they would do with their Anglo-Russian ploughs. Two pairs of oxen, which are most usually used for this work in South Russia, were accordingly harnessed to one of these ploughs, and some fine deep straight ploughing was immediately commenced. The Russian proprietors seemed hardly to know how far to go in ridiculing the American implement. After doing their usually fine heavy work, the Englishman put a steel share of the necessary form on to one of the ploughs, and it was then set into a piece of unreclaimed gorse land. This sort of work was rather new to the agent who had hoped so much from the American implements, and, although it is a great boast with the Americans that their "steel" ploughs will cut up roots, he did not have enough oxen put on to his plough to attempt to turn so rooty a sod. Another display in which only the American implement was to be tested had been arranged, but the English firm again heard of the matter and were again present. Similar exhibitions of the powers of the two sorts of ploughs were gone through with the same results as before. Russian farmers from these and the accounts of some other such displays gradually began to learn the truth about the American ploughs. For some months they had had it dinned into their ears that the cheapness and superiority of these American ploughs were going to drive every other sort out of the market. The reporters for the ordinary newspapers had spoken in glowing terms of them when they had attended one-maker plough exhibitions, but they found themselves obliged to speak very differently when they saw the ploughs in competition. Little or nothing is now heard there of the American implements and machinery which were to cut everything else out of the field, and the steam engines which were to be sold at half the English price never found a customer, for the Russians found that the English engines were about double the size if double the price. South Russia has thus proved a mare's nest to the American plough maker, but as it is not to be supposed that all Americans will refrain from reporting the sale of a big ship when they have got the order for a few copper nails for one, it may be as well to remember that accounts of the extension in certain directions of some classes of American industrial commerce are often, though untruthfully, published simply with a view to obtaining trade in the country referred to.

CHEAP PATENTS.

A SOMEWHAT instructive comment upon the cry for cheap patents comes from the country blessed with both these and a corps of examiners. Even the heavy fees charged in England for patent protection are not always sufficient to cause sanguine inventors to ponder their invention long enough to find that they are defying some mechanical or other equally rigid law, and hence the numerous useless patents for inventions of the perpetual motion and similar classes. These men will not cool down or allow themselves to learn the truth until they have been allowed to pay a considerable sum to the Patent-office, so that they may publish their enthusiasm and publicly learn their folly. In order that such men may be protected against themselves, and that they may run their heads against walls at less expense, a body of expert examiners and patents at a cheaper rate are demanded. Patent fees as low as those charged in America would probably do more to prove the accuracy of Carlyle's well-known remark as to the proportion of fools in a large population, than any other change that could be made. In illustration of the working of cheap patents and boards of examiners in America, the land of perfection for poor inventors, a correspondent sends a letter to the *American Machinist*, which we cannot refrain from quoting. He says:—"Some time ago you illustrated an ingenious English patent for increasing the pressure upon a piston by corrugating it, and thereby getting an increased area for pressure. This is outdone, for real inventive power by the patent issued by our own office in 1872 for a water motor. The inventor says: 'My invention consists in the arrangement of the piston rods for filling up the space in the cylinder, to economise water, so as to economise the water space and retain the same area on the piston for pressure.' This is a good illustration of the thorough examinations made by the corps of expert examiners at the Patent-office. It also illustrates the personal interest taken in the welfare of his client by the average patent lawyer. This patent was put through by a law firm that runs a scientific newspaper attachment to its patent business, and it is safe to say that they realised on the idea, if the inventor did not. I am going to patent the idea of making the piston-rods as large as the piston, and economise all the water. My patent will be for sale entire, and I should not demand any royalty on the machine sold. We are a great and inventive people, and—the patent lawyers—make a boast that there are 200,000 patents in force—mostly like this one—and the crying need of the nation is cheaper patent fees—more patent lawyers—and more patents." The drawing accompanying the specification shows the piston-rods at both ends of the piston nearly as large as the cylinder, except close to the piston itself, and here the piston-rods are turned down for a short distance, so that nearly the whole possible area of the piston is exposed to the water, the inventor imagining that the water could not press upon the inclined area of the turned-down rods. It is perhaps easy to understand the value of searches and examinations made by thoroughly qualified men, but the impossibility of obtaining, except at enormous cost, the large number of examiners which would be necessary to protect inventors against themselves and to save them the trouble of satisfying themselves of the novelty or usefulness of their invention, precludes the idea of making a serious application for the establishment of such a body, especially if patent fees are to be largely reduced. On the other hand, the absurdity of employing youths and others whose only training is that necessary for passing a civil service examination, is sufficiently obvious from the working of the system in the United States.

LITERATURE.

The Scientific English Reader. Englisches Naturwissenschaftlich-Technisches Lesebuch. Von Dr. F. J. WERSHOVEN. II. Theil. *Maschinentechnik und Mechanische Technologie.* Leipzig: F. A. Brockhaus. 1881.

THIS little volume is, as above indicated, one of a series of scientific reading books in the English language for German students. The book consists of a selection of chapters from the works of well-known English authors, and from THE ENGINEER and other journals. The chapters deal with steam engine and other branches of mechanical engineering, the strength of materials, principles of mechanism, tools, &c. A good selection of articles on such subjects suitable for reading lessons and free from formulæ is not very easily made, but Dr. Wershoven has not failed in this respect. The works of Rankine provide a very considerable part of the readings on the strength of materials, principles of mechanism, water-power engines and wheels, and work; and generally there is an absence of any of that sort of reading which the student may find it afterwards necessary to forget.

Materials and Construction: A Theoretical and Practical Treatise on Strains, Designing, and Erection of Works of Construction. By FRANCIS CAMPIN, C.E. Weale's Series. London: Lockwood and Co. 1880.

THERE are very few practical engineers who do not owe a good deal to one or more of the many excellent rudimentary and elementary treatises in Weale's series of little volumes. Few books are better known at sight than the green or red-covered Weale. Mr. Campin's addition to the series seems to be quite a new one, and it is one which adds to the already high value of the series as far as its parts deal with the same or allied subjects. The title given to Mr. Campin's book is rather comprehensive, and is, perhaps, liable to give a wrong impression to those who read it. It is quite clear, for instance, that a theoretical and practical treatise on designing and erection could not be comprised within the compass of one of Weale's series. It must, therefore, be remarked that the book is a theoretical and practical treatise on its subjects as far as it goes, but that the subjects are treated elementarily, and not comprehensively. Mr. Campin has, however, made a most useful selection of points or questions to be chiefly dwelt upon, these being so selected as to form keys to many other problems of a similar order. Though concisely treated, the properties of materials and their behaviour under strain are clearly stated; and the theoretical examinations of the strains in bridge, girder, and roof structures are exceedingly neatly explained, the formulæ being of a simple order, without any sacrifice of accuracy. The author seems to have acquired a good idea of the points at which the student and practical man often stumble, and in order that there should be no misunderstanding of the theoretical explanations, he has worked out in figures numerous applications of the formulæ to practical work. He has given a tangible application of them in all the different parts of the book, relating to strains and strength of structures and their parts, including girders, arches, piers and abutments, revetment walls and roofs. These worked examples are of the greatest value, not only as affording additional explanation of what precedes, but they give the practical student the means of satisfying himself of the correctness of his learning, and confidence in his application of it.

BOOKS RECEIVED.

The Steam Engine and its Inventors. A historical sketch by Robert L. Galloway. London: Macmillan and Co.

A Practical and Theoretical Essay on Oblique Bridges. By G. Watson Buck, M. Inst. C.E. Third edition, revised by his son, J. H. Watson Buck, M. Inst. C.E., and with addition of description to diagram for facilitating the construction of oblique bridges, by W. H. Barlow, M. Inst. C.E. London: Crosby Lockwood and Co.

Water: Its Composition, Collection, and Distribution. A practical handbook for domestic and general use. By Joseph Parry, C.E. London: Frederick Warne and Co.

A System of Practical Arithmetic adapted to the Use of Schools; containing the fundamental rules, and their application to mercantile, cotton spinning, manufacturing and mechanical calculations. By Samuel Young. Manchester and London: John Heywood and Co.

A Complete Course of Problems in Practical Plane Geometry, adapted for the use of teachers and students preparing for the examinations conducted by the Science and Art Department, with an introduction to elementary solid geometry. New revised and enlarged edition. By J. W. Palliser. London: Simpkin, Marshall, and Co. Leeds: The Author.

Zeitschrift fuer Instrumentenkunde. Erster Jahrgang, 1881. 1 Heft. Januar. Berlin: Julius Springer.

Laxton's Builders' Price Book for 1881, containing above 72,000 prices; originally compiled by William Laxton. Sixty-fourth edition. London: Kelly and Co. and Simpkin, Marshall, and Co.

Almanach fuer de k.k. Kriegs-Marine, 1881. Mit Genehmigung des k.k. Reichs Kriegsministeriums Marinesection. Neue Folge: 1 Jahrgang, Wien: Gerold and Co. Pola: W. Schmidt.

TENDERS.

KIDDERMINSTER TOWN COUNCIL.—CORPORATION SEWAGE FARM.

E. PRITCHARD, engineer, 27, Great George-street, Westminster, S.W., and 37, Waterloo-street, Birmingham. Quantities by E. J. Purnell, Coventry.

Name. Address.	Tender. £ s. d.	Alternative Tender. £ s. d.
Kellett and Bentley, Ealing	6500 0 0	5969 0 0
Davison, W., Sheldon	5797 0 0	5303 0 0
Hughes, H., Lower Gornar	5550 11 3	5243 2 5
Currall and Lewis, Birmingham	5235 0 0	4560 0 0
Mackay, J., Swansea	4710 0 0	4227 0 0
Kirk, T., Chester	4320 0 0	3990 0 0
Burkett and Co., Birmingham	4198 0 0	3997 0 0
Vale, T., Kidderminster	3680 0 0	3100 0 0
Smith, T. M., London	3078 0 0	3012 0 0
Law, G., Kidderminster—accepted	2800 0 0	2550 0 0

THE SOLWAY VIADUCT.

Within little more than a year after the Tay Bridge disaster, we have to report the failure of the Solway Viaduct, near Annan, forming the most important part of the Solway Junction Railway, and until this week, a connecting link between England and Scotland. On Sunday and the two following days a large portion of the Viaduct was swept away, as already reported in our columns, by the shoals of ice, which, since the thaw set in, have been drifting down the channel. In former years the thaw has been accompanied by high winds, breaking up the ice and saving the Viaduct; but this season no wind has arisen, and the packs have been carried down in unbroken masses, hurling themselves against the piers, carrying everything before them. The accident has been unattended by any loss of life, owing to the vigilance of the railway authorities, who had watchmen stationed, who gave timely warning.

The structure is very similar to the Tay Bridge in construction and size. Perhaps a better description cannot be found than that of Mr. Brunlees, in his evidence before the Select Committee—21st July, 1880, Ques. 942—where he describes it as "entirely wrought iron columns and lattice girders; exactly the same construction as the Tay Bridge;" with this exception, however—the columns are of cast iron.

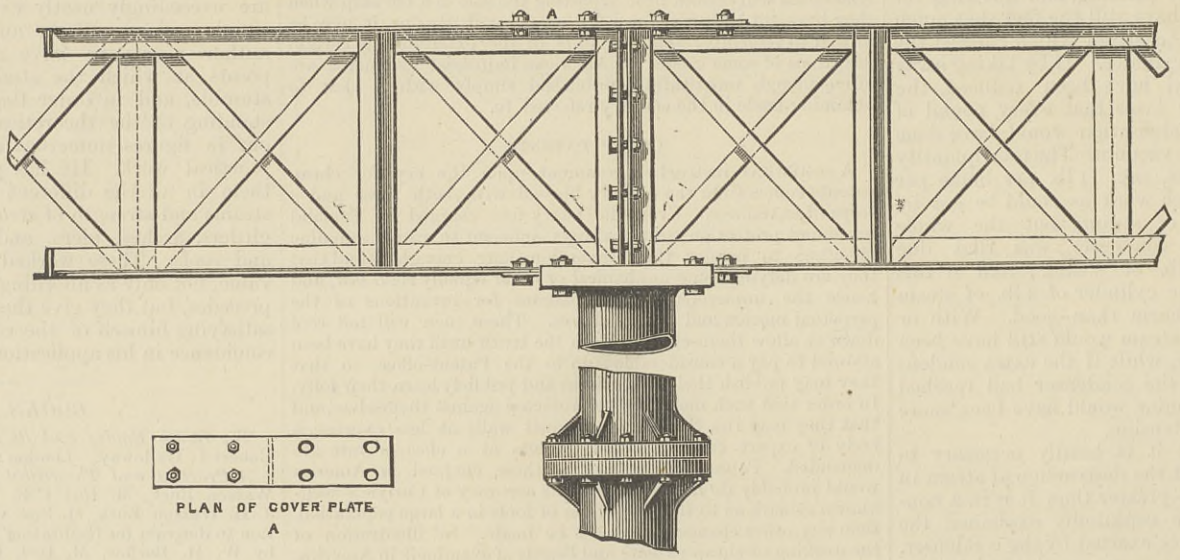
THE SOLWAY VIADUCT AS IT APPEARED ON THE 7th Inst.

We give herewith a perspective sketch taken about half a mile up channel, our artist sitting at the door of the fishing station exposed to all the fury of wind and sleet. The viaduct is about a mile and a-quarter in length, and about 40ft. in height; the spans are in groups of seventeen of 30ft., each group being connected by a span of 5ft. The design was for a double line of rails, but only that portion requisite for a single line—the right hand looking south—has been erected, with the exception of the shore spans and a short portion at the centre of the viaduct, on which a "bothey," or watch-house, stands. The superstructure consists of four lattice girders, the rails being carried directly over the two central girders on longitudinal timbers; the deck is formed of buckle-plates, with the convex side upwards; the girders are supported by braced piers of five cast iron columns 12in. in diameter. Commencing then from the north abutment, the first or "Scotch" gap is at the end of the doubled portion; about 50 yards of the viaduct have been swept away at this point. Many of the columns on the standing portion have, however, been shattered, for about 250 yards after the first gap the platform is supported by the few piers that have withstood the shock of crashing ice, the undulating girders indicating very clearly where the gaps occur. Next comes the largest or "Cumberland" gap, extending to between 200 and 300 yards, after which the viaduct remains continuous although much damaged, it is understood, in the substructure, as in the other portions described.

Some idea of the force of the floating ice may be formed from the narrative of the fishermen. They said that for some days the channel was covered with fields of ice acres in extent from 6ft. to 12ft. in thickness, and that it would have been almost possible at one time to have crossed to Cumberland on the pack. The crashing of the ice as it swept along, borne by the current at the rate of twelve knots an hour, was heard two or three miles off they said, and even half a mile away from the viaduct the noise was audible, although the wind was blowing in the opposite direction. While we stood on the viaduct, near the first gap, huge blocks of ice, fifteen or twenty yards square, were hurled against the columns, making the whole structure vibrate and tremble again.

The girders are, as before remarked, of the lattice type; 30in., or one-twelfth of the span in depth; those on the outside being formed of two 3in. by 3in. by $\frac{3}{8}$in. angle irons, connected by lattice bars $2\frac{1}{2}$in. by $\frac{3}{8}$in. The inside girders are of similar scantling, with the addition of a plate flange 10in. by $\frac{3}{8}$in.—doubled at the centre—and lattice bars of increasing section towards the piers. On reference to the accompanying sketch it will be seen that the girders, though independent in themselves, have been made imperfectly continuous by a system of sliding covers, vertical bolting, and in their connections at the column heads provision has been made for expansion by leaving a space of an inch between the girders. Half of this only is, however, available for that purpose, the cross-bracing intervening. On looking over the end of the girders, at the watchhouse where the first gap occurs, we found the falling ironwork had been torn away from the bolts, from which portions of the angle irons were hanging; the column heads, forming the girder seats, had also been broken by the leverage of the girders in their fall. In the distance he had seen a line stretching across the "Scotch Gap," this, on closer inspection, he found to be the right hand rail—looking south—the fishing of which had remained intact, leaving it hanging in an almost perfect catenary, with its chairs and spikes suspended—a slender but unbroken link, bridging the gap where five spans had so lately stood.

Mr. McKerrow, of Messrs. Brunlees and McKerrow, the engineers of the viaduct, arrived at the scene of the accident on Monday, and inspected the ruins. Arrangements have been made, we learn, for supporting those portions of the superstructure from which the piers have been swept away. Messrs. Waring Brothers and Eckersley, of London, were the contractors of the structure; since its completion the maintenance and repair have been in the charge of one of the erectors who was engaged in its construction, requisite tools and materials being provided in a workshop on the north embankment. Quoting from the *Glasgow Herald* of the 1st inst.:—"The line, of which the bridge formed a part, was opened in 1868, and its stoppage will cause considerable inconvenience to the districts on both sides of the Solway, and especially to parties in Cumberland who were accustomed to attend the Annan stock markets. The erection of the bridge was completed in 1868, and none of the Solway storms have hitherto had any effect upon it. It is supposed that if the present thaw had been accompanied with more wind, so as to more effectually break up the ice, the disaster would not have occurred. The line of the girders is 40ft. above low-water level."



DETAIL OF GIRDER.

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

(*From our own Correspondent.*)

Prices were irregular to-day—Thursday—in Birmingham, and also yesterday in Wolverhampton. Most strength was seen in low-priced rolled iron. Although last week's advance of 5s. per ton in hoops was not upheld, yet the makers of common merchant bars did not hesitate to ask £6 2s. 6d. up to £6 5s. per ton. Nail rods and nail strip were weak, but tip iron was worth more money. In this class of iron all the mills are busy. The chief extra demand has come from Lancashire, and it is traceable to the temporary closing of some of the mills there for want of coal. Some good tube strip orders are under execution, but more work of this class is needed, and orders might be placed at very low figures.

Nail sheets were easy to buy, and specifications were sought by some makers of tank and galvanising sheets; though the orders distributed this week have embraced those to hand by the last mail from Australia.

The latest news from the antipodean markets gave the prices of galvanised sheets of 26 w.g. at from £21 5s. up to £22 10s., according to brand. The prices were a trifle stronger upon the month, and the stocks are less heavy. Galvanisers of repute this afternoon quoted their former price of £15 for 24 w.g. corrugated sheets delivered in London, and £17 for 26 w.g. And they were materially assisted in maintaining these prices in that certain black sheet makers demanded an advance of 5s. per ton on the week, making "singles" £8 per ton.

The home orders include a revived demand in one or two quarters for high-class boiler plates. Common plates and angles sell a little better, and at a trifle better price. Minimum quality plates were quoted up this afternoon to 5s., making them £8 5s. Cable bars and anchor iron are looking up quietly; but anvil iron moves only slowly.

Marked bars were unobtainable at under £8 2s. 6d. to £7 10s. and those prices are securing a trifle more business than of late colonial orders showing an improvement.

Medium merchant iron was in plentiful supply at from £7 to £6 10s. for round and squares of the ordinary sizes.

Best sheet makers reported that they were experiencing a better demand at the works. Their order books are filling faster, and as a result they are more independent in the matter of prices. They quoted £10 for "singles," £11 10s. for doubles, and £14 for trebles. Tin-plates were likewise announced to be selling rather more freely on export account.

Generally speaking, there was this afternoon much reluctance to give advanced rates for either finished or pig iron; and as producers declared their inability, now that fuel has risen, to sell at former rates, business was largely at a standstill.

Cold-blast pig iron was slightly less in request at £4 5s. up to £4 7s. 6d. Hot-blast all-mine sought customers at from £3 5s. to £3 7s. 6d., the further 2s. 6d. being asked as the result of the rise in coal. Part-mine iron ranged from £2 10s. to £3, according to the proportion of mine. Common pigs were scarcely so strong at £2 2s. 6d. to £2 5s. Vendors of Cleveland forge iron held by merchants sought sales at 37s. 9d. to 38s. into trucks at makers' furnaces. This was a drop on the week of 1s. 6d. per ton. A few sales, mainly of foundry iron, at from 6d. to 9d. more money were reported. Stocks of Staffordshire pigs are accumulating at the furnaces since some consumers are refusing to accept deliveries. Four blast furnaces have been set on since the year began. The most recent accession is one at the Willingsworth plant, Wednesbury.

Coal is not difficult to buy from several collieries at 6d. under the rates which are charged by a few leading firms as the result of the advance of 1s. a ton declared last week. Neither to-day nor yesterday was there much confidence that the rise will be long maintained. A meeting of the coal-masters in the Bloxwich district was held there on Monday, and the price of coal was formally advanced 1s. per ton. This advance leaves forge coal, mined from the thin seams in the district named, at 7s. 6d. per ton.

The Cannock and Huntingdon Colliery Company's pits are rapidly being brought into order again. Pit No. 1 has been cleared, and sinking of the tubbing begun. About 430ft. of tubbing in No. 2 pit has been cleared of water, and the precautions taken against a rush of water have preserved the bottom quite dry. The sinking by the ordinary method is to be at once resumed, and the first workable seam of coal will probably be reached in a day or two, as it is only 5ft. below the bottom of the tubbing. This seam is 4ft. $4\frac{1}{2}$in. thick. The next seam is at a depth of 540ft., and is 8ft. thick.

Traders hereabouts regard with much interest the views upon the state of trade which were expressed on Monday by Mr. Thomas W. Shaw, the head of one of the largest hardware merchant firms in Wolverhampton, in his capacity as chairman of the Wolverhampton and Staffordshire Bank. This authority said that it could not be denied that throughout the country there had been, and still was, a decided change for the better. But unfortunately this district appeared to be about the last to realise the improvement. Although the important iron industry did not appear to be in so bright a condition early last year, yet he believed that it was in a healthier condition now than then. There was no speculation appertaining to the present demand, but it was of that steady and genuine character which bid fair to continue and develope. Whilst the trade of the district had been in the depressed state he had sketched, there had still been branches whose better condition had gone far to redeem the trade of the district from the imputation of being altogether bad.

A large amount of activity at present characterises the wrought iron tube trade. Colonial, Continental, Indian, and other foreign orders of much value for gas and water tubes are under execution in the several centres of manufacture. But the business is robbed of that satisfaction which the activity should afford by the very low prices that prevail. These are largely profitless, and an early meeting of the Association is very likely to be held soon in Birmingham to try and prevent the underselling. Wrought iron boiler tubes are in good demand from Lincoln and other agricultural machinery centres, but in marine boiler tubes the competition of the Glasgow manufacturers is almost overwhelming.

The Midland Association of Gas Managers, at their annual meeting just held in Birmingham, set on foot a scheme which is likely to stimulate gas engineers to fresh efforts in scientific study. The object of the scheme is "to raise a fund sufficient for the endowment of a gold medal, to be called the Birmingham medal, for the encouragement of original research in gas manufacture." About £370 is already promised.

The directors of the South Staffordshire Waterworks Committee, in their report to be laid before the proprietors at the half-yearly meeting, state that the gross revenue from water rates during the half-year ending 31st Dec., 1880, was £24,844, as against £23,007 in the same period of 1879. After all deductions, the amount remaining for division is £9797, and the directors recommend the declaration of a dividend for the half-year at the rate of 4 per cent. per annum, payable on 1st March next. The sum needed for this dividend will be £7609, leaving, to be carried over to the credit of the next half-year, £2188.

In reply to the notice given by the North Staffordshire colliers for an advance in wages because of the exceptional demand from Lancashire, the North Staffordshire Iron and Coal Masters' Association, at a recent meeting at Hanley, resolved that the notice be not accepted, being quite irregular and not being given by the workmen themselves to their employers; but that as soon as ever improved prices could be obtained so as to enable wages to be advanced, the employers would be ready and willing to grant an advance.

The "Institute pit" of the Whitfield Colliery, at Chatterley, North Staffordshire, belonging to the Chatterley Coal and Iron Company, fired on Monday through the ignition of an accumulation of coal dust, and the fire after raging a short time exploded gas that was in the pit. The result of the explosion has been the death of some twenty-one people, the destruction of machinery and plant, the burning of a train of railway wagons, and the throwing out of work of upwards of three hundred miners. The accumulation of dust was near the blacksmith's forge, and either a spark thence or the throwing, by a boy, of some burning cotton-waste upon the heap, is the conjectured cause of the fire. It was in the early morning, and only about forty men were down; when the fire became uncontrollable they were drawn up, but a party of twenty volunteered to descend and bring up the fifteen horses. Three horses had come to bank, and the cage was being lowered with four men on—one the manager's son—when the explosion of gas occurred. The cage and its freight were hurled up the shaft and into the overhead gearing. No communication has been possible with the volunteers in the pit, all of whom it is feared must have succumbed. The up-cast shaft has been filled in with rubbish and the mine has been flooded.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here continues very quiet; most of the consumers in the district are still well covered, and are under no immediate necessity to buy, whilst the local makers being well sold for the present are not pushing sales. Any speculative business is also checked by the weaker tone reported from the Glasgow and Middlesbrough markets. Makers' prices are without material change, but iron held in second hands is easier, and to secure any business of importance some concessions have to be made to buyers.

Lancashire makers of pig iron report very little inquiry during the week, but they still hold for late rates, their quotations for delivery into the Manchester district remaining at 46s. 6d. for No. 4 forge to 47s. 6d. for No. 3 foundry less 2½, and three months continues the outside limit over which they are willing to extend deliveries. The business doing in local brands has been restricted to a few very small sales.

In outside brands the transactions reported are also extremely limited in extent. Middlesbrough iron has been offered at 47s. 4d. per ton net cash for g.m.b. delivered equal to Manchester, but north-country brands have still no chance in this market. Lincolnshire and Derbyshire irons for delivery into the Manchester district are quoted at about late rates, the average prices being 47s. to 47s. 6d. for forge to 48s. 6d. to 49s. for foundry less 2½, with some Derbyshire makers quoting nominally higher figures than these. Sales, however, are difficult to effect except at something under the above quotations.

Finished iron is in a somewhat better position than the raw material. A tolerably steady tone is maintained in the market, and manufacturers in view of the probability of higher rates ruling for coal are inclined to be firm in their prices, and are unwilling to commit themselves very far forward at present rates. For hoops there is a fairly good demand, and the pressure of work in the hands of north country makers has thrown a good many orders for sheets and plates into the hands of manufacturers in this district. For delivery into the Manchester district hoops are to be bought at about £6 7s. 6d. to £6 12s. 6d. per ton; sheets, £7 15s. to £8; common plates about £7 16s.; and ordinary boiler plates at £8 to £8 10s. per ton. For ordinary bars delivered into the Manchester district quotations average from £5 17s. 6d. to £6 2s. 6d., and transactions have taken place during the week at £6 per ton.

Machinists and engineers in this district are still only going on with the orders they have in hand. The year has not opened well so far; the inquiries which were in the market have not yet developed in actual orders, and this is causing rather a discouraging view as to the prospects before the trade. The textile trades of the district do not show a revival sufficient to encourage the erection of new mills, manufacturers preferring to go on with their present equipment, and as a consequence the local demand for machinery and engines is very small. Locomotive builders are also chiefly employed in finishing work.

In the coal trade an unsettled feeling has again been produced during the week by the renewal of the strike in the Manchester district, and the local firms who have had less stocks to work upon than when their pits were stopped last month have been compelled to decline orders for any specified delivery, and also to withdraw their prices, orders being only taken subject to the rates which might be ruling when deliveries could be made, whilst in some cases circulars have been sent out intimating that under present circumstances they could not undertake to deliver coal to works. In the West Lancashire districts the stoppage of the pits has also continued, with few exceptions, during the week, and any actual resumption of work has been confined to the Ashton and Oldham districts, where the pits have been in full operation, and to the Atherton and Tyldesley districts, where about half the men have gone in. During the last few days there have been strong anticipations of an early termination of the strike throughout Lancashire, but apart from the districts already mentioned, comparatively few men have as yet returned to work. So far as supplies of round coal are concerned these have been plentifully offered from outside districts, and prices are rather easier as compared with the exceptional prices which have previously been ruling; but engine classes of fuel are still scarce, and for these high prices are still being obtained.

The seventh annual report which has just been issued by the directors of Messrs. Andrew Knowles and Sons, Limited, one of largest colliery firms in Lancashire, affords a very fair means of judging what has been the condition of the coal trade of the district during the past twelve months. The total profits earned by the company have been £242, and to meet interest, charges on mortgage debentures, overpaid calls, reserve fund, and £2000 towards formation expenses, it has been necessary to withdraw £28,954 from the reserve fund, which is now reduced to £8482. The nominal capital of the company is £1,250,000, of which £623,281 has been paid up, and the debenture bonds amount to £500,000. The directors naturally express regret that there has not been that improvement in the coal trade which was anticipated at the commencement of the year. They add that at no time during the year could prices have been advanced materially without the risk of losing trade, and to keep the colliers going during the summer months large quantities of coal have had to be put down into stock.

I hear that a company which has been projected in Manchester, with a capital of £150,000 is being formed for the purpose of working Turnbull's patent pontoon dock system. It is claimed by the inventor that his pontoon docks can be constructed at a saving of upwards of £17,000 as compared with the dry docks now in use, and the working of the docks, which are constructed of iron, and divided into air and water-tight compartments, is described as follows:—The dock is submerged by letting water into the water compartments at the bottom, but as this does not sink the dock to a sufficient depth to take in the ship to be docked, nor put the vessel afloat again, water chambers in the upper part of the structure are filled, or partly filled, as may be required. As soon as the ship is centred over the keel blocks, the water in the upper chambers is allowed to escape by the opening of a valve, and the dock being thus relieved of weight rapidly rises to the ship's keel. She is then blocked and secured, and the water in the lower compartments pumped out by centrifugal pumps placed in the fore end of the dock, the dock and ship rising to the surface, where the ship may remain on the pontoon, or, if so desired, transferred to the slipways on land, for which purpose the pontoon serves as a turntable. One of the great advantages which the inventor claims is the adoption of a steadying cylinder, which gives such an amount of stability to the dock as to remove all anxiety as to its canting or listing, while it gives greater strength to the dock and a large gain in lifting power, as well as a great saving in the cost of construction.

Barrow.—The activity at the various iron and steel works throughout this district is fully maintained, and from what I can see, the year will be one of the most active periods we have ever experienced. Not only are a large proportion of the furnaces in blast, but the demand for iron is such at present, and is likely to be such in the immediate future, that makers will be compelled to put in blast all the furnace plant which is now standing idle. The delivery of metal is still on a very large scale, and the traffic receipts on local railways are well maintained, for they show no falling off from last year, although it will be remembered that twelve months ago an extraordinary demand for iron existed and extraordinary prices were ruling. The make of iron this week shows an improvement, all round qualities of Bessemer iron being worth 69s. at makers' works, and Nos. 3 and 4 forge and foundry iron 67s. 6d.; while inferior qualities of metal realise about 65s. per ton. There is a fair inquiry for all classes of steel, and Bessemer qualities are realising full figures, while Siemens' steel is in larger output and is selling at a trifle more money. The output of the latter will soon be very considerably augmented by the putting in operation of new furnaces and mills on a large scale at Barrow. The shipbuilding trade is very busy, and builders and engineers have so many orders on hand that they are in many instances refusing new work. The trade in finished iron is very steady. Iron ore finds a very good market at unchanged prices. The coal trade is unsteady, owing to the short supplies and the advancing prices brought about by the strike in Lancashire.

The Anchor Line steamer Furnessia left Barrow on her trial trip for the Clyde at the close of last week, and made a satisfactory voyage. She is the largest vessel ever built in England with the exception of the Great Eastern, having a gross tonnage of 5500 tons, and her dimensions being—length between perpendiculars, 445ft.; breadth of beam, 44ft. 6in.; and depth of hold, 34ft. 6in. Her engines are of the usual inverted compound type, with a nominal power of 450 horses, and 2500 actual horse-power. The cylinders are 54in. and 108in. in diameter respectively, and the stroke is 5ft. 6in.

The Whitehaven Shipbuilding Company launched last week a steamer named Walney, built for Captain Nelson, her dimensions being—length, 130ft.; breadth, 21ft., depth of hold, 9ft.; and registered tonnage, 220 tons.

The price of all classes of coal in Cumberland has been advanced 10d. per ton, and strenuous efforts are being made to increase the output.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A VERY important resolution was passed at a meeting of coal-owners held in Sheffield on Monday. The meeting was very largely attended, and was an excellent representation of the proprietors of the South Yorkshire coalfield. The resolution was as follows:—"That this meeting regrets that the condition of the coal trade does not warrant any advance in wages at present, but with a view to placing the question of wages upon a basis that would be mutually satisfactory to the workmen and the masters, a committee be appointed to confer with the representatives of the workmen, particularly with reference to the future regulation of wages by the adoption of a sliding scale." Immediately after passing this resolution the meeting agreed to invite the secretary of each of the miners' unions, with representatives from the principal collieries in the district, to meet the committee and confer with them on the subject of the resolution. This joint meeting is to be held on Friday at Sheffield. An arrangement on the basis of the sliding scale has already been arrived at in the case of Manvers Main Colliery; and if the proposition of the masters is agreed to, there will be an end of many of the painful disputes which periodically occur in the coal trade. I am not very confident, however, that this arrangement will be agreed to. At Aldwarke Main and Carr House Collieries, the property of Messrs. John Brown and Co., Limited, 1200 colliers are on strike. The chairman of the company—Mr. J. D. Ellis—offered the men the chance of going back to work on the understanding that if an advance was given in the district they should have it on all coals raised on and after the date of their return to work. The men declined this offer. I know that they have also been offered the sliding scale, and likewise to refer the whole matter to arbitration. Both proposals have been refused. Under these circumstances there is not much hope of a general adoption of a sliding scale, except on such terms as would not be agreeable to the employers. Another objection in the eyes of agitators is that it will to a large extent put an end to agitation, by which they live.

The table blade grinders are requesting a return to the statement of wages agreed upon in 1859, on the ground that trade is now in a condition to permit of the advance. The men urge that their wages, after all deductions are made, do not average 25s. a week, and it is probable that their request may be granted to some extent. This important department of the Sheffield trades is worked under circumstances which are not very advantageous to the grinders. They find their own tools—which cost from £20 to £30—and they have to pay for wheel rent as well. "Wheel rent" is the price the grinder pays for the place he works in, and the power by which he works. The trade—*i.e.*, the union—desire to put the work on a different basis. They are anxious that the grinder should be paid so much for his labour, without any deductions at all.

The scheme which the directors of Messrs. Brown, Bayley, and Dixon, Limited, propose for carrying on the works at Attercliffe is now known. They suggest a call of £5 per share—being one-half of the uncalled capital—and that directors and joint liquidators continue the undertaking for six months, the shareholders at the end of that period to be called together and asked to say what should definitely be done with the works. Their resolution, of course, will be guided by the practical results of the working and the prospects in view. I believe the scheme will meet with the general approval of the proprietors.

Wagon companies have had a good time of it recently. The British Wagon Company, Limited, has made a profit, available for dividend, of £2213 16s. 6d., which permits of 7 per cent. The Sheffield Wagon Company declare 4 per cent.

The Bishop of Queensland gave Messrs. Ward and Payne, of Sheffield, a good advertisement on Monday. Speaking at Sheffield on the claims of his vast "diocese," Bishop Staunton had thousands upon thousands of visiting cards in Australia in the shape of shears, with "Ward and Payne, 38-shear, Sheffield," on them. Mr. Ward, the surviving and sole partner, is now in Australia on a visit to the Melbourne Exhibition, where he has a "stand" which contains the largest and most complete collection of files, edge tools, carver's tools, &c., ever shown anywhere.

The failure is announced of the Monkwood Colliery Company, the proprietor of which is Mr. Henry Walker. The liabilities are £33,000. The assets have not yet been ascertained.

Mr. R. K. Moorhouse, manager of the Andover Gasworks—who was for many years connected with the Sheffield Gas Light Company—has been appointed manager of the Guildford Gasworks.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE anticipated heavy increase of stocks has now taken place and has been officially announced. Fifty thousand tons was the amount prophesied, and forty-eight thousand is, in round numbers, the actual figure. Buyers and sellers are at last realising their true position. Sanguine hopes have been obliged to yield to the force of statistics, and a fall of 1s. 6d. per ton is the result. On Tuesday No. 3 Cleveland pig iron was sold at 38s. 6d. per ton, and some cases of even lower sales were reported for prompt delivery. Very little business was, however, done, and that little by merchants alone. Makers, without exception, held aloof. Besides the large increase of January stocks, the comparative insignificance of the shipments for the week has told upon the market. These reached only to 9677 tons for pig, and 2281 tons for manufactured iron. There has been a recurrence of bad weather upon the north-east coast, contributing to this result. Several wrecks have taken place, and lifeboats have been in frequent requisition. Inland snow has fallen thickly, some trains have been blocked, and traffic generally impeded. On Monday the shipyards were again laid off, and, indeed, almost all outside work suspended, owing to the heavy gale of wind and driving snow. At the various sea ports great numbers of vessels, especially those of small burden, are lying wind and weather bound. Many have been detained for several weeks and are still unable to proceed. All this tends to stop industrial activity and depress markets. The stock in Connal's store has increased during the week by 1404 tons, and now amounts to a total of 137,615 tons.

The ironfounding and general engineering trades are far from brisk, but makers of shipbuilders' forgings continue actively employed. In finished iron the demand is quiet and steady, the quotations of last week being closely adhered to. Plates are £6 15s.; angles and bars, £5 17s. 6d. per ton, free on trucks at works. A demand for puddled bars has sprung up, transactions having taken place at £4 per ton net cash, or a shade under. Old rails are slightly weaker than they have been of late, flat-bottomed ones being worth from £3 17s. 6d. to £4 per ton c.i.f. Tees, and double heads 2s. 6d. per ton more. Very few old rails are, however, being used in the Cleveland district, as it is cheaper in the present state of the market to buy puddled bars.

The ironworkers appear quietly to have accepted the 2½ per cent. reduction which came into operation on the 31st inst. The only case where it was resisted was at Tysack's forge at Monkwearmouth, and there the ironworkers eventually went to work when they found their tactics met with neither countenance nor support. This is the third alteration which has been made since the acceptance of the sliding scale, and the fourth since the commencement of the revival of trade in the autumn of 1879. The net result is that wages are now 7½ per cent. in advance of the rates previously current.

There is a strong demand for coal, partly in sympathy with the Lancashire strike, and the consequent dearth in that market, and partly on account of the recent cold weather. Steam coal commands from 8s. to 8s. 6d. per ton; coke from 10s. 6d. to 12s. 6d., according to quality.

The scarcity of trucks available for the Cleveland iron trade is another difficulty which at present is causing much loss and annoyance. It is one thing to have to put up with troubles, such as severe weather, which are beyond control, and another to remain calm under those which, like the one in question, might have been avoided by greater foresight on the part of the railway authorities. Now that the difficulty is pressing heavily upon every department of trade, the North-Eastern directors are beginning to recognise it; and it is said they are about to spend £100,000 upon new rolling stock. But that sum cannot be spent in that way in a day. The resolution so tardily adopted ought to have been arrived at months ago, when it was seen that the dormant works were one by one being re-started. Who knows but that the trade may have departed again by the time the railway company are ready to deal with it as it ought to be dealt with? If, as is sometimes asserted, the majority of the board are too rurally minded, and not sufficiently commercially minded, to appreciate the wants of the most railway-paying district in the world, and to see it to be their truest policy to anticipate and satisfy those wants; if that be so, that rural majority ought at least to act on the old rural proverb, that "One should make hay while the sun shines." Then let them be ready with their trucks, when freighters are ready with their goods and minerals, or maybe when the trucks are ready there will be nothing to put in them.

Strikes and rumours of strikes continue to trouble the constructive trades. The workmen employed in the various engineering departments of Messrs. Bolckow, Vaughan, and Co.'s works have been agitating for an advance of 5 per cent. On Friday a deputation waited upon Mr. Godfrey, the engineer, and formally demanded it; but they met with a refusal. Thereupon they held a meeting and decided to put in their notices the following day. At Messrs. Richardson and Duck's shipyard at Stockton, after a long contest the platers' helpers appear to have obtained the 2s. per week advance they have been fighting for, and to be at work again.

It is announced that the Walker-on-Tyne Rolling Mills, formerly belonging to Messrs. Bell, Ridley and Bell, are likely to be re started. At least an attempt is being made to form a company with that object. The premises have for some time been in the hands of one of the Newcastle banking firms, who naturally wish to rid themselves of the burden. The blast furnaces, which formed part of the plant, are now separated, and are being worked by another firm. The mills are not very favourably situated, being on a bank side, and, it is believed, without railway access. They would have to obtain most of their pig iron from Cleveland by boat, and except in very prosperous times might find great difficulty in competing with the better situated Cleveland works. Possibly the new company, if floated, may contemplate adapting its works to the manufacture of steel, for which there is a certain demand on the Tyne, for marine boiler and other purposes. Such a trade would have a better chance of permanent success; but still the future of the manufactured steel trade is in a problematical state.

Ironworkers, especially puddlers and underhands, continue scarce at Middlesbrough. There is now ample employment for all unskilled labourers who are able bodied and steady. The contrary seems to be the case with joiners, mechanics, &c., the demand in their case being scarcely equal to the supply.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow warrant market has been in a rather excited state this week owing to the continued decline in the prices. It may be admitted that bearing operations have been at work, but still the demand has not been at all satisfactory, and the prospects are so uncertain that not a few holders have been disinclined to run any further risk in the face of a falling market. From 51s. upwards the late rise in warrants was, to a great extent, purely speculative, and whether the same term can be applied to the depression below that figure which we are now experiencing will no doubt appear presently. Few will deny that there is ample reason for a backward market, if we do not look beyond the present time.

Business was done in the warrant market on Friday morning at 51s. 3d. eight days, and 51s. 4d. one month; the afternoon quotations being 51s. 1½d. to 51s. cash, and 51s. 3½d. to 51s. 2d. one month. The market was backward on Monday, when business was done in the forenoon at 51s. 1d. to 50s. 7½d. cash, and 51s. 2d. to 50s. 10d. one month. In the afternoon business was done at 50s. 7d. to 50s. 3d. cash, and from 50s. 9d. to 50s. 7½d. one month. The market was still further depressed on Tuesday, when transactions were effected at 50s. 3d. cash. The tone of the market was steadier on Wednesday, at 50s. 6½d. cash. To-day — Thursday—the market has been flat, with business from 50s. 5d. cash and 50s. 8d. one month, to 50s. cash and 50s. 3d. one month.

A further reduction has been made in makers' prices, to the extent, since I last wrote, of from 1s. 6d. to 2s. per ton, the quotations being now as follows :—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 60s.; No. 3, 52s.; Coltness, 61s. and 62s.; Langloan, 61s. and 52s.; Summerlee, 60s. and 52s.; Calder, 60s. and 53s.; Carnbroe, 58s. and 52s.; Clyde, Quarter, Monkland and Govan, each 51s. 6d. to 49s. 6d.; Shotts, 61s. 6d. and 53s. 6d.; Carron, 52s. 6d.—specially selected, 56s. and 51s. 6d.; Kinneil, 52s. 6d. and 51s.; Glengarnock, 58s. and 53s.; Eglinton, and Dalmellington, 52s. and 49s. each.

The malleable iron, engineering, and steel trades continue well employed, and as yet prices of manufactured iron are nominally without change.

The wages of the Lanarkshire ironworkers have been reduced to the extent of 2½ per cent., in accordance with the recent arbitration award in the North of England.

Since the snow passed away, the coal trade in the West of Scotland has, on the whole, been active, and as yet the f.o.b. prices obtained by coalmasters during the past year are, as a rule, fully conceded. Of course, should open weather continue and the disputes in England be settled, it is probable that prices might settle down to their former level. At some of the collieries there is a scarcity of good miners, and the wages have been advanced 6d. per day by the Ayrshire sale coalmasters; but the advance has not taken effect in Lanarkshire as yet to any extent, and not in the other mining counties at all. The Scottish miners' delegates meet in Glasgow on Monday, when a better idea of the exact relations between employers and workmen will be obtained; but it may be said, in the meantime, that the drop in the prices of pig iron renders it highly improbable that the ironmasters will agree to advance wages just yet. Meetings of the colliers have been held in various districts, when, of course, resolutions were carried in favour of the advance, but these sectional movements can have but little influence upon the question.

The liquidators of the Blochairn Iron Company, Limited, have issued a final report to the shareholders and creditors of that unfortunate concern, in which they state that the whole of the assets are now realised, and that the creditors have been paid 15s. 6d. per pound. A committee of the creditors have voted £1000 to Mr. James Morton, of Greenock, Mr. M. Kennedy, and Mr. Fletcher, the liquidators, for their services. The works, ground, plant, and stocks, cost the limited company about £600,000, and they have been sold for £60,000 to the Steel Company of Scotland, who are utilising them for the manufacture of steel. Every farthing of the shareholders' money went towards the liquidation of the debts that had been incurred upon the concern, and of £10 per cent. which they were promised for several years, they received nothing.

The twenty-first general meeting of the Glasgow Caradon Copper Mining Company was held in Glasgow this week. Mr. Archibald Arrol, who presided, expressed the regret of the directors that the report had been unfavourable. The results of the working of the mine had been disappointing so far, but the directors had hopes that experiments to be made would give better results.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

Colliery owners of the new era are adopting every possible means to avoid disasters. Putting aside sentiment, it is known to be a much less expensive course. I have heard of one of the explosions in past years costing the proprietors £30,000, including the loss in sales of coal, &c. I was at Harris's Deep Navigation Colliery lately, and was much pleased with the precautionary system in force. The lamp house, for example, is something worthy of the name. Every lamp is numbered and has its place on the shelf. Competent examiners subject each lamp to a careful scrutiny, and test with a jet of gas, and outside of the building a similar jet is provided for the colliers to satisfy themselves that the lamps are in good condition. One part of the building is devoted to the repair of lamps, and in this part I was favoured with an exhibition of tests in which the lamp of Williamson's came out in a most triumphant manner, and the primitive Davy maintained its excellence for testing the presence of gas. This colliery now turns out 500 tons daily. A mile of long wall work is being opened out, and so vast is the area that with the two shafts, double shifts, and four trams per journey the ultimate will be 3000 men employed, and about as many tons of coal sent to bank. The doom of little collieries and small hips except for coastwise purposes is, as I once observed, gone forth. The coal trade has quite regained the tone it had, and even with prices not only firm but advancing, the exports are well maintained. A little over 150,000 tons left the Welsh ports last week. This week there will be a falling off on account of the severe weather. We have had again a series of wrecks on the coast, and Cardiff shipping has suffered a good deal. Several casualties to vessels laden at Cardiff have already been notified.

In iron, large shipments have been made. The total from Newport and Cardiff for last week amounted to 5400, while the total iron we received, principally from Bilbao, came to 28,000 tons.

Business in iron and steel is fairly brisk and hopeful, but there is some degree of dulness in the Forest of Dean, and Parkend and Sewdley furnaces are still "on stop." The cause of this is the development of the hematite produce in the North of England. It was stated in one of the iron newspapers lately that Welsh pig was pushing the North out of the market. I have no doubt that there has been an increased make of Welsh pig to the detriment of the North, especially for tin-plate workers; but still large imports of Middlesbrough pig are taking place. This week Forester, Durnford, and Co., had a consignment of 700 tons. At the same time, large exports of Welsh pig are going out to New York.

A petition is to be presented for winding up the Glanyravon Iron and Tin-plate Company. Tin-plate continues dull, and in several quarters there is a partial stoppage on account of wages differences. Masters have been urgently requested by the "prophets" of this branch of our industry to stop work two or even three days a week, as the Americans have but small stocks, and purchases are simply kept back in the hope of further reducing prices.

Dafen and Old Lodge Works are idle, and several of the mills are quiet at Beaufort, Oldcastle, Cwmburla, Cwmfelin, and Landore.

Patent fuel is selling freely at 10s. 6d. Coke has maintained its advance, and No. 3 Rhondda small, which is much liked for coking purposes, is in good demand. Cyfarthfa coke ovens are in a forward state, and Dowlais has a large range preparing on a similar model to those at Ebbw Vale. Tredegar is also turning out a good coke, and makes for the market. The progress of the docks at Swansea is regarded by Cardiff with considerable interest, and regret is freely expressed that similar energy is not shown at the latter place in providing the much-needed increase of dock accommodation.

I note that my suggestion for a compulsory insurance by colliers is now advocated as regards seamen. The plan propounded is that each seaman should be compelled to contribute 11d. per month out of his pay, this to be supplemented by a similar sum from shipowners, and an insurance policy of £100 for every seaman's widow be secured.

The local papers abound with arguments *pro* and *con.* in respect of the Colliers' Fund. It is evident that the colliers regard it with suspicion, especially when coupled with the proviso that colliery owners will give 20 per cent. towards it if the men will contract themselves out of the Act. I hope that they will not be prompted only to do the right thing by a succession of other disasters. The Penygraig Fund shows that public sympathy is alienated, and now, by their stubbornness in refusing the trifle per month, the men are bringing about unpleasantness between themselves and the masters.

I am glad to see that Abbot's circular to investors endorses my favourable opinion of the present management at Rhymney Works.

The busy nature of the Taff Vale Railway is shown by the fact that on one day 3263 wagons traversed the line, and the mileage run during one week was 49,000 miles.

Bristol and South Wales Railway Wagon Company declare a dividend of 10 per cent. The rolling stock of the company now consists of 9938 wagons and five locomotives.

I must pay a tribute of praise to the excellent fan engine at Harris's Deep Navigation. It is by Schiele, of Manchester, and Harding's counter attached, which is a capital check.

Coal prices are the same as last week. Iron and steel are firm, and no lower step has been taken in tin-plate.

The sinking of new pits by the Tredegar Company continues, under the direction of Mr. Beith, the successful sinker of Treharris.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners o 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.

1st February, 1881.

419. Roving, &c., Frames, G. W. von Nawrocki.—(*R. Schrke, Buldge, and Hildebrandt, Berlin.*)
420. Stereotype, C. Pieper.—(*A. Faber, Magdeburg.*)
421. Machine Belt, H. and W. Sutcliffe, Halifax.
422. Treating Mixed Solutions, W. Weldon.—(*A. R. Pechiney, France.*)
423. Chlorate of Potash, W. Weldon.—(*A. R. Pechiney, France.*)
424. Chlorate of Soda, W. Weldon.—(*A. R. Pechiney, France.*)
425. Chlorate of Soda, W. Weldon.—(*A. R. Pechiney, France.*)
426. Steel, A. J. Boult.—(*J. Conant, Prairie du Chein.*)
427. Horseshoes, R. Ingram, London.
428. Stocking Suspenders, H. M. Knight, Surbiton.
429. Elastic Linings, O. Wolff.—(*T. Remus, Plauen.*)
430. Navigation, T. J. Capel & A. de la Pauze, London.
431. Moulding, W. R. Lake.—(*W. B. Carpenter, Newark.*)
432. Razor, H. H. Lake.—(*J. D. Frary, Bridgeport.*)
433. Lamps, W. H. Bulpitt, Birmingham.
434. Railway Wheels, W. H. Kitson, Leeds.

2nd February, 1881.

435. Millstones, E. Scholes, Ashton-under-Lyne.
436. Ornamental Designs, C. Poirson, London.
437. Decorating Soap Cakes, P. Chapelain, Paris.
438. Heating Apparatus, B. W. Maughan, London.
439. Window Sashes, &c., E. J. Hill, London.
440. Heating, &c., Water, T. Jackson, Edinburgh.
441. Pipes, J. S. Fairfax.—(*W. Painter, Baltimore.*)
442. Fire Extinguisher, J. C. Hudson, Elmcroft.
443. Horse Gear, R. A. Lister & W. Priestley, Dursley.
444. Valves, T. Rigg, Manchester.
445. Pottery, &c., T. Willett, Burslem.
446. Metal Tubes, J. R. Cassols, Glasgow.
447. Cast Iron Pipes, &c., H. Swift, Stalybridge.
448. Lamps, E. A. and J. D. Rippingille, Warwickshire.
449. Valves, R. Schram.—(*E. Schenson, Upsala.*)
450. Sewing Machines, A. Clark.—(*A. J. Hartu, Paris.*)
451. Tube Expander, G. Allix, London.
452. Blacksmiths' Hearths, R. Gubbins, New-cross.

3rd February, 1881.

453. Hurdles, &c., J. Sheldon, Birmingham.
454. Taps, &c., E. J. Collis, Stourbridge, and J. D. Ready, Wolverhampton.
455. Signal Buoys, F. Barr, New York, U.S.
456. Combined Article for Ladies' use, I. Pick, London.
457. Furnaces, B. J. B. Mills.—(*A. L. Holley, Brooklyn.*)
458. Brewing, A. Manbré, London.
459. Sowing, &c., Machine, H. A. Bonneville.—(*L. A. Douteau, Learville, France.*)
460. Preventing Explosion, H. A. Bonneville.—(*J. F. Delaire, Haine St. Pierre, Belgium.*)
461. Skates, H. Dobson, Hull.
462. Spinning, T. Craven and J. Crabtree, Keighley.
463. Fustian Cords, D. Dewhirst and S. Crossley, Hebden Bridge.
464. Filtering Apparatus, E. P. Alexander. — (*P. Casamajor, Brooklyn, and C. H. Senff, New York.*)
465. Washing, A. M. Clark.—(*A. Michel, Paris.*)
466. Indigo, J. H. Johnson.—(*A. Baeyer, Munich.*)

4th February, 1881.

467. Foot-and-mouth Disease, C. W. House, Gosport.
468. Heel-tip, J. Smith, London.
469. Permanent Way, R. Long, Liverpool.
470. Air Compressors, C. T. Owen, Chesterfield.
471. Ice, H. J. Haddan.—(*T. L. Rankin and C. A. Randall, New York, U.S.*)
472. Paper-making, J. Collins, Bowling.
473. Conveying, &c., Apparatus, E. P. Alexander.—(*J. C. White and H. H. Hayden, New York, U.S.*)
474. Galvanic Batteries, J. C. and G. Fuller, Bow.
475. Cleaning, &c., Carpets, P. Jensen.—(*Mayer, Langfelder, and Hammerschlag, Vienna.*)
476. Preventing Collisions, W. L. Wise.—(*Ronfaut and Gaye, Parss.*)
477. Cleansing Beer, T. Dunlevie, Burton-on-Trent.
478. Neckties, W. R. Lake.—(*Fish, Clark, and Flagg, New York, U.S.*)
479. Money Tills, G. E. Absell, London.
480. Shackles, H. Bezer, London.
481. Hauling Clips, W. R. Wills, Edgbaston.
482. Engines, A. M. Clark.—(*A. S. Lyman, New York.*)
483. Wheels, A. M. Clark.—(*A. B. y Fabregas, Manila.*)
484. Grinding Corn, &c., W. R. Lake.—(*J. T., R. K., and F. H. Noye, Buffalo U.S.*)
485. Measuring Liquids, J. Hepplestone, Sheffield.
486. Gassing Yarns, J. M. Cryer, Bolton.
487. Tooth Gearing, W., J. & E. Whittaker, Oldham.
488. Mould Joints, C. J. Allport, London.

5th February, 1881.

489. Nailing Barrel Hoops, W. Morgan-Brown.—(*E. Cole, Brooklyn, U.S.*)
490. Nailing Machines, W. Morgan-Brown.—(*J. H. Foster, Chicago, U.S.*)
491. Securing Scarf Pins, J. Foxlow, Manchester.
492. Lamp, V. Ragosine.—(*C. von Kordig, Russia.*)
493. Condensing Apparatus, J. W. Cade.—(*A. Mention, Paris.*)
494. Coffin-handle, W. G. Appleford, Birmingham.
495. Hatters' Irons, H. A. Bonneville.—(*F. C. Taylor, New York, U.S.*)
496. Valves, A. Beldam, London.
497. Magnetic Machines, H. Wilde, Manchester.
498. Kilns, E. Edmonds.—(*C. Amand, Belgium.*)
499. Fire-arms, H. A. A. Thorn, London.
500. Sewing Machines, W. Gedge.—(*E. Cornely, Paris.*)
501. Music, &c., Leaves, R. H. Padbury, London.
502. Waterproof Garments, J. T. Goudie, Glasgow.
503. Skate, J. P. Becker, jun., Prussia.
504. Treating Maize, &c., J. Boydell, Dublin.
505. Chimneys or Flues, T. Rowan, Ryde.
506. Fixing Rails, F. Glaser.—(*A. Vautherin, France.*)
507. Packing, E. A. Brydges.—(*W. Wolff, Berlin.*)

7th February, 1881.

508. Slabs, &c., of Sugar, M. Bauer.—(*H. Tietz, J. Selwig, and B. Lange, Brunswick.*)
509. Kilns, A. S. Tomkins, F. M. Courage, and F. A. Cracknall, London.
510. Steam Boilers, H. H. Lake.—(*D. Renshaw and H. T. Litchfield, Massachusetts, U.S.*)
511. Glove, &c., Fastener, E. Horsepool, London.
512. Bicycles, &c., J. White, Coventry, and G. Davies, Manchester.
513. Pencil-case, &c., L. Vayan, Nice.
514. Compressed Air Machines, L. Boye, Dresden, and E. Müller, Chrimmitschan.
515. Fastening, T. Morgan.—(*F. Schindler, Alsace.*)
516. Refrigerators, &c., G. Gilbert, London.
517. Letter Locks, E. Allebos, Brussels.
518. Signal Apparatus, H. Botten, London.
519. Alarum Apparatus, P. Everitt, London.
520. Looms, G. Lendrum, T. Beardsell, and S. Mitchell, Thongsbridge.
521. Looms, W. Whiteley and F. O. Tucker, Yorkshire.
522. Looms, J. Hollingworth, Dobcross.
523. Fire-places, I. Westley, Birmingham.
524. Filling, &c., Bottles, F. G. Riley, London.
525. Small-arms, J. F. Swinburn, Birmingham.
526. Securing Railway Rails, J. Linacre, Brecknock.
527. Water-closets, A. Clark, New-cross.
528. Sawing Stone, J. C. Vanlohe.—(*P. Gay, Paris.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

431. Moulding Apparatus, W. R. Lake, Southampton-buildings, London.—A communication from W. B. Carpenter, Newark, U.S.—*1st February*, 1881.
455. Signal Buoys, F. Barr, New York, U.S.—*3rd February*, 1881.
471. Ice, H. J. Haddan, Strand, Westminster.—A communication from L. Rankin and C. A. Randall, New York, U.S.—*4th February*, 1881.

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

693. Brake Apparatus, F. W. Webb, Crewe.—*20th February*, 1878.
850. Pumps and Valves, J. G. Kinghorn and W. J. Coe, Liverpool.—*2nd March*, 1878.
367. Pens, F. W. Holdt, Berlin.—*29th January*, 1878.
410. Working Wood, E. Jackson, Bradford, and J. Jackson, Leeds.—*31st January*, 1878.
486. Printing Machines, E. Hewitt, New York, U.S.—*6th February*, 1878.
533. Printing Surfaces, A. Pumphrey, Birmingham.—*8th February*, 1878.
543. Couplings, J. Douglass, Blaydon-on-Tyne.—*9th February*, 1878.
387. Looped or Terry Fabrics, J. McCabe, Droylsden. *30th January*, 1878.
390. Steam Pumps, W. Morgan-Brown, Southampton-buildings, London.—*30th January*, 1878.
401. Testing the Strength of Metals, &c., D. Adamson, Dukinfield.—*30th January*, 1878.
408. Controlling, &c., Electric Currents, L. de B. y O'Lawlor, Hammersmith.—*31st January*, 1878.
415. Hand-lights, &c., W. J. Barns, Bristol.—*31st January*, 1878.
532. Bricks, &c., J. Hamblet, West Bromwich.—*8th February*, 1878.
481. Photographs, &c., H. R. Newton, Seymour-street, Hyde Park, London.—*5th February*, 1878.
418. Pianos, E. C. Cadot, Paris.—*31st January*, 1878.
515. Corn and Seed Drills, &c., J. J. Smyth, Peasenhall.—*7th February*, 1878.
624. Pistols, W. R. Lake, Southampton-buildings, London.—*14th February*, 1878.
437. Cutting Coal, &c., H. Rigg, Bonnyrigg, and A. Meiklejon, Dalkeith.—*2nd February*, 1878.
467. Portable Forges, H. J. Haddan, Strand, Westminster.—*5th February*, 1878.
673. Propelling Vessels, &c., G. W. von Nawrocki, Koch-strasse, Berlin.—*18th February*, 1878.
689. Conservatories, &c., J. Lewis, Stamford-hill, London.—*19th February*, 1878.
828. Colouring Matters, C. D. Abel, Southampton-buildings, London.—*1st March*, 1878.
2003. Generating Apparatus, H. J. Haddan, Strand, Westminster, *18th May*, 1878.
947. Electric Lighting, H. J. Haddan, Strand, Westminster.—*11th March*, 1879.
3750. Electric Lamps, H. J. Haddan, Strand, Westminster,—*18th September*, 1879.
562. Ball and Bib Taps, J. H. Jefferies, Wolverhampton.—*11th February*, 1878.
588. Lamps, J. Hinks, Birmingham.—*12th February*, 1878.
761. Small-arms, W. M. Scott, Birmingham, and T. Baker, Aston.—*23rd February*, 1878.
953. Electro-magnetic Machines, J. H. Johnson, Lincoln's-inn-fields, London.—*29th March*, 1878.
453. Charging Gas Retorts, J. West, Maidstone.—*4th February*, 1878.
477. Iron Fencing, R. S. Moncaster, Kirk-Ella.—*5th February*, 1878.
551. Syrups, &c., A. Clark, Frith-street, Soho, London.—*9th February*, 1878.
652. Corking Bottles, J. Schultz, Alter Steinweg, Hamburg.—*16th February*, 1878.
491. Transmitting, &c., Apparatus, H. F. Joel, Queen Victoria-street, London.—*6th February*, 1878.
821. Screws, W. R. Lake, Southampton-buildings, London.—*28th February*, 1878.
500. Sulphur, J. Hollway, Jeffrey's-square, London. —*6th February*, 1878.
521. Sowing, &c., Machine, W. Shaw, Edinburgh, and D. Williamson, Wishaw.—*8th February*, 1878.
548. Cutting Machinery, J. D. Brunton and F. H. J Trier, Battersea.—*9th February*, 1878.

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

605. Gas Motor Engines, C. D. Abel, Southampton-buildings, London.—*18th February*, 1874.
472. Gussets, &c., of Boots & Shoes, H. A. Oldershaw, Southampton-buildings, London.—*5th February*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 25th February, 1881.

3381. Omnibuses, &c., G. M. F. Molesworth, Northdown Hall, Bideford.—*20th August*, 1880.
3941. Docking Knife, J. McKenny, Stephen's-green, Dublin.—*29th September*, 1880.
3950. Triturating, &c., Apparatus, H. J. Haddan, Strand, Westminster.—A communication from L. Janssens and E. Bodart.—*29th September*, 1880.
3959. Paper-making Machines, C. Herbert and J. Loch, Edinburgh.—*30th September*, 1880.
3963. Pocket Knives, W. R. Lake, Southampton-buildings, London. — A communication from D. Peres.—*30th September*, 1880.
3970. Breech-loading Fire-arms, J. J. Atkinson, Middle Temple, London.—*30th September*, 1880.
3975. Fermented, &c., Liquors, J. A. Fawcett, Wakefield.—*1st October*, 1880.
3979. Stoves, W. Smith, jun., Barnard Castle.—*1st October*, 1880.
3985. Mowing, &c., Machines, A. C. Bamlett, Thirsk. —*1st October*, 1880.
3993. Treating Flour, &c., H. Simon, Manchester.—Com. from G. Daverio.—*2nd October*, 1880.
3994. Gassing Yarns, &c., W. T. Stubbs and J. Corrigan, Manchester.—*2nd October*, 1880.
3995. Brace Buckles, C. N. Eyland, Walsall.—*2nd October*, 1880.
4011. Filtering Medium, P. A. Maignen, Great Tower-street, London.—*2nd October*, 1880.
4049. Dynamo, &c., Electric Machines, A. W. L. Reddie, Chancery-lane, London.—A communication from A. Biloret and C. Mora.—*5th October*, 1880.
4072. Preserving Compositions, J. P. Geary, Tudor-road, South Hackney, London.—*7th October*, 1880.
4185. Valve Gearing, F. C. Marshall, Tynemouth.—*14th October*, 1880.
4273. Boring Tool, W. Timms, West Hartlepool.—*20th October*, 1880.
4274. Impregnating, &c., Apparatus, C. Kesseler, Berlin.—Com. from W. Raydt.—*20th October*, 1880.
4281. Nails, L. W. Boynton, Southampton-buildings, London.—*20th October*, 1880.
4430. Sewing Machines, S. Keats, Leeds, and A. Keats, London.—*29th October*, 1880.
4468. Furnaces, W. Black, South Shields, and T. Larkin, East Jarrow.—*2nd November*, 1880.
4522. Sulphuric Acid, J. Imray, Southampton-buildings, London.—A communication from F Benker and H. Lasne.—*4th November*, 1880.
4546. Switches, C. W. Hartley, Bradford.—*6th November*, 1880.
4709. Cast Iron Slag Boxes, M. and J. Cornthwaite, Parton.—*16th November*, 1880.
4846. Colouring Matters, O. N. Witt, Mülhausen, Germany.—*22nd November*, 1880.
5302. Reels, W. H. Harfield, Mansion House-buildings, London.—*17th December*, 1880.
5328. Skates, &c., T. B. Drybrough, Edinburgh.—*20th December*, 1880.
5333. Valves and Shafts, C. R. Stevens, Lewisham, Kent.—*20th December*, 1880.
5405. Cutter Holders, F. M. Newton, Eton College, Eton.—*23rd December*, 1880.
5435. Steam Hammers, A. C. Wylie, Cannon-street, London.—*24th December*, 1880.
5446. Ordnance, Sir W. G. Armstrong, Newcastle-upon-Tyne.—*28th December*, 1880.
5511. Velocipedes, J. Starley, Coventry.—*31st December*, 1880.
9. Railway Vehicles, H. H. Lake, Southampton-buildings, London.—A communication from J. W. Chisholm.—*1st January*, 1881.
97. Knitting Machinery, I. Stubley, Leicester.—*8th January*, 1881.
123. Fastening Tubular Handles, F. Ryland, West Bromwich.—*11th January*, 1881.
181. Husking Rice, &c., J. H. C. Martin, Church-hill, Walthamstow.—*14th January*, 1881.
199. Steering Gear, J. K. Kilbourn, Brixton, and G. Fossick, Stockton-on-Tees.—*15th January*, 1881.

Last day for filing opposition, 1st March, 1881.

4003. Revolving Heels, W. Brown, King-street North, London, and W. Peover, Leigh-street, Burton-crescent, London.—*2nd October*, 1880.
4007. Magneto-electric Apparatus, G. Zanni, Holborn Viaduct, London.—*2nd October*, 1880.
4024. Necktie Fastening Device, L. Michaux, Boulevard de Strasbourg, Paris.—*4th October*, 1880.
4033. Discharging Ashes, J. J. and T. L. Galloway, Glasgow.—*5th October*, 1880.
4050. Applying Motive Power, J. Robson, Falmouth-road, Surrey.—*5th October*, 1880.
4059. Travelling Boxes, H. Josselsohn and J. Goodman, Whitechapel, London.—*6th October*, 1880.
4075. Motor Engines, S. Clayton, Bradford.—*7th October*, 1880.
4079. Dyeing, J. Lepine and P. H. Roelants, Brussels. —*7th October*, 1880.
4082. Moulding Planes, C. Pieper, Berlin.—Com. from W. Grossler.—*8th October*, 1880.
4096. Grate Bars, J. Dean, Waterloo Mills, Bradford. —*8th October*, 1880.
4098. Furnaces, G. A. Dick, Cannon-street, London. —*9th October*, 1880.
4116. Transmitting Electrical Currents, W. R.

Lake, Southampton-buildings, London.—A communication from L. Maiche.—*9th October*, 1880.
4126. WATER-CLOSETS, D. T. Bostel, Duke-street, Brighton.—*11th October*, 1880.
4127. PULVERISING MACHINES, W. Michaëlis, Royal Hotel, Blackfriars, London.—*11th October*, 1880.
4131. NAVIGABLE VESSELS, A. Reddie, Chancery-lane, London.—Com. from R. Fryer.—*12th October*, 1880.
4144. SCUTCHING MACHINES, A. J. Boult, High Holborn, London.—Com. from S. S. Fuller.—*12th October*, 1880.
4146. PISTOLS, A. J. Boult, High Holborn, London.—Com. from M. O'Mahoney.—*12th October*, 1880.
4154. PRINTERS' QUOINS, H. J. Haddan, Strand, London.—Com. from J. Young.—*13th October*, 1880.
4170. CARPENTERS' PLANES, W. R. Lake, Southampton-buildings, London. — A communication from P. Brunet and V. Brossier.—*13th October*, 1880.
4218. MEASURING APPARATUS, J. Imray, Southampton-buildings, London. — A communication from J. Canale.—*16th October*, 1880.
4219. PIANOFORTES, H. R. Schreiber, Hart-street, Bloomsbury, London.—*16th October*, 1880.
4224. LOOMS, W. Thompson, Larkfield Rawdon, Leeds.—*16th October*, 1880.
4235. LOOMS, R. Hindle and F. Greenwood, Blackburn.—*18th October*, 1880.
4294. PACKING MEAT, W. R. Lake, Southampton-buildings, London.—A communication from J. A. Whitney.—*21st October*, 1880.
4317. FEED-WATER HEATERS, W. Chance, Calcutta.—*22nd October*, 1880.
4369. HORSESHOES, W. R. Lake, Southampton-buildings, London. — A communication from J. D. Billings.—*26th October*, 1880.
4400. OBTAINING COLOURS on COTTON, &c., T. Holliday, Huddersfield.—*28th October*, 1880.
4401. WHEELS, A. C. Uljée and J. Cleminson, Westminster-chambers, London.—*28th October*, 1880.
4405. UTILISING RESIDUARY PRODUCTS, T. Holliday, Huddersfield.—*28th October*, 1880.
4433. CONVERTING REFUSE, &c., into GAS, B. J. B. Mills, Southampton-buildings, London.—Com. from L. E. E. C. D. T. Anthony.—*30th October*, 1880.
4526. SURFACE-POLISHING MACHINERY, W. Weems, Johnstone, and C. D. Douglas, Glasgow. — *4th November*, 1880.
4768. DECORATION of GLASS, &c., J. Couper, jun., Glasgow.—*19th November*, 1880.
4797. MACHINE EMBROIDERY, C. A. Barlow, Warren-street, Manchester.—A communication from J. Wiget and C. Wetter.—*20th November*, 1880.
4963. PLOUGHS, J. Howard, Bedford.—*29th November*, 1880.
5102. PIPE JOINTS, N. Talard, Boulevard Magenta, Paris—*7th December*, 1880.
5103. EMPTYING CESSPOOLS, N. Talard, Boulevard Magenta, Paris.—*7th December*, 1880.
5111. CATCHING BEETLES, A. Nash, Canterbury.—*8th December*, 1880.
5172. LAMPS, F. Siemens, Southampton-buildings, London.—*10th December*, 1880.
5181. JUTE, W. M. Black and A. Taylor, Dundee.—*11th December*, 1880.
5227. BRAKES, N. Talard, Boulevard Magenta, Paris.—*14th December*, 1880.
5280. PIPES, H. E. Gräpel and J. Candelent, Birmingham.—*16th December*, 1880.
5313. METALLIC ALLOYS, G. A. Dick, Cannon-street, London.—Partly a communication from C. J. A. Dick.—*18th December*, 1880.
5321. SECURING BRISTLES in BRUSHES, E. Wright, Lower Sydenham, Surrey.—*18th December*, 1880.
5458. HEAVY ORDNANCE, B. J. B. Mills, Southampton-buildings, London.—A communication from J. H. McLean and M. Coloney.—*28th December*, 1880.
5459. MACHINE GUNS, B. J. B. Mills, Southampton-buildings, London.—A communication from J. H. McLean and M. Coloney.—*28th December*, 1880.
5499. PUTTIES, &c., I. R. Blumenberg, Chancery-lane, London.—*30th December*, 1880.
5514. TORPEDOES, C. A. McEvoy, Adam-street, Adelphi, London.—*31st December*, 1880.
20. DENTAL ENGINE, P. Shaw, Manchester.—*3rd January*, 1881.
35. BICYCLES, &c., W. Woolley Birmingham.—*4th January*, 1881.
40. STEAM BOILERS, G. Petrie, Rochdale.—*4th January*, 1881.
84. BURNERS, J. N. Douglas, Dulwich, Surrey.—*7th January*, 1881.
92. EMBOSSING APPARATUS, T. J. Palmer, Letterstone-road, Fulham, and C. F. Dietrich, Shrubland-road, Dalston, London.—*8th January*, 1881.
117. BRUSHES, G. W. von Nawrocki, Berlin.—Com. from C. E. Flemming, sen.—*10th January*, 1881.
129. GALVANIC POLARISATION BATTERIES, J. H. Johnson, Lincoln's-inn-fields, London.—A communication from C. Faure.—*11th January*, 1881.
185. FURNACES, G. Love, Malton House, Lanchester.—*14th January*, 1881.
189. TAPS, J. Starley, Coventry.—*14th January*, 1881.
203. STOP VALVES, J. Dewrance and G. H. Wall, Great Dover-street, London.—*15th January*, 1881.
206. FURNACES, E. A. Barry, St. Leonard's-hill, Clewer.—*15th January*, 1881.
213. INSERTING BOBBINS in CARRIAGES, H. Boden and S. Whitehurst, Derby.—*17th January*, 1881.
291. LOOMS for WEAVING, W. Adam, Kidderminster.—*22nd January*, 1881.
301. PRODUCING OIL, J. H. Johnson, Lincoln's-inn-fields, London. — A communication from F. F. Rohart.—*22nd January*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 4th February, 1881.)

3203. GAS BURNERS, T. Fletcher, Warrington.—*5th August*, 1880.
3204. COOKING-STOVES, I. Chorlton, Manchester.—*5th August*, 1880.
3211. SHIRTS, L. Davis, Liverpool.—*5th August*, 1880.
3236. CARTRIDGES, B. T. Moore, Upper Teddington.—London.—*7th August*, 1880.
3238. TUB-CLOSETS, C. Kesseler, Mohren-strasse, Berlin.—*7th August*, 1880.
3249. REGULATORS, J. Bates, Croydon.—*9th August*, 1880.
3251. BRONCHITIS KETTLE, W. H. Lloyd, Harborne.—*9th August*, 1880.
3262. AERATED DRINK, A. S. Orr, Upper Sackville-street, Dublin.—*10th August*, 1880.
3265. SECURING ENDS of SHEET METAL CANS, &c., E. Parry, New Bridge-street, London.—*10th August*, 1880.
3270. TIP VANS, &c., E. Hora, Camberwell-road, Surrey.—*10th August*, 1880.
3302. NAVIGABLE VESSELS, H. W. Cook, Stondon Massey, Essex.—*13th August*, 1880.
3317. STEAM GENERATORS, H. Ashton, Birkenhead.—*16th August*, 1880.
3321. UTILISING FUEL, W. L. Wise, Whitehall-place, London.—*16th August*, 1880.
3352. REFINING ALCOHOL, &c., W. R. Lake, Southampton-buildings, London.—*18th August*, 1880.
3367. SECURING HANDLES of TABLE CUTLERY, S. C. Friston and W. H. Firth, Sheffield.—*19th August*, 1880.
3472. MOWING, &c., MACHINES, E. Manisty and J. W. Gibson, Dundalk.—*27th August*, 1880.
3489. GOVERNORS, J. Kennedy, Liverpool.—*28th August*, 1880.
3492. STOP-VALVES, A. H. Cochrane, Princes-square, Bayswater, London.—*28th August*, 1880.
3511. ORNAMENTING FICTILE WARES, E. Andreoli, Strand, London.—*30th August*, 1880.
3513. OIL CUPS, E. Ludlow, Birmingham.—*30th August*, 1880.
3702. PHOTOGRAPHIC PRINTS, W. Morgan-Brown, Southampton-buildings, London.—*11th September*, 1880.
3895. CARRIAGE AXLES, &c., J. Dakers, Aberdeen.—*25th September*, 1880.
047. WATCH-PROTECTORS, T. Wainwright, Hunslet.—*5th October*, 1880.
4397. PACKING CASES, W. Dawes, Kingston-grove, Leeds, and A. H. Dawes, Staveley.—*28th October*, 1880.
4413. FEEDING BOTTLES, E. O. Day, Waterloo Bridge-road, London.—*28th October*, 1880.
4787. TREATING SLAG PRODUCTS, J. J. Sachs, Manchester.—*19th November*, 1880.
4870. PREVENTING FLOW of WATER, C. J. Galloway and J. H. Beckwith, Manchester.—*24th November*, 1889.
4885. DRIVING SCREW PROPELLERS, C. Maw, Hyde Park-terrace, London.—*24th November*, 1880.
5008. ELECTRO-MAGNETIC INDUCTION MACHINES, H. Wilde, Manchester.—*1st December*, 1880.
5133. GRAPPLING APPARATUS, W. R. Lake, Southampton-buildings, London.—*8th December*, 1880.

(*List of Letters Patent which passed the Great Seal on the 8th February*, 1881.)

3242. BOOTS and SHOES, E. Jefferys, Southampton-buildings, London.—*9th August*, 1880.
3252. SPINNING MACHINERY, J. Clough, Haincliffe.—*9th August*, 1880.
3274. SHEET-METAL PLATES, W. Elmore, Blackfriars-road, London.—*10th August*, 1880.
3275. STAIR-CASE, &c., E. A. Day, Worcester, and P. Price, West Malvern.—*11th August*, 1880.
3278. TRAVELLING TRUNKS, L. A. Groth, Finsbury-pavement, London.—*11th August*, 1880.
3283. VACUUM VALVES, W. Collier, Salford.—*11th August*, 1880.
3287. BLOW-OFF APPARATUS, S. Watkins, High-street, Wolverhampton.—*12th August*, 1880.
3295. ANNEALING POTS, S. Williams, Llandaff, Cardiff.—*13th August*, 1880.
3297. BRICKS, &c., W. H. Turner and W. R. Renshaw, Tunstall.—*13th August*, 1880.
3301. STOPPERS, B. Beddow, Battersea Park-road, London.—*13th August*, 1880.
3310. INSULATING TELEGRAPH CONDUCTORS, E. T. Truman, Old Burlington-street, London.—*14th August*, 1880.
3328. CENTRIFUGAL EXTRACTING, &c., MACHINES, F. Wolff, Copenhagen.—*17th August*, 1880.
3378. PROPELLING VESSELS, W. Clark, Chancery-lane, London.—*19th August*, 1880.
3386. WINDING YARN, J. Boyd and T. A. Boyd, Shettleston.—*20th August*, 1880.
3394. INOXIDISABLE ALLOY, P. de Villiers, Silver-hill, St. Leonards-on-Sea.—*20th August*, 1880.
3400. SOLES for BOOTS, H. B. Fox, Oxton.—*21st August*, 1880.
3411. LOCOMOTIVES, H. P. Holt, Park-row, Leeds, and F. W. Crossley, Manchester.—*23rd August*, 1880.
3438. SECURING TELEGRAPH WIRES, A. E. Gilbert, Edinburgh.—*25th August*, 1880.
3443. BRAKES, J. C. Mewburn, Fleet-street, London.—*25th August*, 1880.
3444. STEAM BOILERS, F. C. Glaser, Berlin.—*25th August*, 1880.
3448. FIRE ENGINES, H. Merryweather, Greenwich, and F. Cotton, Adelphi, London.—*25th August*, 1880.
3567. JOINTS of PIPES, H. Doulton, High-street, Lambeth, London.—*2nd September*, 1880.
3576. FURNACES, G. Love, jun., Malton House, Lanchester.—*3rd September*, 1880.
3652. VERTICAL STEAM ENGINES, R. Wilson, Patricroft.—*8th September*, 1880.
3812. COOLING BLAST FURNACE SLAG, J. A. Birkbeck, Middlesbrough.—*20th September*, 1880.
3964. MAGNETO-ELECTRIC MACHINES, P. Jensen, Chancery-lane, London.—*30th September*, 1880.
4046. FIRE-ARMS, B. Burton, Brooklyn, U.S.—*5th October*, 1880.
4064. MAINTAINING HIGH DEGREES of HEAT, J. T. Dann, Canterbury-road, Brixton.—*6th October*, 1880.
4162. DYEING YARN, &c., J. Chadwick and J. H. Mather, Chadderton.—*13th October*, 1880.
4262. BRUSHES, G. Jobson, Derby.—*19th October*, 1880.
4391. MEASURING ELECTRICAL CURRENTS, P. Jensen, Chancery-lane, London.—*27th October*, 1880.
4422. BAG-MAKING MACHINERY, H. Rankin, Harman-street, Kingsland-road, London.—*29th October*, 1880.
4603. TREATING ANIMAL, &c., SUBSTANCES, J. H. Johnson, Lincoln's-inn-fields, London.—*9th November*, 1880.
4634. FIREPLACES, J. Jobson, Derby.—*11th November*, 1880.
4809. PERMANENT WAY, P. Burrell and H. Valpy, Victoria-street, Westminster.—*20th November*, 1880.
4911. TRAMWAYS, A. H. Rowan, Westminster-chambers, London.—*25th November*, 1880.
4949. PHOTOGRAPHS, J. Dredge, Clapham Common, London.—*27th November*, 1880.
4989. WARMING RAILWAY CARRIAGES, C. D. Abel, Southampton-buildings, London.—*30th November*, 1880.
5004. MEASURING, &c., ELECTRIC CURRENTS, J. Swan, Newcastle-upon-Tyne.—*1st December*, 1880.
5007. COMPASSES, J. Readman, Norton.—*1st December*, 1880.
5014. ELECTRIC LAMPS, J. W. Swan, Newcastle-upon-Tyne.—*2nd December*, 1880.
5015. LAMPS, A. Thurlow, Atherstone.—*2nd December*, 1880.
5049. TRIMMING the HEELS of BOOTS and SHOES, W. H. Dorman, Stafford.—*3rd December*, 1880.
5129. WORKING BRAKES, C. D. Abel, Southampton-buildings, London.—*8th December*, 1880.

List of Specifications published during the week ending February 5th, 1881.

2284, 4d.; 2455, 4d.; 2550, 2d.; 2551, 6d.; 2557, 2d.; 2561, 6d.; 2564, 2d.; 2566, 2d.; 2579, 6d.; 2580, 2d.; 2588, 6d.; 2598, 6d.; 2599, 4d.; 2624, 8d.; 2625, 6d.; 2643, 8d.; 2647, 6d.; 2668, 8d.; 2693, 10d.; 2705, 6d.; 2715, 2d.; 2722, 2d.; 2724, 2d.; 2725, 6d.; 2727, 2d.; 2732, 6d.; 2736, 4d.; 2737, 2d.; 2738, 2d.; 2739, 2d.; 2740, 2d.; 2741, 2d.; 2743, 1s. 2d.; 2744, 2d.; 2747, 6d.; 2748, 2d.; 2752, 6d.; 2753, 4d.; 2754, 2d.; 2757, 2d.; 2758, 2d.; 2759, 2d.; 2762, 2d.; 2763, 6d.; 2769, 2d.; 2770, 2d.; 2772, 2d.; 2777, 8d.; 2779, 2d.; 2783, 4d.; 2784, 4d.; 2786, 6d.; 2788, 2d.; 2789, 2d.; 2790, 6d.; 2791, 2d.; 2792, 2d.; 2794, 2d.; 2796, 2d.; 2798, 2d.; 2799, 6d.; 2800, 6d.; 2801, 1s.; 2802, 2d.; 2804 6d.; 2805, 2d.; 2806, 2d.; 2808, 4d.; 2809, 4d.; 2810, 2d.; 2811, 2d.; 2812, 2d.; 2813, 2d.; 2814, 6d.; 2825, 4d.; 2826, 2d.; 2827, 2d.; 2828, 2d.; 2830, 6d.; 2831, 4d.; 2832, 4d.; 2834, 2d.; 2835, 4d.; 2836, 2d.; 2837, 2d.; 2839, 2d.; 3021, 6d.; 3294, 8d.; 4476, 6d.; 4566, 6d.; 4619, 4d.

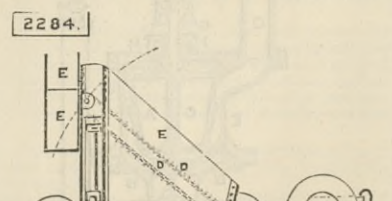
*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane,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

ABSTRACTS OF SPECIFICATIONS.

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

2284. EXCAVATOR FOR CUTTING TRENCHES, *J. F. Sang.*—*Dated 5th June*, 1880. 4*d.*

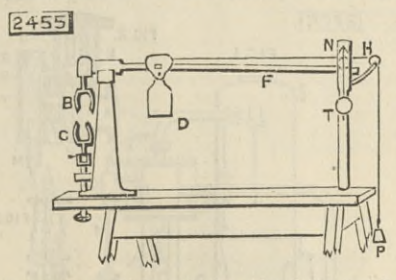
This consists of a grinding wheel A with cutting discs attached to it, and ploughs C arranged in a frame



in combination with the elevator D, so that the earth cut by the discs can be conveyed to any height and delivered to the right or left by the trough E, so as to form an embankment.

2455. TESTING CEMENTS, &c., *P. Adie.*—*Dated 17th June*, 1880. 4*d.*

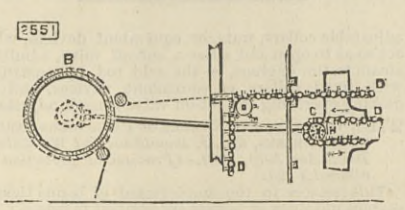
The briquette to be tested is placed in the clips B and C, the rolling or testing weight D being moved along the beam F by the pulling of the weight P, passing over and attached to a pulley between the forks of the crutch, which also keeps the end of the



beam F in its position. To the side of the crutch is attached an escapement wheel H, with or without a train of wheels to alter speed; at N is mounted a pair of pallets working into H and having a pendulum T attached. When the pendulum is started, P pulls D along the beam, the rate being regulated by the pendulum.

2551. TENTERING AND FINISHING FELT CARPETS, &c., *W. Mitchell and M. C. Cuttle.*—*Dated 23rd June*, 1880. 6*d.*

So as to stretch any number of pieces to one uniform length the ordinary tension bars are dispensed with, and the fabric is caused to pass over a roller B covered with card teeth, and driven at a slower speed than the chains D carrying the tenter pins. The expanding



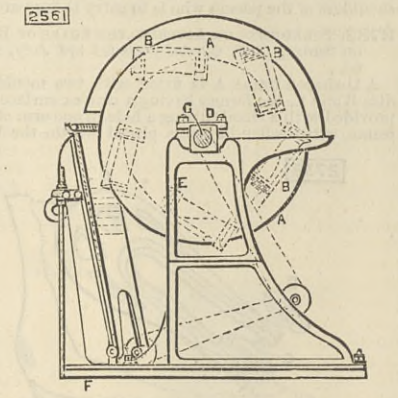
rollers over which the fabric passes at each end of the machine are in the form of skeleton cages, consisting of end discs, a central block G, and a series of rods H, which are supported in the end discs and in countersunk grooves in the block G.

2557. BALL CASTORS, *C. E. Maudsley.*—*Dated 23rd June*, 1880.—(*A communication from L. A. Aspinwall.*)—(*Not proceeded with.*) 2*d.*

This consists in applying the principle of the so-called universal joint to ball castors.

2561. SCUTCHING FLAX, &c., *J. R. Dry.*—*Dated 23rd June*, 1880. 6*d.*

The apparatus consists of a revolving cone drum A with preferably five straight blades B, the faces of the blades being arranged at an angle with the axis and



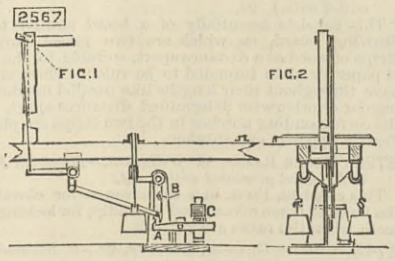
equidistant around the circumference of the drum. The cone drum is securely keyed to the central shaft C, which is carried by the bearings D formed in the strong frames E, the latter being securely attached to the bed-plate F.

2564. GALVANIC BATTERIES, *R. C. Anderson.*—*Dated 23rd June*, 1880.—(*Not proceeded with.*) 2*d.*

The usual elements are employed, such as zinc and copper, the former of which may be acted upon by any of the usual agents generally employed, but for the latter or negative element is employed oxalate of copper dissolved in muriatic acid more or less diluted according to the strength required.

2567. AUTOMATIC RAILWAY SIGNALS, *G. L. V. Loyd.*—*Dated 23rd June*, 1880. 6*d.*

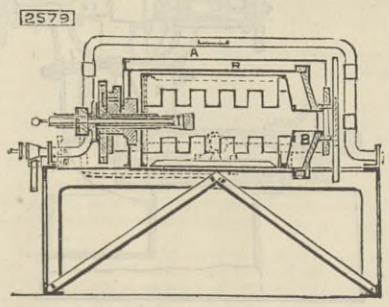
This is another combination of apparatus for use in block working. The inventor has a longitudinal slit in the rail at the commencement of each section, in



which a movable blade acts, *v*, Fig. 1. The train actuating the blade causes the signal to be raised, and the mechanism is held in position by the catch at end of arm A holding B. When the section is clear an electric current sent through the electro-magnet C causes it to unlock the arm A and the signal falls.

2579. ROASTING COFFEE, &c., *F. G. Fleury and E. D. Barker.*—*Dated 24th June*, 1880. 6*d.*

A is a steam-tight roasting cylinder, capable of withstanding a considerable pressure. Before commencing



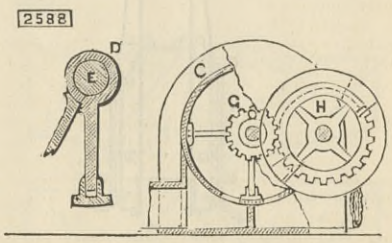
to roast, this cylinder is charged with a considerable volume of compressed air or other gas, and the roasting is carried on under this superinduced pressure. B is a copper lining coned at one end to constitute a funnel connection with the hollow journal of the cylinder by which the coffee is admitted to and discharged from the cylinder. The lining B is provided with blades which extend the whole length of the linings, and serve as the cylinder rotates to turn over the coffee, and expose it all equally to the heat applied to the cylinder.

2580. WASHING, &c., LINEN, *W. L. Wise.*—*Dated 24th June*, 1880.—(*A communication from M. K. Muchin.*)—(*Void.*) 2*d.*

This relates to the combination of an Archimedian or water screw with centrifugal apparatus, in such manner as to enable washing, &c., to be effected with considerable economy of liquid.

2588. EXHAUSTING, LIFTING, FORCING, OR MEASURING FLUIDS, *H. S. Stewart.*—*Dated 25th June*, 1880. 6*d.*

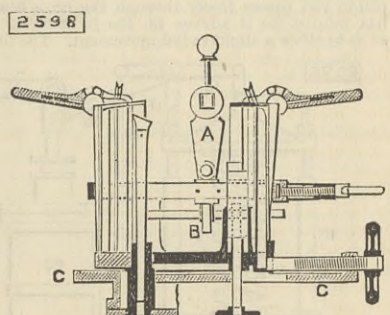
Inside the shell C are two vanes, one secured to the spindle E, and the other forming part of a hollow spindle D revolving round E. Each spindle is fitted with a pinion G, and with them gears a wheel H of



sufficient width to engage with both pinions, the teeth to gear with one pinion being continued round one-half of its periphery only, and those to gear with the other pinion round the other half, whereby the pinions are driven alternately.

2598. LASTING BOOTS AND SHOES, *A. Balme and W. Hall.*—*Dated 25th June*, 1880. 6*d.*

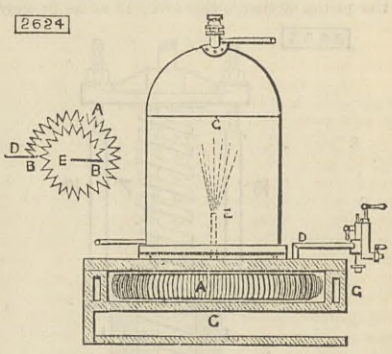
The upper is placed upon the last by ordinary means, and in order to complete the lasting of the boot or shoe it is necessary that the upper should be stretched



or drawn over the last. For this purpose any required number of side arms A are provided; these are mounted and hinged in suitable bearings B on the table C, or are carried on vertical springs attached to projections and provided with adjustable nippers.

2624. PRODUCING ELASTIC FORCE FOR MOTIVE POWER, &c., *J. Graddon.*—*Dated 28th June*, 1880. 8*d.*

A furnace C is provided with a scroll form of coil of pipes A, with its cavity or centre B close against the side of furnace, and into which heat passes so as to



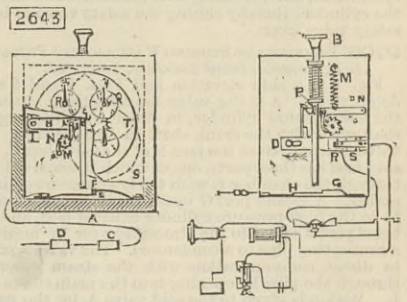
heat the coil. Liquid is forced into the coil at D, and issues at E in the form of steam or gas. E may be either connected with a receiver G communicating with the cylinder of an engine, or directly with such cylinder.

2625. SPIRIT BOTTLE FRAMES, &c., *W. and J. W. Bartram.*—*Dated 28th June*, 1880. 6*d.*

This consists in the employment of a locking bar or bars capable of being raised and lowered to guard the bottles at or near their bottoms.

2643. IMPROVEMENTS IN REGISTERING APPARATUS FOR USE IN TELEPHONE SYSTEMS OR EXCHANGES, *J. H. Johnson.*—*Dated 28th June*, 1880.—(*A communication from C. J. Bell and S. Tainter.*) 8*d.*

This is an invention for registering the number of times the telephones of a system or exchange have been used; if, however, the central office be called and no answer received the apparatus does not register the telephone as used. With the call arrangement and registering apparatus a switch is combined, so that the first operation of the call arrangement to send a



signal causes the operation of the registering device, but any subsequent operation of the call arrangement till the answer is made to repeat the signal fails to further affect the apparatus. A subscriber cannot call the central office except by means of the proper push knob. In first figure A shows registering device, B the push knob, C the call bell, and D the transmitter. The registering apparatus consists of dials showing units, tens, hundreds, &c. In the second figure A is the portion of the call register more particularly concerned in this invention, E being a secrecy switch insuring privacy of communication. There are thirteen claims to new combinations.

2647. BATS FOR PLAYING TENNIS, &c., *W. and D. A. Quiggin and R. A. Sloan.*—*Dated 29th June*, 1880. 6*d.*

The frame or rim of metal is so combined with

movable parts that the area for netting within the frame may be increased or decreased at pleasure, and at the same time that the area is being increased or decreased the netting is being tightened or slackened.

2668. Increasing the Draught in Chimneys and Shafts, *A. M. Clark.—Dated 29th June*, 1880.—(*A communication from G. E. Wery.*) 8*d*.

F is the smoke pipe ; D annular jacket surrounding F and divided by a partition G into two chambers, each communicating at its bottom end with a pipe E, which is open to the outer air at such a distance from

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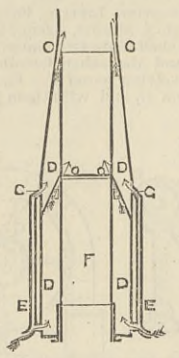

the chimney as to insure its being cool ; O are annular orifices through which the air, heated and rarefied in the annular casings D, escapes into the chimney at such a velocity as to carry with it the smoke and gases therein.

2693. Safety Valve for Steam Boilers, *J. D. Churchill.—Dated 1st July*, 1880. 10*d*.

The cylinder 1 communicates with the boiler and contains a piston provided with packing rings and loaded by spring 7 interposed between it and a cross head adjustable by nuts turning on bolts 10. The piston rod passes freely through the cross head and has jointed to it a lever 13, the joint being made so as to allow a slight radial movement. The fulcrum

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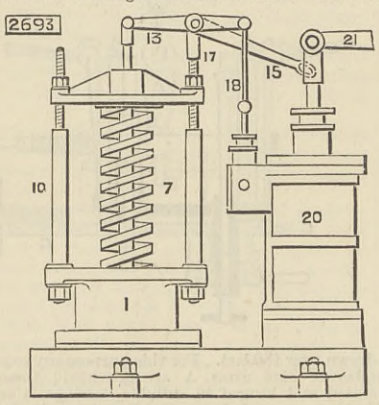

of lever 13 is fixed in an arm 15 in a position excentric to its own fulcrum, which is supported in a piece 17 fixed on one of the rods or bolts 10. One arm of lever 13 is connected by a rod 18 to a D-slide in the steam chest of the cylinder 20, in which the top port communicates with the bottom of the interior of the cylinder, the next with the exhaust, and the lowest with the top of the cylinder. When the pressure in the boiler rises the piston actuates the lever 13 so as to move the

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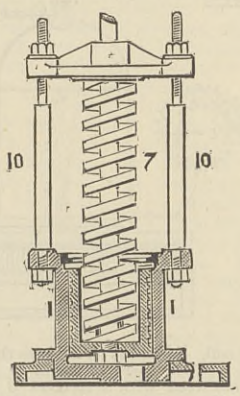

slide and close communication between the port leading to the bottom of the cylinder and the exhaust, and also shut off steam from the top port, thus reducing the pressure on the top of the piston in cylinder 20, and thereby allow the safety valve to be opened, while, should it not open, the continued downward movement of the slide will admit steam to the bottom of the cylinder 20 below the piston, thereby bringing it into operation to assist the opening of the safety valve. As the piston in cylinder 20 rises it raises the lever 13, thereby returning the slide sufficiently to close the top and bottom ports to both steam and exhaust, thus retaining the piston in the position it has assumed in cylinder 20. When the pressure is sufficiently lowered the piston returns to its normal position in cylinder 1, and in so doing operates the slide so as to open the top port to the exhaust and the bottom port to the steam, thus admitting steam above the piston in cylinder 20, and returning that piston to the bottom of the cylinder, thereby closing the safety valve 21 is the safety valve lever.

2705. Pumping and Storing Water under Pressure, *A. B. Brown.—Dated 2nd July*, 1880. 6*d*.

Fig. 1 is a side elevation and Figs. 2 and 3 show detail views. A is the valve for admitting steam to the low-pressure cylinder, in order that the engines shall start with the crank shaft in any position. The valve A acts against the face B of the valve-box C. The said face has three ports, one of which D communicates through the chamber E with the low-pressure cylinder casing. A second port G opens through the chamber H to the high-pressure cylinder exhaust port, and the third port J opens to the atmosphere (or by means of a connecting pipe to a condenser). The valve-box C is in direct communication with the steam generator through the pipe K, opening into the main steam pipe L. Motion is given to the said valve A by the rod M attached to a valve in the box N of the delivery pipe. In the position shown the engines are at rest, and steam from the generator passes freely through the port D to the casing of the low-pressure cylinder, and the exhaust port of the high-pressure cylinder ; the high-pressure cylinder exhaust port I is open to the atmosphere through the ports G and J past the valve A. A Second part of the invention consists in giving motion to the valve which controls the admission of water to the condenser of jet condensing accumulator pumping engines, by connecting rod, lever, or like appliance, receiving motion from the gearing which actuates the starting valve under the first part, or separate gear may be used for that purpose. A Third part consists in actuating the starting and stopping gear of steam accumulator pumping engines by adjustable mechanism, receiving motion from the accumulator ram, for the purpose of allowing work to be done by the said cam without starting the engines. In carrying the Third part into practice under one modification, in which the pressure on the accumulator ram is obtained by steam acting on a piston, a rod is attached to the atmospheric side of the said piston, and this rod is provided with

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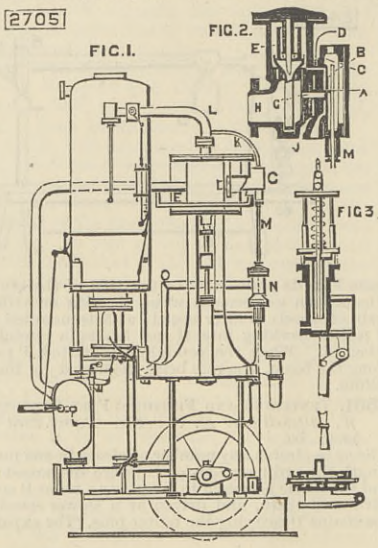

adjustable collars, nuts, or equivalent devices, which act so as to open and close a cut-off valve, admitting steam to the engines, or the said rod is constructed with fixed collars or equivalent devices, and the gearing operating the cut-off valve is made adjustable.

2715. Checking the Number of Passengers Carried by Omnibuses, &c., *J. Donaldson and W. Miller.—Dated 2nd July*, 1880.—(*Provisional protection not allowed.*) 2*d*.

This relates to the employment of bonus tickets ; certain numbers of tickets are entitled to prizes.

2725. Copying Apparatus, *D. Gestetner.—Dated 3rd July*, 1880. 6*d*.

This consists in forming apparatus to be employed in producing copies of writings, drawings, and other delineations of a frame, one side of which is provided with a wire surface to be employed in the production of paper stencils, the other side being used for straining and printing bed, whilst a space in the centre of the frame is used to receive the ink plate when the letter is not required for use.

2727. Exhibiting Advertisements, &c., *H. A. Dufrené.—Dated 3rd July*, 1880.—(*A communication from F. Griot.*)—(*Not proceeded with.*) 2*d*.

This consists of a box, case, or lantern, with opaque or transparent sides, which serve to receive advertisements, &c. ; this case or lantern is supported on the shoulders of the person who is to carry the apparatus.

2732. Stretching or Altering the Shape of Boots or Shoes, *C. F. Gardner.—Dated 3rd July*, 1880. 6*d*.

A U-shaped frame A is fitted with two moulds or dies B and C, the former having a convex surface and provided with a shank fitting a hole in one arm of the frame, which when in use is placed within the boot.

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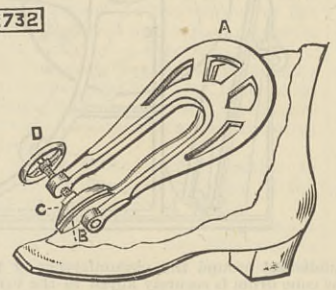

The other mould C is bowl-shaped or convex, and its shank receives a screw-threaded rod passing through the other arm of the frame, and fitted with a hand wheel D. The part of the boot to be stretched is placed between the dies and the wheel D turned so as to force the two dies together.

2736. Alcohol, &c., *J. H. Johnson.—Dated 3rd July*, 1880.—(*A communication from E. Porion and L. Mehay.*) 4*d*.

This consists essentially in the use of means for obtaining in the treatment of grain by saccharification with acids, liquid, pasty, or solid residues adapted for feeding cattle, and as highly concentrated as possible, with a view to increasing their nutritious qualities.

2737. Ruling Parallel Lines on Paper or Slates, *D. Hammond.—Dated 3rd July*, 1880.—(*Not proceeded with.*) 2*d*.

This consists essentially of a board similar to a drawing board, on which are two raised parallel strips of wood at a distance apart, suitable to the size of paper or slate intended to be ruled. These strips have throughout their lengths like parallel notches at regular or otherwise determined distances apart, and the corresponding notches in the two strips are placed exactly opposite one another.

2739. Horse Rakes, *S. Wilkerson.—Dated 5th July*, 1880.—(*Not proceeded with.*) 2*d*.

This consists, First, in a contrivance for elevating the teeth of horse rakes ; and Secondly, for locking the teeth when the rakes are at work.

2743. Cutting Glasses, Goblets, &c., *E. Edmonds.—Dated 5th July*, 1880.—(*A communication from the firm of Volpp, Schwarz and Co.*) 1*s*. 2*d*.

The machine cuts the facets by means of a grindstone, and the glass is placed on a plug of flexible material attached to a cone 1, and is pressed against a flexible back centre 2. The whole pivots on two centres

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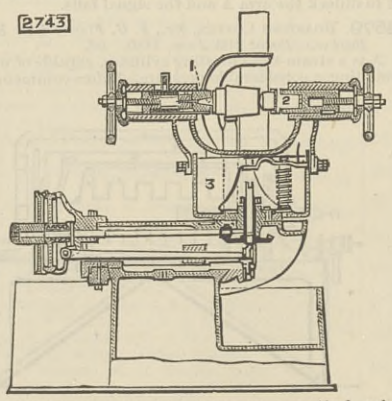

carried by a box 3, which turns on a vertical axis so as to permit of the presentation of the glass to the grindstone at a suitable angle. So as to regulate the depth of cut and guard against the diminution of the diameter of the grindstone, the box 3 is carried on a carriage sliding on the frame. The glass when fixe in position is automatically advanced to the grindstone and guided so as to produce the required cut, and is then withdrawn and moved into the position to receive the next cut.

2744. Addressing Envelopes, &c., *E. de Zuccato.—Dated 5th July*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to writing by making minute perforations in prepared paper, which thus forms a stencil plate.

2747. Moistening and Disintegrating Oil and Other Seeds, *H. Holt.—Dated 5th July*, 1880. 6*d*.

A flat circular casing A is corrugated its full width, and through it passes a central shaft carrying a number of radiating arms D arranged so that the beaters at the ends form sections of a coarse-threaded

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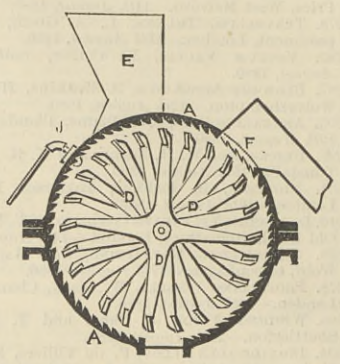

screw. The seed, previously crushed, is fed in through hopper E near the top and at one side, and is disintegrated by the beaters revolving through it and carrying it across the casing to the other end where it is delivered at F. To thoroughly permeate the oil or other seed with moisture, steam or other moisture is admitted through a nozzle J.

2748. Fusible Plugs for Steam Boilers, &c., *H. J. Harman.—Dated 5th July*, 1880.—(*Not proceeded with.*) 2*d*.

The casing of the plug is made in two parts, viz., an upper part and a lower part, which are arranged and combined together in the following manner :—The lower part of the casing is made of gun-metal or other suitable material, in the form of a hollow vertical cylinder or of any other suitable shape, the said lower part having an external or male screw at the lower end and an internal or female screw at the upper end.

2752. Press for the Extraction of Juice from Meat, &c., *H. A. Bonneville.—Dated 6th July*, 1880.—(*A communication from C. Drevelle.*) 6*d*.

The first figure shows the manner of operating the press, the construction of which is shown in the second figure. It consists of a receiver B, in which the meat is placed, and in which fits a piston C,

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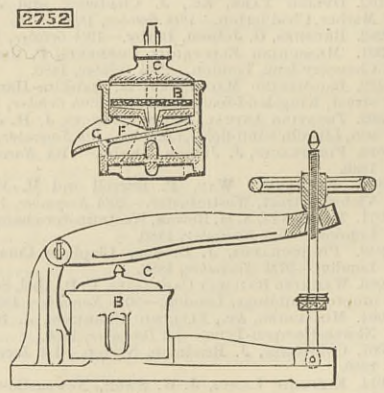

operated by a lever so as to exert pressure on the meat, and thereby extract the juice. This juice passes through a filtering tissue, and then through a perforated plate to the draining plate P, and passes out down the incline G.

2753. Combined Cape and Hood, *W. Hyman.—Dated 6th July*, 1880. 4*d*.

This consists in the combination and use with a fur or sealskin cape or tippet of a central backing of silk or satin of any desired colour, made in the form of a hood and surrounded with a border of fur or sealskin, braided or otherwise ornamented.

2754. Railway Signals, *S. J. V. Day.—Dated 6th July*, 1880.—(*A communication from J. S. Williams.*)—(*Not proceeded with.*) 2*d*.

This relates partly to the operation and governing of the working of signals, switches, and other moving parts of railways, through the medium of the ignition of explosive materials by electricity.

2757. Obtaining Colours on Cotton, &c., *T. and R. Holliday.—Dated 6th July*, 1880. 2*d*.

This consists in impregnating cotton or other textile fibre with naphthol, and a diazo-compound separately or simultaneously, taking care that the naphthol is present with the diazo-compound and the fibre, when an alkali operates to develope the colour.

2759. Envelopes, *M. Emanuel.—Dated 6th July*, 1880.—(*Not proceeded with.*) 2*d*.

The envelope is formed with a line of holes or perforations extending across it in an inclined direction, that is to say, at an angle with the bottom or top edge of the envelope. The holes or perforations are pierced right through the envelope. At that corner of the envelope which forms the right angle of the triangle of which the line of holes is the hypothenuse, a sufficient portion of the front and back are united by gumming or otherwise to give a hold to the thumb and finger. The letter or enclosure, the corner of which will generally require to be folded, is thus kept from reaching the corner of the envelope.

2763. Centrifugo-helical Pump, *P. F. Aerts.—Dated 6th July*, 1880. 6*d*.

A is a turbine, consisting of a cup-shaped casting with a central hollow stem, which receives a spindle C

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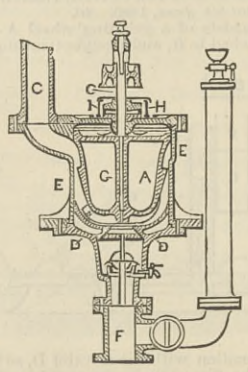

screwed into the bottom of the casting. Outside the cup are wings or blades D in the form of a quintuple or sextuple screw thread, so as to give a combined centrifugal and helical action, the first serving to draw in the liquid, and the second to drive it out. This turbine is placed in a case E, provided with a suction pipe F, and a discharge pipe G. The spindle projects through the case E, and is fitted with a plate H resting and rotating upon a series of conical rollers I, which run upon a second plate secured to the pump case.

2769. Eyelets, &c., *W. Bodill.—Dated 6th July*, 1880. 2*d*.

This consists in the manufacture of eyelets or circlets and rings or washers to be employed therewith, and also of ship and sail thimbles and hollow rings from sheets of Bessemer steel or Bessemer metal.

2770. Increasing Speed while Swimming, *V. D. de Stains.—Dated 6th July*, 1880.—(*Not proceeded with.* 2*d*.

This apparatus is composed of a sandal and two flaps or fins joined together in the form of a thin flat hinge, and connected with the sandal below by means of four flat props or bars, two of which, fastened to one end of the pin or central part of the hinge, are firmly fixed to the sandal, one on each side, and near to the forward or toe end of the same ; and the two remaining flat props or bars, fastened in the same manner to the other end of the said pin or central part of the hinge, are firmly fixed to the sandal, one on each side, and near to the backward or heel end of the same.

2772. Preventing the Shifting of Cargoes, *W. Lowrie.—Dated 6th July*, 1880.—(*Not proceeded with.*) 2*d*.

A grain feeding trunk is formed the whole length of the cargo space. A partition is carried on each side of the centre line in the 'tween decks fore and aft, to form central feeding trunks, running the whole length of the cargo space. These partitions are inclined inwards, and are provided with iron sliding doors for discharging the side wings of the 'tween decks.

2777. Application of Silicate Cotton or Slag Wool for Buildings, &c., *D. H. Dale.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d*.

Pipes which run along walls are protected by forming a cover of canvas of the required width for enclosing the pipe, so as to leave an intermediate space to be filled with silicate cotton, and a thin lath is glued along each edge of the canvas ; the laths have nail holes for fastening to the wall.

2779. Separating Iron from Animal Charcoal, *D. MacEachran.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d*.

The apparatus is so arranged as to permit the charcoal or sugar or saccharine syrup to be passed slowly across a magnet or a series of magnets.

2783. Measuring and Registering the Shape of the Foot, *J. Fisher.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d*.

A case or box is made resembling the shape of the foot but considerably larger. The box receives a series of tubular sockets which are fitted into corresponding holes drilled through its thickness, and at distances apart greater or less, according to the greater or less variation in shape of the part of the foot opposite to which they are applied, or the greater or less accuracy with which it is intended that the shape of the foot shall be reproduced.

2784. Artificial Alizarin, *A. Domeier and J. Marzell.—Dated 7th July*, 1880. 4*d*.

This consists partly in the treatment of the alizarin melt with sulphurous acid, the separation of the precipitated alizarin and the treatment of the alkaline sulphite liquors with caustic lime, baryta, or strontia, in order to obtain or recover caustic alkali and sulphite of lime, baryta, or strontia.

2786. Cranks for Velocipedes, *J. Turner.—Dated 7th July*, 1880. 6*d*.

In order to provide means for attaching cranks to their axles, and of insuring the tightening up of the same should they become loose, the conical end A of the axle to which the crank arm B is fitted is formed

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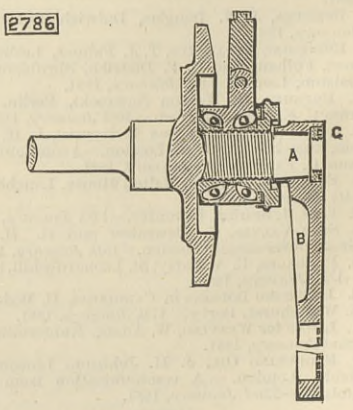

with a longitudinal groove to receive a key, which projects beyond the inner periphery of the socket of the crank arm. The extreme end of A receives a circular nut C with holes on its outer face to screw it home by means of a spanner. The outer face of the crank arm is bored to receive the nut. When the nut C is tightened the socket of the crank is forced tightly on to the conical end A, and is prevented from turning by the key which enters the groove in the end A.

2788. Generating Steam, *R. Stevenson.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d*.

Air or gas is compressed by means of an engine or other machine and forced into a boiler containing water or any watery fluid, so that the whole of the air or gas is made to come into direct contact with the water in the boiler, and in its passage upwards through the water greatly assist the ebullition and the generation of steam.

2789. Looms, *J. Holding.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d*.

This relates partly to a means of rendering the crank arm self-adjusting.

2790. Disinfecting Mohair, &c., *J. Scharr.—Dated 7th July*, 1880. 6*d*.

The fibre to be disinfected is placed in the vessel A, into which projects a taper pipe B perforated, except

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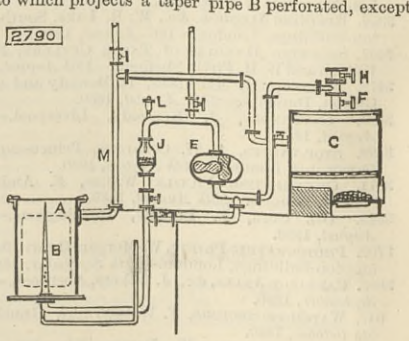


for a few inches, at top and also at the bottom. A hole is made in the bottom of the bale of fibre and lowered on to the pipe B. The vessel is covered by a lid, and a rotary blower E is put in motion, blowing either fresh

air or air saturated with disinfecting spirit, steam, or a disinfecting gas. To blow air saturated with disinfecting spirit through the bale, the valve F, communicating with the combustion chamber G (in which a disinfecting gas can be prepared), is closed and valve H opened. Fresh air then passes through the blower and becomes saturated with spirit when passing through pipe J, partly filled with pumice stone and supplied with spirit from bottle L. When a gas is used it can either pass out through pipe M to a chimney stack, or back to the combustion chamber G, where it is renovated.

2791. HORSESHOES, *W. Spence.—Dated 7th July*, 1880. —*(A communication from H. Lüdicke.)—(Not proceeded with.)* 2*d.*

The shoe is made of vulcanised india-rubber, in which is inserted the iron or steel to which the calkins are secured.

2792. COMBS, *H. Bawcombe.—Dated 7th July*, 1880.—*(Not proceeded with.)* 2*d.*

This consists in making the comb so as to be composed of separate teeth, connected together at the tang or back part by suitable means, admitting of their being removed from the combs as required.

2794. HORSE-RAKES, *A. W. Tooley.—Dated 7th July*, 1880.—*(Not proceeded with.)* 2*d.*

The brake is caused to act indirectly on the wheel, and for this purpose a twisting motion is imparted to the brake or to that part which presses on the rim of the wheels.

2796. PISTONS, &c., *J. Watts.—Dated 7th July*, 1880. —*(Not proceeded with.)* 2*d.*

The piston is formed of two short cylinders, which are of less diameter than the interior of the cylinder in which the piston is to work, and which are capable of sliding telescopically one over the other. Each short cylinder at one end has a flange projecting outwards from it, which fits loosely against the interior of the cylinder. A number of vulcanised india-rubber rings are placed round the exterior of the inner short piston.

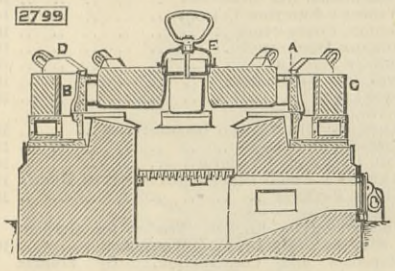
2798. BICYCLES, *J. Goodman.—Dated 7th July*, 1880.—*(Not proceeded with.)* 2*d.*

To the lower ends of the fork, which usually terminate with the hubs, elongations are added below the radius of the cranks and so as to clear the same. These elongations are then bent outwards to a sufficient distance to clear the cranks and pedals or stirrups. They are then turned upwards and terminate in suitable handles, one on each side of the rider.

2799. "JUMPING" THE TIRES OF LOCOMOTIVES AND RAILROAD CARS, *W. Brierley.—Dated 7th July*, 1880. —*(A communication from L. Mohn.)* 6*d.*

The tire A is introduced to the fire either cold or, preferably, after some heating, and the frames B, which transfer the pressure of the further heated tire

2799



to the slightly heated jumping ring C, are put in so that they lay on tightly after further heating the tire. Through the thickness of the adjusting ring D all small differences in diameter of the tire are equalised. When the cover E is put on a blower is put into action, and the tire heated to a degree proportional to the jumping requisite.

2800. POWER STORING BRAKES, *W. Brierley.—Dated 7th July*, 1880.—*(A communication from G. Leuffgen.)* 6*d.*

On one of the axles of the car are fixed two friction wheels B, with which two other friction wheels C or C^1 can be brought in contact by the reversing mechanism. The latter wheels are fitted to shafts, which cannot move in their relative position to one another, and are suspended on hangers D. A spiral spring F is tentered directly by the wheel C or in-

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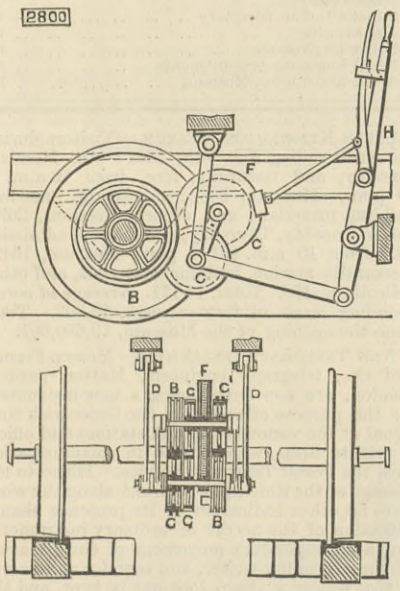

directly by C^1 by means of gear wheels G. When lever H, which holds the spring, is fixed, the mechanism can be reversed, so that the other friction wheel then comes in contact, whereon the tension of the spring, after releasing the lever H, facilitates the starting of the car. A modification shows the application of a flat spring for this purpose.

2801. PRINTING MACHINERY, *W. R. Lake.—Dated 7th July*, 1880.—*(A communication from W. P. Kidder.)* 1*s.*

The bed frame B can swing toward and from the main frame on a rod. The platen A is supported

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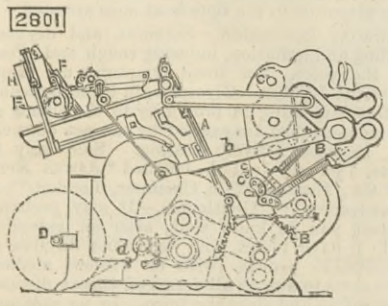

adjustably on the main frame, and the bed is carried by the bed frame. The bed frame B is vibrated by connecting rods *b*, so as to carry the forme of type to the paper supported on the platen. The platen is adjusted by means of four screws and the bed by turning the shaft to which one end of the connecting rods *b* are connected excentrically. C and C^1 are the inking cylinders, each provided with a fountain, feed roll, distributing roll and feeder roll. The forme lies between the inking cylinders, and the forme inking rollers C^2 dwell first on one cylinder, then pass over the forme, dwell on the second cylinder, and pass back again over the forme, so that the forme rollers are inked upon each side of the forme, and supply ink to the forme first from top to bottom and then from bottom to top. The paper is placed in a roll on shaft D, and the end passes to the slack feed *d*, the function of which is to draw the sheet from the roll so as to leave it slack between the roll and the intermittent feed, by which the sheet is brought over the platen ready to receive the impression, and is carried from the platen after the impression. It then passes to the cutting mechanism, which with the main feed is supported by a sliding frame H actuated by a screw, and made adjustable on the main frame. F are the feed rollers which are actuated intermittently by a clutch mechanism, the extent of their feed being adjustable.

2802. OBTAINING MOTIVE POWER, *J. Broel.—Dated 8th July*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to apparatus for obtaining motive power by the force of gravitation combined with leverage.

2804. VALVES OF GAS MAINS OR PIPES, *J. Aird.—Dated 8th July*, 1880. 6*d.*

This consists in the employment of gas mains or pipes of two or more valves in combination with a

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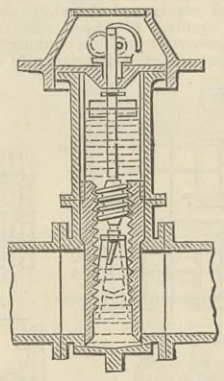

body of liquid interposed between them for the purpose of maintaining a gas-tight joint.

2805. TOOLS FOR TURNING MOTHER-OF-PEARL BUTTONS, *A. Wright and W. Jones.—Dated 8th July*, 1880.—*(Not proceeded with.)* 2*d.*

Diamonds are shaped either on a lap or by cutting or grinding them otherwise, so as a form on them a fine sharp cutting edge similar to the cutting edge of the steel tools at present used.

2806. AFFIXING METALLIC PLATES OR LABELS TO ARTICLES OF METAL, *C. Westwood.—Dated 8th July*, 1880.—*(Not proceeded with.)* 2*d.*

The plates or labels are placed upon the article while the japan thereon is in a plastic state, thereby embedding it in the japan, which will flow slightly over the edges of the metal, and when subsequently hardened by the stoving process will form a slight flange of japan all round the edge of the label in addition to any actual adhesion which may be imparted to the label by the japan at the back.

2808. BENDING METAL TUBES, *H. J. Haddan.—Dated 8th July*, 1880.—*(A communication from G. Riese.)* 4*d.*

This consists in machines for bending tubes into knees, of the method for producing folds by turning a

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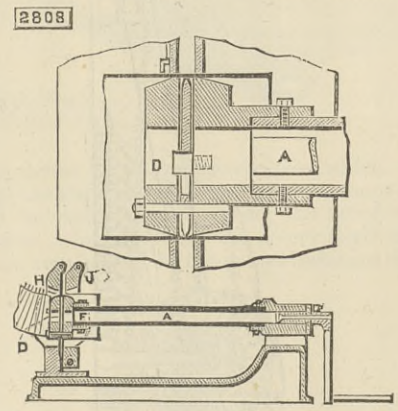

shaft A provided with an excentric pin D acting on a disc F, and for finishing the folds by means of the disc holders H and J and levers.

2809. RAILWAY SWITCHES, *J. Hough.—Dated 8th July*, 1880. 4*d.*

This relates partly to the tie-rods A A which connect the two switch rails or points B B together. It consists in providing the inner side of the nut with a socket or bush which passes through the thickness of the

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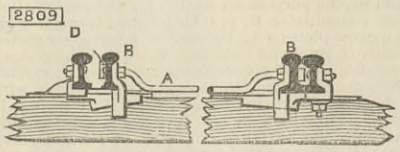

switch rail B and is secured inside, so that although the head of the nut D is no thicker than before, it yet has a firm hold on about eight or ten threads of the screw, and is thus much less likely to work loose or to strip the thread.

2810. HEALDS, *H. Tetlow.—Dated 8th July*, 1880.—*(Not proceeded with.)* 2*d.*

The yarn is formed partly of yarn and partly of steel, iron or metal wire. One or more lengths of wire are twisted with one or more strands of yarn.

2811. CAP FOR SHIPS' MASTS, *A. A. Rickaby.—Dated 7th July*, 1880. 2*d.*

The cap is constructed of cast steel, and around the top and bottom of the casting is formed a beading or fillet of such a depth and of such a thickness as shall give sufficient strength to the parts to meet any sudden pressure of strain that may arise in the usual manner. Suitable holes for the attachment of shackles are also formed.

2812. OPENING AND SECURING WINDOW SASHES, *S. C. Taylor and W. Riley.—Dated 7th July*, 1880.—*(Not proceeded with.)* 2*d.*

Balance pulleys are fixed to the window frame, and the sashes are suspended by means of a cord, chain, or other equivalent, attached to each window, and passing over the balance pulleys. The sashes are secured in any position by a rack attached to one of the sheets, and to the window frame a single or double catch is attached in such a manner that when a double catch is placed in the rack the window sashes are secured and cannot be opened or closed from the outside; and when a single catch is placed in the rack the window sashes cannot be opened, but can be closed from the outside.

2813. DECORATING AND ORNAMENTING LOOKING GLASSES, &c., *E. Evans and J. N. Lee.—Dated 8th July*, 1880. 2*d.*

This consists in placing under the glass various designs in colour printing, so as to form a decorative or ornamental border or frame which shall be visible through the glass, and which may, if desired, be used in place of the ordinary mirror or picture frames.

2814. SCREW HELM FOR STEAMERS, *Compte de Bruc, Duc de Busignano.—Dated 8th July*, 1880. 6*d.*

When an auxiliary screw H^1 is to be used it is mounted on an independent shaft A^1 which revolves in the rudder G. The rotation of the main shaft A is

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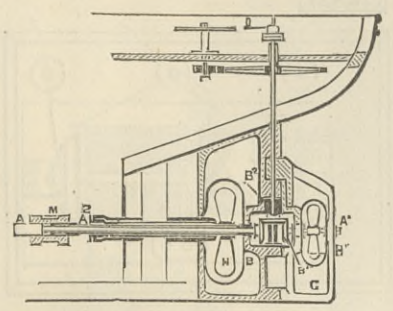

transmitted to the screw in all its positions by the bevel gearing B, B^1, and B^2, the first pinion, B^1, of which is mounted fast on the shaft A^1 of the said auxiliary screw H^1, and the second B on the end of the shaft A, which carries the hollow shaft A^2, on which the screw propeller H is keyed; M is a clutch which allows the screw propeller H to be brought into gear at will.

2825. PREPARING WASTE WOOL FOR FELLING AND DYEING, &c., *R. Aston and R. A. Kinder.—Dated 9th July*, 1880. 4*d.*

This consists in submitting the fibres to the combined action of steam and ammonia.

2826. TELEPHONES, *J. Imray.—Dated 9th July*, 1880. —*(A communication from Dr. C. Herz.)—(Not proceeded with.)* 2*d.*

The object of this invention is to obtain great distinctness in the sounds, even when transmitted over considerable distances. For this purpose the receiving instrument is rendered microphonic by the use of discs or blades of conducting ores, such as sulphides of iron, copper, lead, and other pairs of voltaic elements, all being pressed together with adjustable pressure, and subjected to the sound vibrations of a diaphragm. By the use of discs thus connected and arranged, the sounds are magnified; and in order to render them clear and distinct when transmitted, condensers are introduced in the line conducting from one station to the other.

2827. ATTACHMENT TO BIBS, &c., *G. Fromage.—9th July*, 1880.—*(Not proceeded with.)* 2*d.*

The bib is made of waterproof material and is provided with a flap piece forming a pocket in which any liquid food which falls will be caught.

2828. IMPREGNATING AND PRESERVING WOOD, *F. H. F. Engel.—Dated 9th July*, 1880.—*(A communication from J. D. Francks.)* 2*d.*

This consists in impregnating wood by a mixture of lime and urine after having treated the materials by steam or boiling water.

2830. SECURING GLASS IN SKYLIGHTS AND ROOFS, &c., *A. Smith.—Dated 9th July*, 1880. 6*d.*

This consists in the employment of strips of lead

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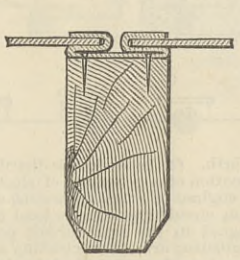

or other soft metal moulded or pressed into a trough-shaped form.

2831. TREATMENT OF VEGETABLE OILS, *T. H. Gray.—Dated 9th July*, 1880. 4*d.*

This consists in subjecting linseed and rape oils while in a heated state to the action of a precipitating solution.

2832. STAMP CUSHIONS, *G. W. von Nawrocki.—Dated 9th July*, 1880.—*(A communication from W. Haber.)* 4*d.*

This consists of an elastic stamp cushion, which permanently communicates colour to india-rubber or other stamps, composed of gelatine or other similar more or less elastic mass or composition, which said mass or composition is saturated with a suitable colouring matter.

2834. TWISTING OR DOUBLING MACHINERY, *J. T. Taylor and J. Tinker.—Dated 9th July*, 1880.—*(Not proceeded with.)* 2*d.*

This consists in placing upon the top front drawing roller a counterbalanced instrument or lever, so formed and arranged that it fits partially around the said top roller with one end hanging down, and upon this end the two threads rest or bear previous to their arrival to the ring or flyer.

2835. ELECTRIC SIGNALLING AND CONTROLLING APPARATUS FOR RAILWAY TRAINS, *G. W. von Nawrocki.—Dated 9th July*, 1880.—*(A communication from T. Balukiewicz.)—(Not proceeded with.)* 4*d.*

The electric current necessary for the working of signal and controlling apparatus for railway trains is generally produced by a magnet, electric, or dynamo-electric machine, which is placed either in the guard's van, just behind the locomotive, or is driven by one of its running axles, so that the current is produced during the running of the train; and by suitable circuits in the train and on the line to-and-fro signals can be given between the officials themselves of the train, between the passengers and officials, as well as from the train to the line and the station for controlling the trains, and *vice versâ*.

2836. TRAP OR VALVE FOR HOUSE WASTE-WATER PIPES, *J. W. Lamb.—Dated 9th July*, 1880.—*(Not proceeded with.)* 2*d.*

A trap is applied to the discharge end of the pipe The trap is formed with a slanting mouthpiece, against which fits a hinged flap valve, which shuts with its own weight, or is shut by means of a weight, according to the position of the valve.

2837. LIGHT HOLDERS FOR CHANDELIERS, CANDLESTICKS, &c., *H. G. Grant.—Dated 9th July*, 1880.—*(A communication from C. Ménard.)—(Not proceeded with.)* 2*d.*

This consists partly in the employment of a socket or holder, formed of a bearing plate or disc with three or more vertical arms, which are caused to embrace the lower end of the candle.

2839. TANNING HIDES AND SKINS, *S. F. Cox.—Dated 9th July*, 1880. 2*d.*

This consists in the use in tanning of powdered zinc, spelter, or like metal, together with tan liquor and tanning ingredients to operate on hides or skins immersed in such liquor.

3021. LOCKS OF KNITTING MACHINES, *F. H. F. Engel.—Dated 22nd July*, 1880.—*(A communication from A. S. Biernatzki.)* 6*d.*

With the position of the lock parts as shown in the first figure, the needles are guided by the edges of the centre cams B B^1 B^2, and wing cams A A^1, in the same manner as with the lock now commonly in use. For producing ribbed work, lever M is removed from pin R, and turned on its fulcrum E, in consequence of which part B of the centre cam, which slides by piece D in a slot of the lock plate S, is shifted towards the unmovable part B^2. The part B^1 is guided by a bolt O in a slot of the lock plate S, and is pressed down upon parts B B^2 by spring P. As soon as the lifting of the needles begins by motion of the carriage, the edge of part B presses the needles upward until the shanks or feet of the needles meet edge of part B^1. This part B^1 is

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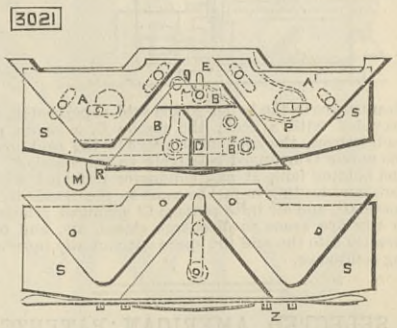
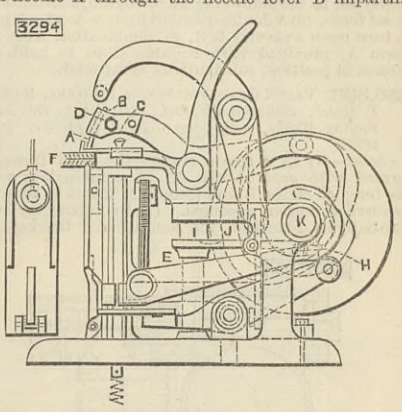


lifted by the pressure of the needles sufficiently to allow the shanks of the needles to pass between B, B^2, and B^1, after which, by the action of spring P, B^1 is again pressed down upon B B^2. After being passed along the centre cam, the needles are guided downward by the edge of the wing cam A^1 in the same manner as with the ordinary lock. The Second part of the invention consists in the application of the thin steel bar Z—shown in the second figure—which is screwed to the lower edge of the lock plate S. The action of this bar is that, according to the position, the needles are either guided between centre cam and corresponding wing cam, or brought to pass underneath the lower edge of the cam.

3294. SEWING MACHINES. *M. H. Pearson.—Dated 12th August*, 1880. 8*d.*

The needle A, which is curved, is mounted on the end of a lever B and held there by the plate C and screw D; this lever B is pivotted on the top of or above the vertical shaft or needle post E, which receives a rotary reciprocating or oscillating movement for the purpose of feeding the work at F; such movement is conveyed to the needle A through the needle lever B imparting

3294



thereto a lateral reciprocating motion, and thence to the work at F; this movement takes place after the completion of the needle's downward stroke, and whilst it is stationary and the shuttle G is taking the needle thread for the purpose of locking it with its own. The radial reciprocating motion is imparted to the vertical needle post or shaft E from the cam H and transmitted thereto by the lever I; also the motion required for the needle lever B is derived from the cam J; these cams are mounted on the driving shaft K.

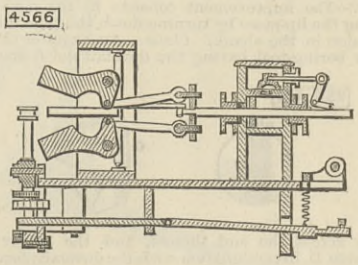
4476. ROLLER SKATES, *W. P. Gregg.—Dated 2nd November*, 1880.—*(Complete.)* 6*d.*

This consists in roller skates constructed with a small supporting roller under the toe and a similar supporting roller under the heel of the stock, a middle wheel arranged at the inner side of the stock, with the upper part of its rim above the upper surface of the stock, in combination with a larger middle wheel arranged at the outer side of the stock, the hubs of the middle wheels being placed on axles in different planes, and so located that when the treads of both wheels are in the same horizontal plane, the stock of the tread is horizontal.

4566. FORGING MACHINERY, *W. R. Lake.—Dated 6th November*, 1880.—*(A communication from S. S. Putnam.)—(Complete.)* 6*d.*

This comprises a series of hammers, connected with and operated by the piston of a steam engine, or other motor placed in close proximity therewith, in such a

4566

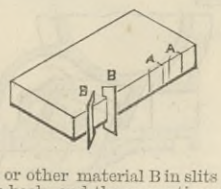


manner that the reciprocating motion of the piston-rod will be communicated directly to the hammers without being first converted into rotary motion as heretofore, whereby the employment of springs, cams, shafts, belts, and pulleys for actuating the pulleys is avoided.

4619. BOOKBINDING, *L. Finger.—Dated 10th November*, 1880.—*(Complete.)* 4*d.*

This consists in the insertion of strips of cloth,

4619



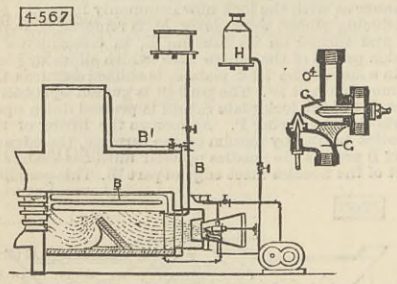
leather, paper, or other material B in slits A created in the back of the book, and the cementing of such strips in said slits without sewing.

4567. STEAM BOILER FURNACES, &c., *W. R. Lake.—Dated 6th November*, 1880.—*(A communication from W. D. Dickey.)—(Complete.)* 6*d.*

This relates to the construction and arrangement o

a steam boiler and its connections, whereby pulverised or fluid fuel may be advantageously burned for the generating of steam and other purposes. It consists partly in the combination with the fire space of a steam boiler, of a steam superheater B located in the said fire space; a steam pipe B^1 leading from the

4567



steam space in the boiler to the said superheater, and provided with a cock, the nozzle C, a steam pipe leading from the said superheater to the said nozzle, the nozzle G arranged relatively to the nozzle C, the fuel holding tank H and conductor provided with a cock, and leading from the same to the nozzle G, the nozzle G^1, and air inlet passage C^4 arranged relatively to the fire space to discharge steam, air, and fuel, directly into the said fire space without any intervening conductor.

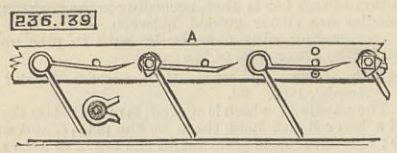
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

236,139. HARROW, *James H. Barley, Sedalia, Mo.—Filed October 28th, 1880. (Model.)*

Claim.—(1) The combination of a harrow-beam and a double harrow-tooth pivotted thereto, the tooth being adapted to turn upon the bolt, so that either prong may be brought into use, substantially as shown. (2) The combination of the harrow-beam and a double-

236.139

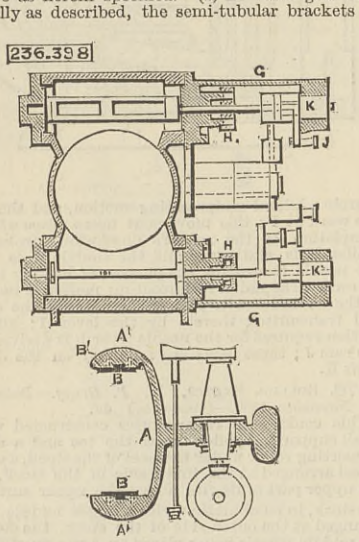


pronged harrow-tooth pivotted thereto, one of the prongs being straight, while the other one is bent, so that when brought into use it will stand vertically, or nearly so, to the side of the harrow-beam, substantially as set forth. (3) A double-pronged harrow-tooth adapted to turn upon a pivotal bolt, in combination with the beam A, provided with suitable stops to hold the prongs in position, substantially as set forth.

236,398. VALVE GEAR FOR STEAM ENGINES, *Willard T. Hatch, Indianapolis, Ind., assignor to the Atlas Engine Works, same place.—Filed September 29th, 1879.*

Claim.—(1) In a steam engine the solid frame A formed with grooved ribs A′, in combination with the tongued slides B and fastening means *b′*, adapted to serve as herein specified. (2) In valve gear substantially as described, the semi-tubular brackets G,

236.398

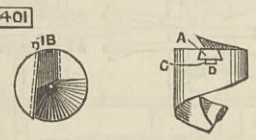


arranged relatively to the valve stems and valve arms and long stuffing boxes H, substantially as and for the purposes herein specified. (3) In valve gear substantially as described, the bushing K, mounted concentrically in the semi-tubular brackets G, in combination with the valve stems and with the detaching cams J, all arranged as herein specified.

236,401. DETACHABLE LIP FOR AUGERS, *John R. Adams and Daniel Robertson, Oakland, Cal.—Filed November 5th, 1880. (No model.)*

Brief.—The improvement consists in the mode of securing the lip-piece by turning down the edge into a depression in the shank. *Claim.*—An auger or other similar boring-tool having the dovetail slot B diame-

236.401

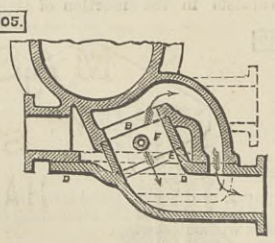


trically across the end thereof, and the cavity or depression D, in combination with the dovetail piece A, with point or cutting edge and lip C, the piece A being secured within the slot B by forcing down the lip into the depression, so that the outer edge or face shall be preserved smooth and flush with the rest of the shank, substantially as and for the purpose set forth.

236,405. STEAM CYLINDER, *John H. Allen, Brooklyn, N.Y.—Filed September 3rd, 1880. (No model.)*

Claim.—(1) In combination with a cylinder and

236.405

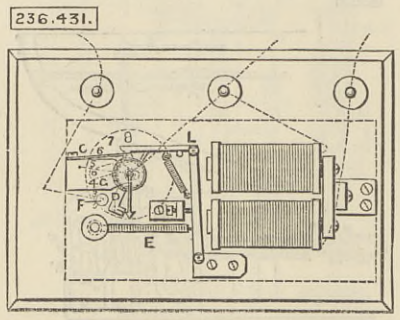


balance slide valve F, the valve-chest cover D, provided with surfaces E on its inside corresponding with the valve-seat surfaces B, cast on the cylinder, bearing upon the back of the balance slide-valve F, and arranged at an angle with the joint face of said cover D, substantially in the manner and for the purpose described. (2) In a cylinder provided with a balance slide valve, the exhaust passage from front and back of the valve, connected together by a passage through the valve chest cover, substantially in the manner shown and described.

236,431. INDIVIDUAL ATTACHMENT FOR ELECTRIC BELLS, *Angus S. Hibbard, Milwaukie, Wis.—Filed September 3rd, 1880. (Model.)*

Brief.—Improvement in that class of apparatus known as "step-by-step" devices, whereby one station can be called without sounding the bell at any other station. *Claim.*—(1) The combination, in an individual attachment for electric bells, of the magnet, hinged

236.431.

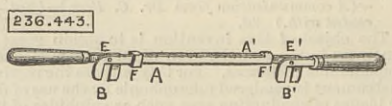


armature, pawl L, spring E, ratchet, excentric spring C, and arm D, with button F and connecting lines, as set forth. (2) The combination, in an individual attachment for electric bells, of the magnets, hinged armature, pawl L, ratchet wheel, excentric and springs, pawl G, arm D, button F, indicator and dial, and connecting lines, as set forth. (3) The combination with the ratchet wheel and arm with the indicator having weighted end for bringing the instrument to unison after the last tooth of the ratchet has passed the pawl L, as described.

236,443. TIRE LIFTER, *Andrew A. Linthicum, Columbia, Md.—Filed November 8th, 1880. (Model.)*

Claim.—In a tire lifter, the combination of the connected arms A A′, having half-jaws or dogs B B′ at

236.443.

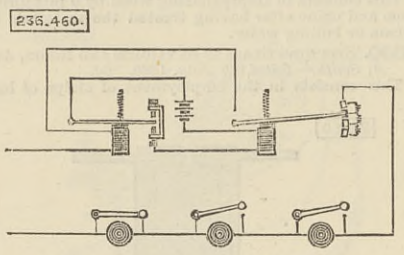


their outer ends, and the pivotted levers E E′, having half-jaws or dogs F F′, constructed and operating substantially as and for the purpose set forth.

236,460. AUTOMATIC REGULATOR FOR ELECTRIC CURRENTS, *William E. Sawyer and William Sawyer, New York, N.Y., assignors to Eastern Electric Manufacturing Company, Middletown, Conn.—Filed October 2nd, 1880. (No model.)*

Claim.—(1) In an electric distributing system, the combination of a generator of electricity, a series of electric engines or other apparatus, a relay magnet in the local circuit provided with a current regulating armature automatically operated, and actuating mechanism to introduce or cut out resistances in the main line, substantially as described, and for the pur-

236.460.

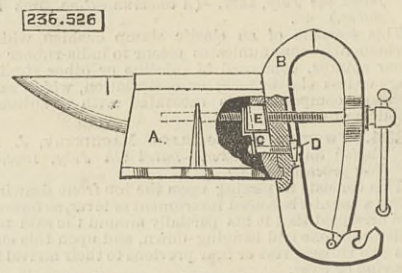


poses set forth. (2) In an electric distributing system, the combination of a generator of electricity, a series of electric engines or other apparatus, a relay magnet in the main circuit operating a local circuit, and an electro-magnet in the local circuit provided with a current regulating armature actuating a lever traversing a series of resistance terminals in the main circuit, substantially as described.

236,526. COMBINED ANVIL AND VICE, *Albert L. Adams, Cedar Rapids, Iowa.—Filed June 17th, 1880. (No model.)*

Claim.—(1) In combination with an anvil, a vice, one jaw of which is provided with a pivot or pivots at its lower end, adapted to operate in serrations formed in

236.526

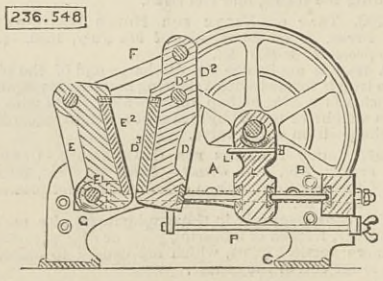


the corresponding part of the other jaw, substantially as and for the purpose set forth. (2) In combination with anvil A, jaw B, and nut E, the stop C, bolt D, and nut to secure it in position, substantially as and for the purpose set forth.

236,548. STONE-BREAKER, *C. Gordon Buchanan, Brooklyn, N.Y.—Filed August 6th, 1880.—(No model.)*

Claim.—(1) In a stone-breaker, the combination, with the frame A A and shafts D′ E′, respectively, of the movable jaws D E, the former of which is pivotted at the top and the latter at the bottom, and rigid connecting links F F, as and for the purpose set forth, which links transmit motion from jaw D to jaw E, and thereby produce motion in the latter. (2) In a

236.548

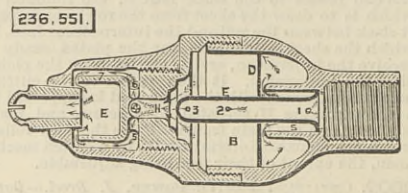


stone-breaker, the main jaw D, constructed substantially as herein shown and described, with vertical lever extension D″, whereby the motion of the said lever D″ will be the reverse of the motion of the lower portion of the jaw D, for the purpose of producing and controlling the motion of the jaw E, as set forth. (3) The combination, with the movable jaw E and shaft E′, of the adjustable boxes G G, tension rods H H, and toggle block I, substantially as herein shown, and for the purpose described.

236,551. GAS REGULATING BURNER, *John N. Chamberlain, Springfield, Mass.—Filed May 3rd, 1880.—(No model.)*

Claim.—(1) The combination, with the burner case provided with the annular passage 8, chamber B, and passage H of the disc D, provided with the tube E having a flange on its bottom end, as shown, and the

236.551.

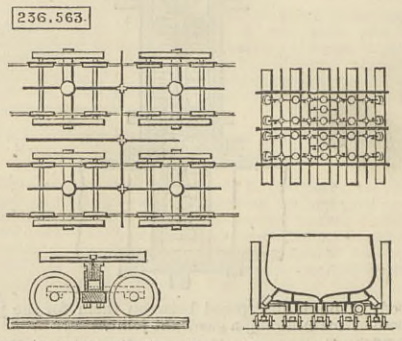


gas passages 1, 2, and 3 formed therein, substantially as and for the purpose set forth. (2) The burner case having the annular chamber 7 therein and provided with the vertical passage H, the horizontal passages 4, 5, 6, and the cup E, substantially as and for the purpose set forth.

236,563. SHIP RAILWAY, *James B. Eade, St. Louis, Mo.—Filed May 8th, 1880.—(No model.)*

Brief.—A system of communicating jacks is arranged between the cradle and the ship, also between the trucks and cradle. *Cldim.*—A ship railway car and cradle constructed with a connected system of hydraulic jacks having stop-cocks or valves, to apply

236.563.

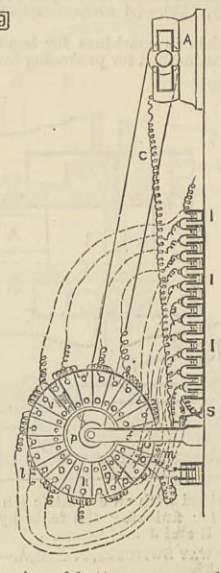


supports automatically with uniform pressure to all parts of a ship's bottom simultaneously, and lock them in the positions in which they are thus set, and with a connected system of hydraulic jacks beneath the supporting bed or cradle to compensate for vertical irregularities in the track.

236,569. EQUALISING DYNAMO-ELECTRIC CURRENTS BY MEANS OF SECONDARY BATTERIES, *Stephen D. Field, San Francisco, Cal.—Filed August 4th, 1879.*

Brief.—The current from a dynamo-electric machine is thrown from one cell to another throughout a connected series, whereby said series of cells are rendered capable of giving a continuous secondary current. The invention consists in peculiarities of the apparatus. *Claim.*—(1) The improvement in utilising dynamo-electric currents for telegraphic purposes, consisting of the commutator provided with alternate wide and narrow plates, the former being connected together in

236.569

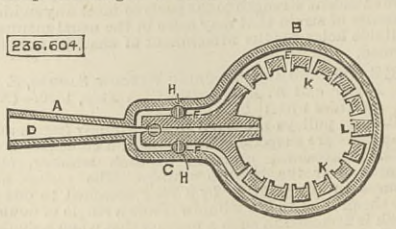


pairs and to a series of battery cups, and the latter plates upon each side of the commutator being connected each to the other and to separate battery cups, in combination with a dynamo-electric machine, its conducting wires, and the circuit wires, substantially as and for the purpose set forth. (2) The combination of the commutator D, provided with alternate wide and narrow plates *g h*, the plates *g* being connected together in pairs and to battery cups, and the plates *h* upon each side of the commutator being connected each to the other and to separate battery cups with the dynamo-electric machine A, wires B C, springs *p*, arms *n*, having hubs O, and brushes V, substantially as and for the purposes set forth. (3) A stationary commutator D, provided with the alternate wide and narrow plates on each side, all the narrow plates on each side being united by a single wire and connected with a cup J, while the wide plates in pairs are connected successively with the cups I I of a battery, in combination with the dynamo-electric generator A, wires B C, springs *p*, arms *n*, with their hubs O, and the brushes V, all combined and arranged to operate substantially as and for the purpose described.

236,604. TUYERE, *John W. McCorkle, Freeport, Wash.—Filed August 10th, 1880.—(Model.)*

Claim.—(1) The tuyere A, B, C, having straight blast passage D and side passages E F, provided with the valves H, the passage *g* connecting with the interior by radial openings K, as shown and described. (2) The stop L arranged to form a partition across the

236.604

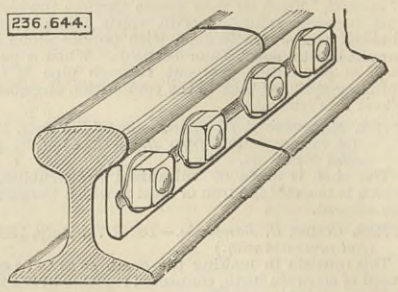


bore E opposite to the blast pipe, as described, for the purpose specified. (3) The water orifice *m* connecting with the bores D, F, F, as and for the purpose specified.

236,644. LOCK NUT, *Oscar Stoddard, Detroit, Mich.—Filed June 7th, 1880.—(No model.)*

Claim.—The combination, with a fish bar having a

236.644.



groove or recess, of a bolt and a nut with a projecting fin on its lower edge, adapted to be locked by striking the edge of the fin into the groove, substantially as described.

CONTENTS.

THE ENGINEER, February 11th, 1881.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Feb. 5th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9682; mercantile marine, building materials, and other collections, 2671. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1642; mercantile marine, building materials, and other collections, 176. Total, 14,171. Average of corresponding week in former years, 13,802. Total from the opening of the Museum, 19,680,601.

NEW TELEGRAPH INSTRUMENT—Messrs. Francis and Co., telegraph engineers, Hatton-garden, London, are now introducing a new instrument for the purpose of receiving the Greenwich time signal at the various telegraph stations and offices of private firms, who may be in communication with the Postal Telegraph Service. Hitherto the passage of the time signal current along the wires gives no other indication of its presence than a deflection of the needle of ordinary instruments and a corresponding movement of the armature of the Morse ink writer, and sounder at 10 a.m., so that unless a sharp look-out be kept, and the eye constantly on the instrument, the actual time is not taken. In the new instrument the index needle, or in other words, the needle of the galvanometer, when deflected, presses against a small spiral spring surrounding the stops or ivory pins on the dial plate, and by this contact the galvanometer forms itself into a "relay" and brings a local battery in circuit with a bell, which is contained in the same instrument, so that when the first part of the time signal is sent the needle is deflected, and at the same moment the bell rings; thus attention to the time is at once arrested.