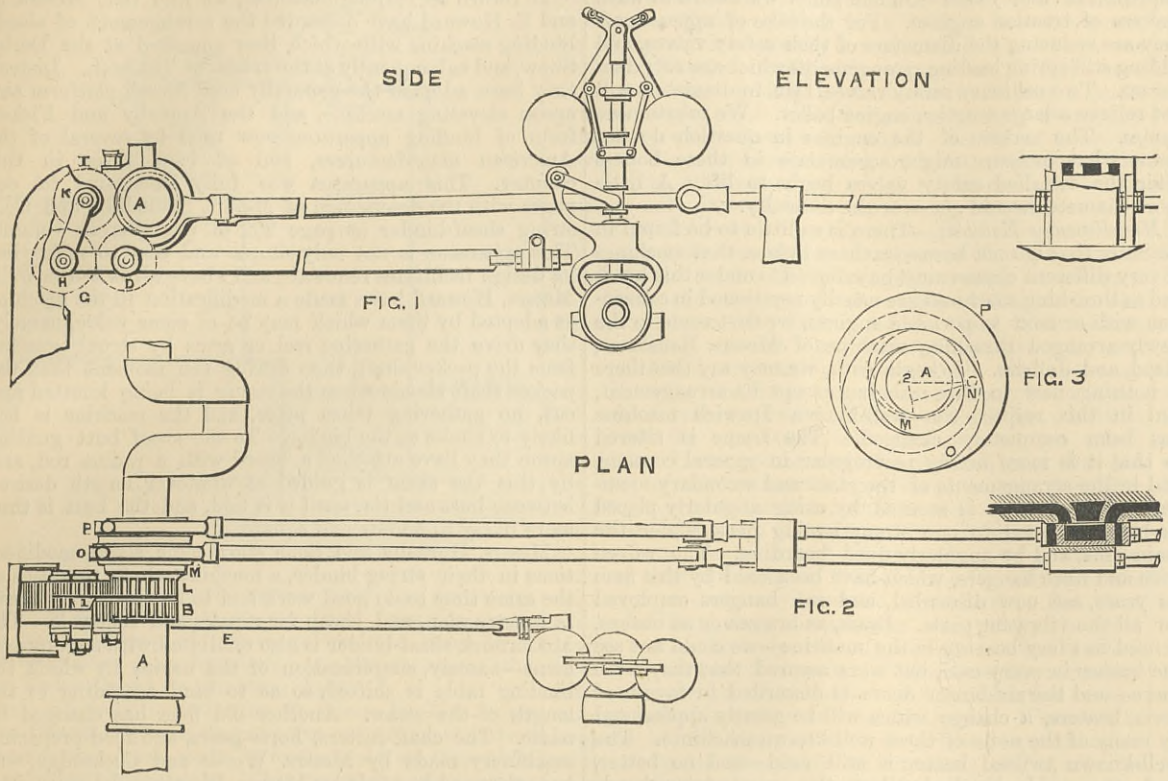
THE SMITHFIELD CLUB SHOW.

THERE are very few novelties in steam engine designs to be seen in the Agricultural Hall; and we are happy to add that the reason why new things are absent is satisfactory. Engineers have been too busy to make novelties; they have been working night and day to meet orders, and under such circumstances they have put on one side for the moment every invention which required much time or expense to develope it. Thus, for example, Messrs. Burrell, of Thetford, have done nothing since summer with compound engines, and at stand after stand may be seen engines perfectly familiar in every detail to those who frequent shows. Of these it is quite unnecessary to speak.



STARKEY'S VALVE GEAR.

We shall confine our attention to the few new things exhibited.

Steam Engines.—The most novel engine in the Agricultural Hall is a semi-portable exhibited by Messrs. Marshall, Sons, and Co., of Gainsborough. It is a compound engine, with the cylinders under the boiler. The cylinders are 5in. and 9in. diameter, by 12in. stroke. The working pressure is 140 lb.; the tubes are $2\frac{1}{4}$in. diameter. The two cylinders and valve chests are all in one casting, which forms the pedestal for the front end of the boiler. The exhaust pipe from the small to the large cylinder forms the intermediate receiver. It passes transversely beneath the cylinders, and is jacketted. The cylinders are fitted with hard cast iron liners, with a space between the cylinder and liner, which makes the jacket. The excentric sheaves are, very properly, of cast iron. The high-pressure cylinder has a cut-off valve on the back of the main valve, which cut off, driven by a separate excentric, is controlled by Hartnell's governor.

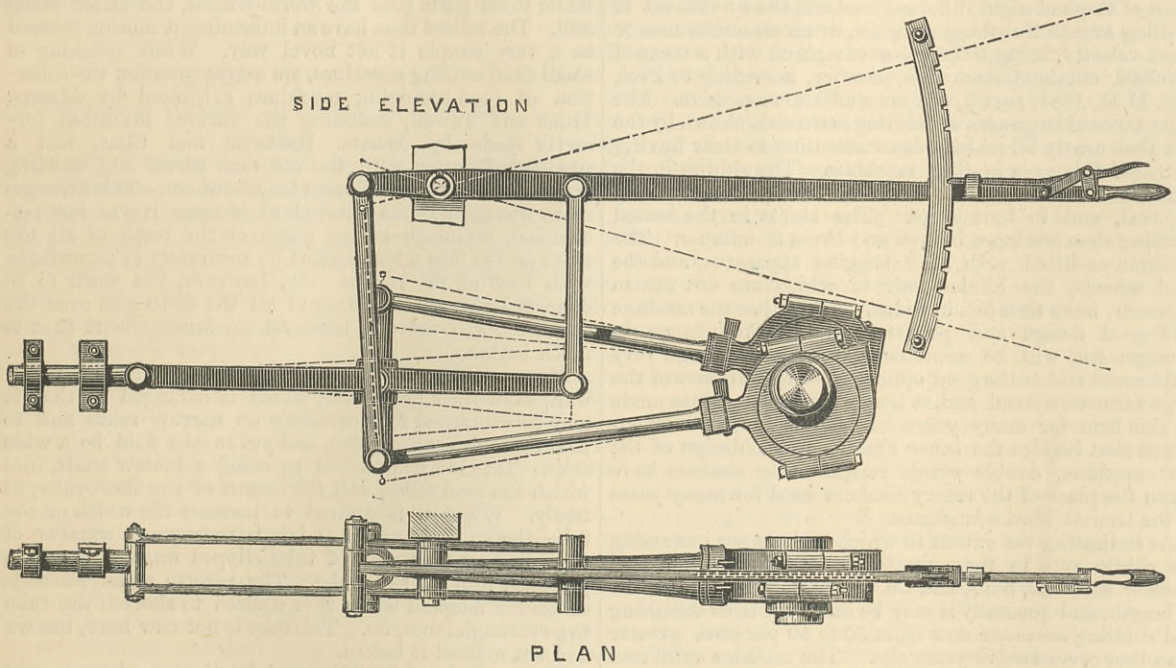


FIG. 5.—MESSRS. AVELING AND PORTER'S VALVE GEAR.

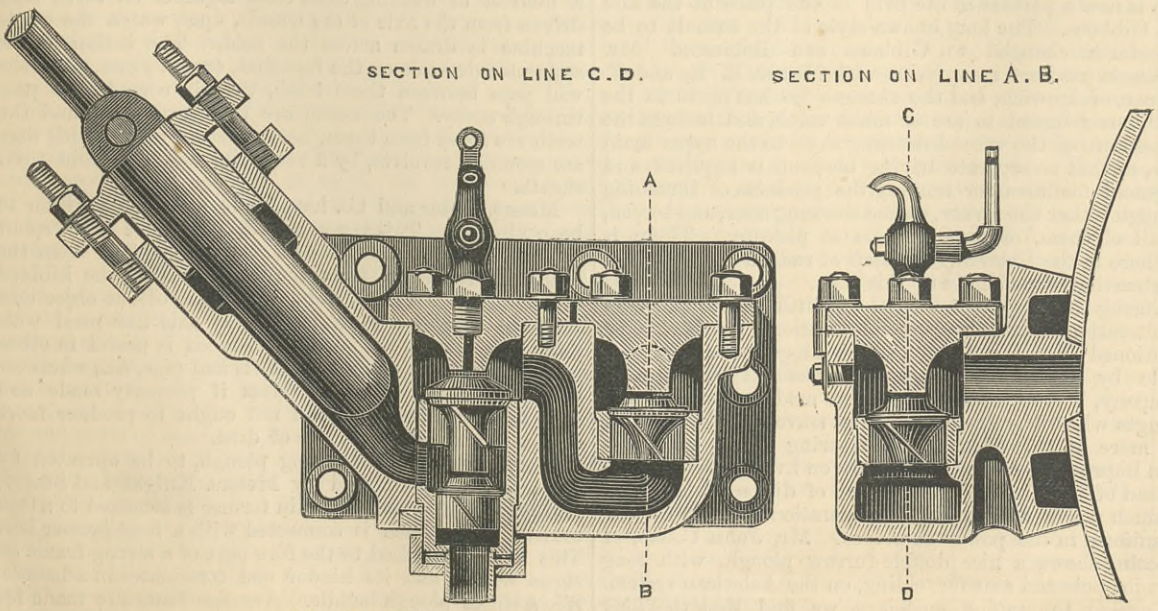


FIG. 6.—MESSRS. AVELING AND PORTER'S FEED PUMP.

The piston speed is 350ft. per minute. The guides are tubular, bored out and faced at each end, and secured to the cylinder at one end and to a motion-plate at the other. The bed-plate or frame is made of two rolled] iron bars, between which the cylinder casting is bolted at one end, while at the other they are secured to a square casting, on which is placed the fire-box end of the boiler. The engine has obviously been got up with the utmost attention to details and proportions, and is one of the best specimens of mechanical engineering ever shown in the Agricultural Hall. It is the first made, and we hope that Messrs. Marshall will find time to test it, and let the world know something of its economic qualities. Messrs. Marshall also show an 8-horse power portable engine, built from new patterns. The tubular guide is used in it also. It is jacketted, and has an unusually large cylinder. The starting gear is all outside the boiler; the working pressure is 80 lb. A 6-horse power engine, by the same firm, is specially designed for driving dynamo-electric machines, for producing the electric light. They also exhibit the traction engine which we illustrate at page 419. This engine has, it will be seen, the tubular guides, which appear to be rapidly coming into fashion. The traction engines of the firm have recently been entirely revised, new patterns having been made of many of the parts with a view to rendering them as simple and efficient as possible. The number of pieces has been considerably reduced. The cylinder, which is steam jacketted, is provided with a gun-metal slide valve and an equilibrium throttle valve; the stop valve and throttle valve spindles are made direct-acting, and are kept parallel with the centre line of the

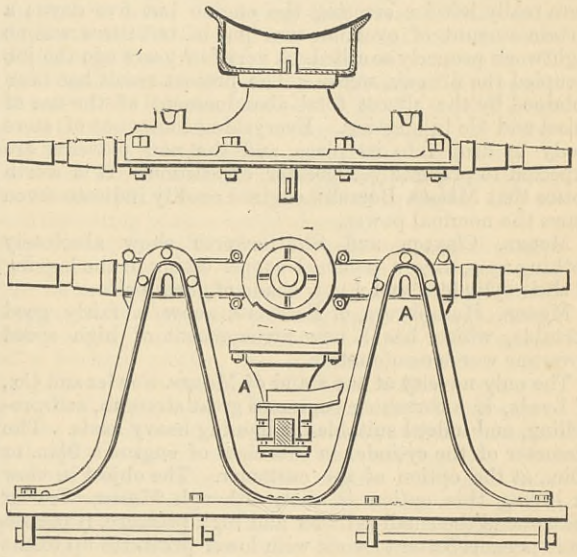
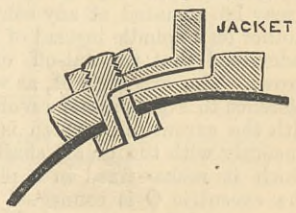


FIG. 4.—RUSTON AND PROCTOR'S FORE CARRIAGE.

boiler barrel. Two spring weighted safety valves are mounted on the top cover of the cylinder, encased, so as to prevent the possibility of their being tampered with, and provided with an easing lever. The ordinary guide bars are dispensed with, as we have said, and a cylindrical bored guide used instead, carried in the centre by a casting, which thus answers as guide stand, governor stand, weigh-bar bracket, and valve rod support; the flange of the guide bolted to the cylinder serves as front cylinder cover and piston rod stuffing-box. The crosshead is of the simple adjustable type as used by Messrs. Marshall for their vertical and fixed engines. The road gearing is all made of steel, and the keys on the crank shaft for the pinions are cut out of the solid material. The brake barrel is cast on the boss of the left-hand side road wheel, so that the brake cannot be rendered ineffective by the driving pin coming out. A winding drum is keyed to the axle on the left-hand side of the engine supplied with a steel wire rope and guide pulleys. The cylinder cocks, water gauges, pump suction and delivery pipes, are all made with flanged connections. A circular tool-box for spuds, &c., is provided on the front axle. The boiler is fitted with suitable wash-out plugs, a mud pocket under the barrel, and the saddle plate is flanged with a sufficiently large radius so that the two mud-holes can be put in the corners.

Messrs. Ruston and Proctor, of Lincoln, show a compound portable engine which has some novel features. In the first place there is a peculiar and highly ingenious starting gear, by which steam can be admitted to the low-pressure cylinder to start the engine, but only while the driver keeps hold of the starting handle. He may, however, start without using the auxiliary valve if he likes. A very compact reducing valve is moreover provided, which prevents a pressure greater than 50 lb. being carried in the large cylinder. It consists of a plunger of different diameters, so arranged that when the steam in the low-pressure valve chest exceeds 50 lb. in pressure the plunger is shifted, thanks to the difference in areas, and steam is shut off. It is rather a protecting valve than a reducing valve. The cylinders are 7in. and 11in. diameter, by 14in. stroke. There are only two steam joints between the boiler and the engine. Steam is admitted to the jacket through the well-known tubular stays used by this firm for years, while drainage is effected by drilling holes in a couple of the holding-on bolts which secure the saddle of the cylinders to the boiler; transverse holes bored into these establish a communication with the jacket at the lowest point, somewhat as shown in the accompanying sketch. The feed pump, which is very simple in construction and vertical, is secured to a downward prolongation of the crank shaft bracket, to avoid making holes in the boiler. The governor works an expansion valve on the back of the main slide, very much as in the case of the valve gear of a very neat fixed engine, which we shall illustrate in an early impression. The fore carriage of this engine is illustrated by Fig. 4. It will be seen that it is made by bending angle iron round blocks, and securing it to castings secured to the axle. The drawing is self-explanatory, and the sim-



plicity and fitness of the design to the intended purpose sufficiently recommend it. The finish of all the engines at Messrs. Ruston and Proctor's stand leaves nothing to be desired.

Messrs. Ransomes, Head, and Jefferies, E. R. and F. Turner, Davey Paxman and Co., Howard, and Savage, show absolutely nothing new, with the exception of a few modifications in the shape of various parts. Messrs. Eddington seem to be determined to improve, and they now exhibit a very fairly designed portable of good finish, a wonderfully better engine than any of those which have appeared at their stands in days gone by. Messrs. Allchin, too, have steadily improved, and their exhibits compare favourably with other makers, but do not call for special remark.

Messrs. Charles Burrell and Sons, of Thetford, have been, as we have said, too busy to go on with the compound engine and the steering gear exhibited at Derby, but they exhibit a traction engine built from new patterns, the prominent idea being to simplify everything, and reduce machinery and labour as much as possible. So successful have they been in this, that the engine exhibited was erected in eight days—the boiler was delivered into shop on a Thursday morning, and steam was got up the following Thursday night. The engine received during this time three coats of paint and two coats of varnish, and on Sunday no work was done on it. Deducting two days required to dry the varnish and the Sunday, there were really left for erecting the engine but five days; a certain amount of overtime was put in, but there was no nightwork properly so called. A very few years ago the job occupied the firm six weeks. The present result has been obtained by the almost total abandonment of the use of chisel and file in erecting. Everything comes out of store ready to drop into its place, and the new patterns are expected to promote yet greater expedition. It is worth notice that Messrs. Burrell's engines readily indicate seven times the nominal power.

Messrs. Clayton and Shuttleworth show absolutely nothing new, save a polished copper casing to the lagging of their cylinders, and a new shade of green paint.

Messrs. Humphreys, of Pershore, show a fairly good portable, which has a new arrangement of high speed governor worth examination.

The only novelty at the stand of Messrs. Fowler and Co., of Leeds, is a thrashing engine of great strength, self-propelling, and indeed suitable for hauling heavy loads. The diameter of the cylinder in this class of engine is 9½in. or 10in., at the option of the customer. The object in view in giving this option is that, although Messrs. Fowler recommend the small cylinder and high pressure, it pleases some persons better to work with lower pressures up to the same power. The length of stroke is 12in.; working pressure, 120 lb.; speed, 150 revolutions per minute; effective horse-power, 35; heating surface, 171·7 square feet; grate area, 6·6ft.; driving wheels, 6ft. high and 18in. wide. This is a very strong engine, suitable for doing a great deal of hard work.

Messrs. Hempstead and Co. show a number of vertical engines of excellent and somewhat novel design, which we shall probably illustrate in another impression.

Messrs. Richard Hornsby and Co. show a new stationary engine, with a good oblong bed plate, that side of it carrying the crank shaft bearing being made deeper and stronger than the other. The cylinder is bolted to one end of the bed plate, but there is no steam joint between the two. The same firm also exhibit a new and well-designed traction engine; the cylinder 8in. diameter by 10in. stroke. This is a very nice little engine, with a tubular guide bar, supported in the middle, the whole, guide cylinder and all, being carried on one saddle plate.

Messrs. Richard Garrett and Sons exhibit nearly the same engines as those shown at Derby. We understand that the boiler recently brought out by this firm, and illustrated in The Engineer for July 15th, is giving most satisfactory results in practice.

Messrs. Robey and Co., Brown and May, and the Reading Ironworks Company show absolutely nothing new—indeed, but three novelties remain to be noticed. The first is Starkey's patent automatic expansion gear, fitted to a well-made portable engine by Messrs. Wm. Foster and Co., of Lincoln. This is illustrated by Figs. 1, 2, and 3. In principle it closely resembles Sells's reversing gear, fitted by Messrs. Maudslay, Sons, and Field to several ships. The action of the apparatus is as follows:—On the crank shaft A being caused to revolve, motion is transmitted from the wheel B through the wheels C G and I to the wheel L, which, together with the excentric M, is thereby caused to revolve in the same direction and with the same speed as the crank shaft. When it is necessary to alter the travel of the valve, the bar E is actuated automatically by the governors or by hand, and a motion independent of that of the crank shaft is thereby transmitted through the train of wheels to the excentric M, altering its relative position to the excentric O, the excentricity or throw of which latter, and consequently the travel of the expansion valve, being thereby varied. This variation may be effected when the machinery is at rest by a hand movement of the bar E. It will be obvious that instead of making the wheel G wide as before described, two wheels, one gearing into one wheel, and the other into the wheel I, may be mounted at any convenient distance from one another on a spindle instead of on the stud H. It will be understood that the cut-off excentric O has a variable throw. The excentric M, as will be well understood on reference to Fig. 3, partly revolves within or in connection with the excentric O, which is caused to revolve simultaneously with the crank shaft by means of a pin N—on which it rocks—fixed in a plate P keyed on the shaft. The excentric O is connected with the expansion valve by means of the ordinary rod. The action of the excentric M varies the excentricity or throw of the excentric O by moving its centre anywhere between the limits 1, 2, and thus varies the travel of the expansion valve in a corresponding degree.

The next novelty in valve gear will be found at the stand of Messrs. Aveling and Porter, of Rochester. It is illustrated in Fig. 5. It will be seen that we have here Allan's straight link, the link being a turned plunger. This is a very elegant and easily fitted up gear. The third novelty is a feed pump, Fig. 6, also used by Messrs. Aveling and Porter this year for the first time. It is simple and good. The drawing explains itself.

We could easily extend this notice of the engines exhibited at Islington, but no good purpose would be served thereby. We have noticed all that was new that we could find on careful examination. The workmanship of the portable engine and its design have wonderfully improved of late years. On one point we desire to warn makers of traction engines. For the sake of appearances they are reducing the diameters of their safety valves, and adding stiff spring loading arrangements which are very dangerous. Two ordinary safety valves, 1½in. in diameter, will not relieve a large traction engine boiler. We mention no names. The makers of the engines in question do not know what pressure might accumulate in these boilers after the so-called safety valves begin to lift. A little more diameter would get over the difficulty.

Miscellaneous Exhibits.—There is so little to be found in the Show that has not been seen there before, that machines of very different classes must be referred to under this head, and as thrashing machines are usually mentioned in connection with or next to portable engines, we first come to the newly-arranged thrashing machine of Messrs. Ransomes, Head, and Jeffries. To begin with, we may say that there is nothing new in this machine except its arrangement, and in this respect the well-known Ipswich machine has been completely changed. The frame is altered so that it is more nearly rectangular in general contour, and in the arrangements of the main and secondary members, while rigidity is secured by using angularly placed tie-bars connected to one strengthening piece under the main cills, and by angularly fixed boarding. The woven wire and fibre hangers, which have been used by this firm for years, are now discarded, and ash hangers employed for all the vibrating parts. Brass, as brasses or as bushes, is used in every bearing in the machine—we could not see the bushes in every case, but were assured that they were there—and the six-beater drum is discarded in favour of seven beaters, a change which will be greatly appreciated by many of the users of these well-known machines. The well-known twisted beater is still used—and no better, perhaps, could be had; but the open drum-heads are replaced by pressed plate-heads, which prevent the accumulation of dust on the drum bearings, and are really stronger and safer. The bearings are 7in. long and 2¼in diameter. The machine shown is of the general purpose width of 4ft. 6in. The caving riddles are 6ft. 2in. by 4ft. 2in., and have thus a riddling area of 25·68 square feet, or about 4 square feet more than the mean of those of eight different makers, the co-efficient of riddling area to thrashing area, *i.e.*, drum circumference × drum velocity, being 0·000944 as compared with a mean of 0·000802 obtained from the practice, according to Proc. Inst. M.E., 1881, part 2, of nine well-known makers. The importance of large area of riddling surfaces is shown by the fact that nearly all makers draw attention to their having increased this area in their machines. The riddles in the machine referred to are made in two pieces for easy removal, and in four steps. The sieves in the second dressing shoe are large in area and three in number. The machine is fitted with chaff bagging apparatus, and the road wheels, the hinder pair of which are 4ft. 2in. in diameter, have tires 5in. in width. Altogether the machine is of good design and proportions, and the change in arrangement will be appreciated by many, though very little could add to the good opinion held by numbers of the large farmers abroad and at home, of the machines made by this firm for many years. It should further be mentioned that besides the other changes in the design of the new machine, double crank reciprocating shakers have taken the place of the rotary shakers used for many years in the Orwell Works machines.

As indicating the extent to which makers are increasing the riddle area in these machines, we may mention that Messrs. Marshall, Sons, and Co. are employing riddles 7ft. in length, and generally it may be said that both thrashing and riddling areas are now from 30 to 50 per cent. greater than they were twelve years ago. The machine exhibited by Messrs. P. and H. P. Gibbons, who have for many years been known as successful makers, has received several modifications under the direction of Mr. Robinson, who is now a partner in the firm in the place of the late Mr. Gibbons. The long known style of the firm is to be henceforth changed to Gibbons and Robinson. Mr. Robinson has been many years with Messrs. E. R. and F. Turner, of Ipswich, and the changes he has made in the machines referred to are of much value, and include the connection of the second dressing shoe to the upper main shoe, so that no separate driving medium is required, and increased facilities for sending the products of thrashing through either the awner, second dressing shoe, and screen, or all of them, or two of them at pleasure. There is nowhere in the Show any evidence of radical change in the construction of machines of this class.

Among the ploughs we found but little that is new, and no alterations demanding special mention; but it may be mentioned that the Darby steam digger, which is now made by the Agricultural and General Engineering Company, Walbrook, E.C., has been modified, so that the changes which have to be made for travelling on the road are more quickly effected; the steering arrangement has been improved, and the diggers are on five frames, or sets, instead of three, so that neither set of diggers takes quite so much power, and the digging operation is more regular or uniform in the power employed. Mr. John Cooke, of Lincoln, shows a nice double-furrow plough, with long draught pole and seat for riding, on the American system.

Turning to reaping machines, we find that the long known names, Burgess and Key, are dissevered, owing to the retirement of Mr. Key, and the Brentwood firm is now Messrs. W. J. and C. T. Burgess. There is nothing new on the stand of this firm, at least not in mowing or reaping machines; but Messrs. Burgess are showing cast iron letters for sign-boards, stations names, &c. These are fine thin castings, and the peculiarity and advantage is that the letters being kept from the sign-boards by the distance bosses through which the fastening screws pass, the letters may be repainted by station porters, or may be freshened up by anyone who can get a bit of rag and a little paint, without daubing the board, and owing to the space between the letters and the board an effective and real shadow is thrown. The name of the firm at the Show is made up of these letters, which are cheap, and they are already being largely used by railway companies.

To return to reaping machines, we find that Messrs. J. and F. Howard have discarded the arrangement of sheaf-binding machine with which they appeared at the Derby Show, and subsequently at the trials at Thulston. Instead they have adopted the generally used Marsh platform and apron elevating machine, and the Appleby and Fisken form of binding apparatus now used by several of the American manufacturers, and at least three in this country. This apparatus was fully illustrated in our pages with the description of Messrs. Samuelson and Co.'s string sheaf-binder at page 202 of our current volume. This apparatus is not only simple and easy to make, but its design facilitates renewals, and above all it works well. Messrs. Howard have made a modification in the machine as adopted by them which may be of some value, namely, they drive the gathering reel or arms by strong gearing from the packer shaft, thus during the moment that the packer shaft stands when the string is being knotted and cut, no gathering takes place, and the machine is less likely to choke at the binder. To the sheaf butt guiding apron they have attached a board with a radius rod, and by this the sheaf is guided at whatever length desired between butt and tie until it is tied, and the butt is thus more likely to be fair and square.

Messrs. Hornsby and Sons show some slight modifications in their string binder, a machine which promises at the same time to do good work and to be reasonably cheap in construction, and cheap for repairs and renewals. The McCormick sheaf-binder is also exhibited with an improvement—namely, simplification of the means by which the binding table is shifted, so as to bind according to the length of the straw. Another old firm has changed its name. The chaff-cutters, horse-gears, and food-preparing machinery made by Messrs. Woods and Cocksedge, will henceforward be made by Messrs. Woods and Long. Mr. Long has been connected with the Stowmarket firm for about a quarter of a century.

There is little that is new in chaff-cutting machines. Messrs. W. J. and C. T. Burgess show a small machine fitted with the ordinary worm-wheels, but not the ordinary worm, inasmuch as that used has two portions of its thread in a direction normal to the axis of the worm, so that while these parts pass the worm-wheels, the latter stand still. The rollers thus have an intermittent motion secured in a very simple if not novel way. While speaking of small chaff-cutting machines, we might mention the collection of food-preparing machines exhibited by Messrs. Hunt and Tawell, including the various machines formerly made by Messrs. Ransome and Sims, and a small chaff-cutter with the old face wheel and shifting pinion for obtaining different lengths of cut. This arrangement was at one time sneered at because it was not mechanical, inasmuch as the angle of the teeth of all the rings on the face wheel cannot be accurately in accordance with that of the pinion. As, however, the work to be done is light, the rounding of all the teeth gets over the difficulty, and there is after all no arrangement that is much better.

Messrs. Davy, Sleep, and Co., of St. Germans, Cornwall, show their horse-rake, which is arranged so that it may be shortened for travelling on narrow roads and to pass through narrow gates, and yet in the field be a wide rake. This is accomplished by using a hollow shaft, into which the road axles, half the length of the short-rake, fit freely. When it is desired to increase the width of the rake the axle at either end is withdrawn, a number of teeth in a set on a piece of tube slipped on, and the axle put back into the axle tube. The reverse arrangement is of course adopted when it is desired to shorten the rake to go through lanes, &c. This rake is not new here, but we had not noticed it before.

Messrs. Ord and Maddison, of Darlington, show a corn weeding machine, to which we have not before referred. It is Jurgenson's patent, and consists of a barrel having a number of weeding teeth close together on three bars driven from the axle of the wheels, upon which the whole machine is drawn across the field. The action of the apparatus depends on the fact that, except grass, no weeds will pass between these teeth, though corn blades pass through easily. The weeds are thus pulled up, and the teeth are freed from them, as the barrel upon which they are mounted revolves, by a retractile motion within their sheath.

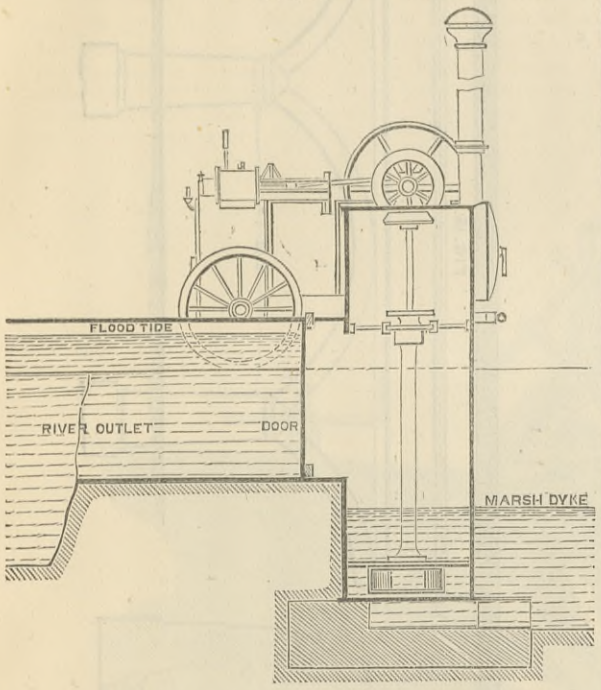
Messrs. Lister and Co. have made a useful addition to bean kibblers. This is a small vibrating sieve in the spout of the kibbler, so that the dust and fine powder from the beans are separated from the large parts of the kibbled beans. This is useful, and avoids some of the objections supposed to attach to giving horses this fine meal with their beans, while the meal so produced is useful in other ways, and is often wanted for fowls and pigs, &c., wherever horses are kept. Bean kibblers if properly made and kept in order, however, did not ought to produce more than a very small percentage of dust.

A simple form of draining plough, to be operated by steam power, is exhibited by Messrs. Knight and Stacey, Harleston. The mole or drain former is attached to a thin coulter-blade, which is connected with a long presser bar. This bar is attached to the fore part of a strong frame on three wheels, and its hinder end terminates in a handle, like a single plough handle. Arrangements are made for lifting the mole by the hauling power, and for regulating the depth.

Messrs. Holmes and Son, of Norwich, amongst other things, have a model of the turbine irrigation pump, shown by the annexed cut, Fig. 7. They have now been erected of

various sizes, capable of raising and delivering from 6000 to 15,000 gallons per minute, at lifts from 5ft. to 17ft., and are working by wind power and steam, both portable and fixed engines. They are made with iron cases, and are then easily fixed, and may be got to work in a few hours. The

FIG. 6.



above woodcut illustrates the turbine pump, as driven by an ordinary portable steam engine direct from the crank shaft; but they may of course be made to drive by a pulley and strap from fly-wheel. As shown above, the engine is connected by a tumbling shaft.

A new article of manufacture is shown by Mr. James Coultas, Grantham, consisting of a fan and drying chamber, for drying grain and seeds by forcing cold air through it at a considerable pressure. This apparatus also carries out a suggestion made in our impression of the 19th of August last, which described a system of stacking hay when green and wet, and corn when wet, and drying it without danger of heating, namely, that some agricultural engineers should take up the manufacture of the necessary fan and pipes for artificially drying hay and corn got up and stacked when nearly green or very wet.

THE LIMITS TO SPEED.

By PROFESSOR OSBORNE REYNOLDS, M.A., F.R.S

No. III.

ALTHOUGH vibration is one of the greatest and most common difficulties with which engineers have to contend, it is, perhaps, of all mechanical phenomena least understood. It does not appear to have been made the subject of any treatise, or to have a place in works which treat of applied mechanics. This has doubtless arisen from the great apparent diversity in the circumstances under which it occurs. The mechanical principles involved are sufficiently well understood by natural philosophers; but they have not been applied to the practical questions. Such an application is, however, not only possible, but the general circumstances on which vibrations depend may be apprehended without the aid of mathematical symbols. In fact an unconscious apprehension of the principles of vibration is one of the earliest lessons which children learn. The act of swinging in a child's swing requires such a knowledge, and this whether swinging oneself by motion in the swing, or swinging another by pushing the swing. And the same may be said of shaking an apple tree. The act of shaking a tree does not consist simply in exerting a force first in one direction and then in the opposite. One might do this, exerting many times the force necessary, if properly applied, to bring not only the apples but the leaves off the trees, without bringing down a single apple. What is required besides the alternating force is that the alternations should be timed right. This timing of the alternations in the direction of the force we exert comes naturally when we are trying to shake an object; for naturally we follow the object in its motion; indeed it is difficult to avoid doing this. But if, instead of shaking the tree by muscular exertion, we were to arrange a steam engine to shake it, then we should at once perceive that there was only one particular speed of the engine at which the tree would shake. The general phenomenon, the apprehension of which has been wanting to the understanding of the circumstances on which vibration depends, is that the discovery of which led Hooke to perceive the mechanical law which bears his name—"*ut extenso sic vis*"—and also led him to construct a watch after the present method. This phenomena is that a fixed object will, when set in motion to a greater or less degree, continue to rock in a particular direction, with a particular, and only with that particular, rate of oscillation. This is no less true of ships, bridges, and parts of machines, than of apple trees, tuning-forks, and the balance-wheels of watches. We say continue to rock; but it is not meant that it will continue for ever, or for any great length of time. The motion will gradually diminish, according to the resistance encountered from the air and the imperfect elasticity of the structure.

The rate at which a structure will rock depends on two circumstances—the stiffness of the attachments by the bending of which the rocking takes place, and the magnitude and distribution of the weight to be rocked. In the case of short, stiff objects, like the prongs of a tuning-fork, the vibrations may amount to hundreds per second; whereas in the case of trees, ships, bridges, or steam engines, they are often as low as two or three per second, or even one in two or three seconds.

The period in which a body will continue to rock in any manner may be called its period of free vibration for that manner of rocking; and having recognised the general existence of such periods of free vibration, a general view of the circumstances under which dangerous vibrations are likely to occur is not difficult. Were it not for the decadence of the free vibration when once set up, owing to such causes as have been already mentioned, then it is obvious that if to the swing already attained a small addition were made, the increased swing would continue, and by continually adding fresh swings, however small, the swing must eventually increase until some limit was reached. Thus, one child swinging another, if there were no retardation, would, if it continued to impart a push, however slight, each time the swing passed, eventually send the swing completely round. As it is, however, owing to the retardation arising from the resistance of the air and the stiffness of the ropes, the work done by the swinger only just balances the energy lost, and so only maintains the speed; the greater the speed the greater the work spent in retardation, and hence the greater the exertion on the part of the swinger necessary to maintain it. Now, the theory of all steady vibration is the same; whatever may be its nature, there must always be something to act the part of the swinger, and by well-timed acceleration make good the necessary loss. In order that the extent of vibration may be constant, the added velocity must be exactly what is lost; if it be too great the amplitude will increase, or too small, diminish. There are several things which may thus act the part of the swinger—any reciprocating or revolving weight, any periodic force, such as may arise from the intermittent pressure of steam on the piston, or a periodic motion, such as is caused by the wheels of a carriage running over the setts on the street or the sleepers on a railway; in fact, any periodic disturbance. But as a matter of fact, such disturbances have always a fixed period, and as the body will only oscillate in a fixed period, it is only in case the period of the disturbance exactly fitting the period of vibration that this vibration can be steady, and this rarely or never happens. What really happens is that the period of disturbance approximates more or less to the period of vibration, and in order to understand the theory of vibrations under consideration it is necessary to consider how a difference in the periods influences the vibration. The swing will enable us to do this. Suppose the period of the swing to be two seconds, and suppose that the swinger pulls a rope every 2·05 seconds; the first pull will set the swing in motion a little; in the second swing the pull will come a little late, but still before the forward motion has ceased, which will be ·5 second from the start. The second pull will therefore accelerate the motion, and so will the eight succeeding pulls. After this, however, the pull will come on the backward motion and exercise a retarding effect, and by the time ten such pulls have been given the retarding effect will have just balanced the previous accelerating effect, and all motion will have ceased. We see, then, that the result would be waves of vibration, ten effective pulls, and as much motion as these would impart, and then ten retarding pulls, destroying the motion. The number of effective pulls clearly depends on the approximation of the period of the pulls to that of the swing. If these had been only ·01 second difference, then we should have had fifty effective pulls and a corresponding motion. The magnitude of the motion attained will thus depend on two things—the magnitude of the desturbing force or pull compared with the weight on the swing, and the number of effective pulls of which the discrepancy of the periods admits, which number will be the whole period divided by four times the difference of the two periods. This result, which is obvious in the case of the swing, is equally true for all classes of vibration. When the period of a disturbing or swinging force differs from the natural period of swing, the result will be batches of oscillations increasing from nothing till they reach a magnitude depending on the magnitude of the disturbing force, and the ratio of the natural period to the difference in the two periods, the number of swings before the maximum is reached being equal to one-fourth this ratio, which will also be the number while the motion is diminishing. It thus appears that if the periods approximate, a comparatively small disturbing force must produce a considerable swinging, while if the difference in the periods is large, then the amount of motion will be confined to that produced by a action of the single disturbance. When this is the case the vibration is called a forced vibration. Of course, when large disturbing forces are allowed, forced vibrations may become important, but this seldom occurs, as large disturbing forces may generally be avoided. Small disturbing forces, however, are almost always present where there is periodic motion, and though the forced vibrations which would result are unimportant, when these, owing to the near coincidence of their period with that of force vibration accumulate, motion of almost any extent may ensue. It is this near coincidence of the period of the disturbance or free vibrations with the period of free vibration which is the condition of danger from vibrations, and the possibility of avoiding the danger lies in the possibility of avoiding this approximate coincidence. This may be attempted in two ways, one by adjusting the period of disturbance, the other by constructing the structure so as to adjust the period of free vibration wide of that of the disturbance. The first of these methods is seldom applicable, for the period of disturbance is generally determined by the speed of revolution of some part of the machinery, and which speed must vary between nothing and the highest which the limit arising from vibration or some other cause will allow. It is, therefore, to the construction of the structure that we must look, in order to prevent the period of disturbance from reaching that of free vibration The period of free vibration in any structure may, and generally will, be different for different directions of rocking, even when the structure rocks as a whole on its supports; and when the structure consists of many parts with more or less elastic connections, all of these parts may have different periods of rocking. Thus each branch of a tree if shaken separately would swing in a different period from the tree as a whole, and each apple in a different period from the branch; so that if we attempt to shake the stem in a wrong period for the whole tree, we shall probably succeed in shaking some branch.

Without going too deeply into the mechanics of the subject, we may look on a structure or a part of a structure as a solid mass on elastic supports; and then there will be in all six independent ways in which it can vibrate or swing, all of which may have different periods. There will be three linear motions—for instance, up and down, north and south, east and west, or in whatever directions these may be, they must be at right angles to each other; and three circular or rotary vibrations about these axes at right angles. Owing to a want of pliancy in the supports perceptible rocking is seldom possible in all these directions. For instance, if we fix a hammer with a long shaft in a vice, pinching the bottom of the shaft with the head upwards, then the head may oscillate in two ways. If the broadest way of the handle be east and west, then the head if set swinging would swing in one period east and west, another north and south, but owing to the rigidity of the shaft there could be no perceptible motion up and down; also the head might have a rotary motion about a vertical axis by twisting the shaft, but the shaft would not allow of the head having any perceptible rotary motion about any horizontal axis. In saying that these are the only three directions of oscillation, it is not meant that the body cannot be set off oscillating in other directions, but that it will not continue to oscillate in other directions if started. In the case of the hammer, the head might be set swinging south-east, but it would then change its manner of swing until it moved in a circle, such a motion being equivalent to two motions in conjunction, one north and south, the other west and east, which would have different periods, and so the corresponding phases would change.

These distinct periods, which are easily conceived in the case of the hammer, will exist more or less in all structures. In the locomotive, for instance, the boiler is capable of rocking on its springs, with a lifting up-and-down motion, or with a rolling motion from side to side, or with what is called a bucking motion, one end rising and the other falling; these three motions will have different periods. And to avoid oscillations in these directions it is necessary that these periods should be such as not nearly to coincide with that of the machinery when this is moving fast. But it is not only the rocking of the engine as a whole that has to be considered; every part of the engine will be capable of free periodic motion, and should the period of any forced vibrations rise into coincidence with any of these periods, the part to which it belongs will be in danger. Such a coincidence is only to be avoided when all the free periods are smaller than the period of any disturbing force at the fastest speed of the engine, for since as the engine acquires motion, the period of disturbance gradually diminishes; this must come into coincidence with any period of free vibration which may be greater than that of the period of disturbance when at its smallest. The periods of vibration of any structure may be diminished by increasing its stiffness, or the stiffness of its supports or attachments, but there is a limit to the stiffness possible, so that the structure may fulfil its functions. For instance the springs of the locomotive have to allow the wheels to adapt themselves to the inequalities of the road, and if they are too stiff they will fail to do this.

In this way it is seen that there must be a limit to the possible smallness of the period of free vibration of the structure and its parts, and hence to the speed of the structure, on which the smallness of the period of disturbance will depend. The stiffness of structures has for the most part been determined by experience, and any further extensions of speeds will require increased stiffness, and this throughout the structure; for in any complex structure, such as a locomotive or a railway carriage, there are so many parts of which the free periods are small—the floor, roof, the sides, seats, and partitions—that as the period of disturbance becomes smaller, nothing but a general stiffening of the entire structure will prevent destructive vibrations. Doubtless the parts may be made stiffer than they are—and this without materially increasing their weight—which would call in other limits to speed. Much has been done of late years, imperfectly as the theory has been understood. This is very apparent when we compare the smoothness of the motion of one of the present northern express trains with what it was some few years ago. The carriages are, however, only stiffened up to the normal speeds, any excess of speed becoming apparent by the tremour or vibration which ensues; and even at the normal speeds there is room for further improvement, in the accomplishment of which careful attention to the foregoing considerations should be of the greatest use.

TENDERS.

LEEDS.—For further works in the erection of stores, cellars, &c., for Messrs. Wright Bros., at their new brewery, Leeds. Messrs. Davison, Inskipp, and Mackenzie, consulting engineers, 62, Leadenhall-street, E.C.

	£	s.	d.
Messrs. Boothman and Son	915	0	0
Messrs. Irwin and Co.—accepted	855	0	0

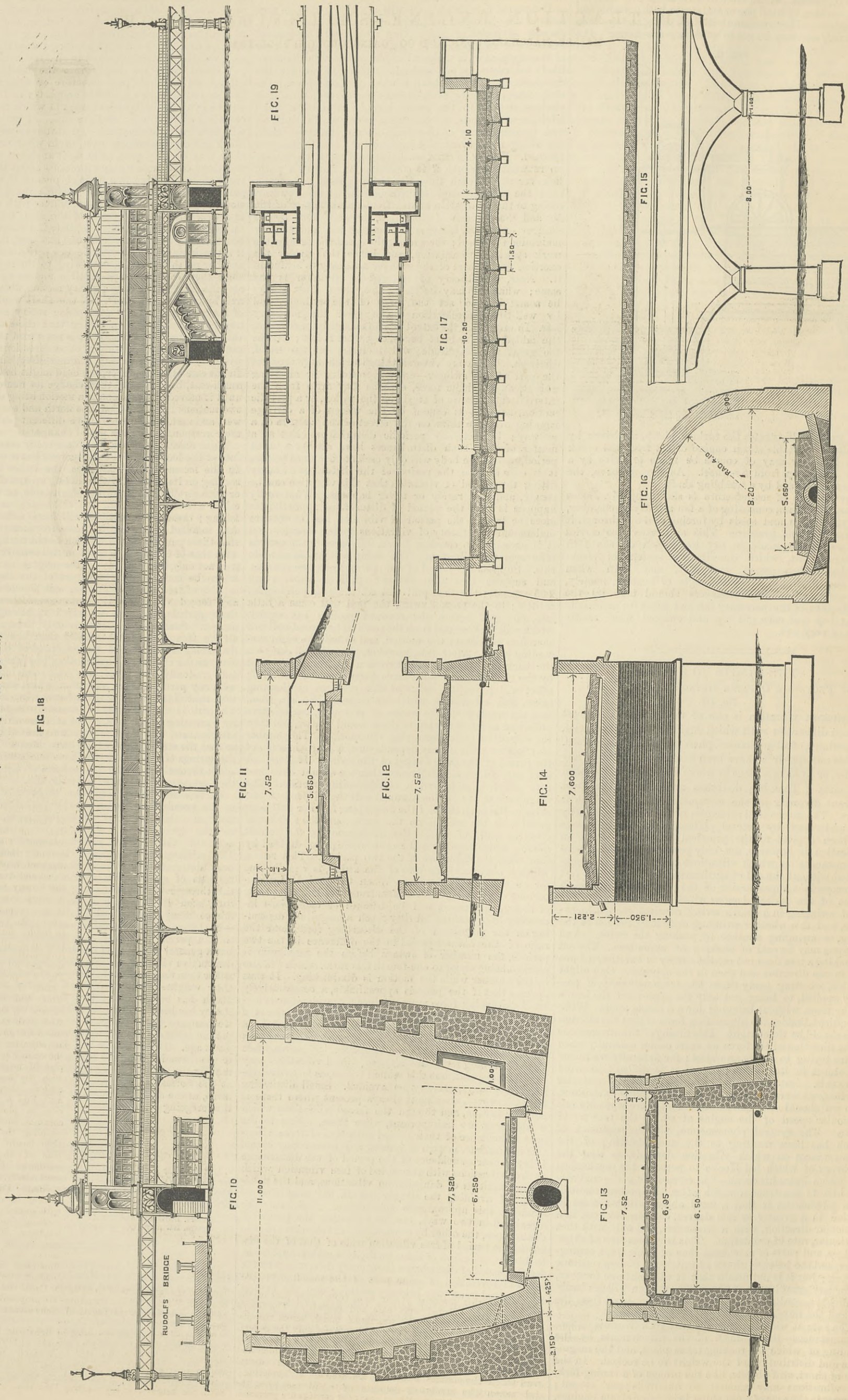
COWPER STOVES.—Referring to the new furnaces of the Holwell Iron Company, near Melton Mowbray, we find that Cowper stoves will be used to heat the blast, and not Whitwell, as we stated in our issue of last week.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Dec. 3rd, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 10,308; mercantile marine, building materials, and other collections, 3691. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 2421; mercantile marine, building materials, and other collections, 209. Total, 16,629. Average of corresponding week in former years, 12,329. Total from the opening of the Museum, 20,530,682.

THE VIENNA CIRCULAR RAILWAY

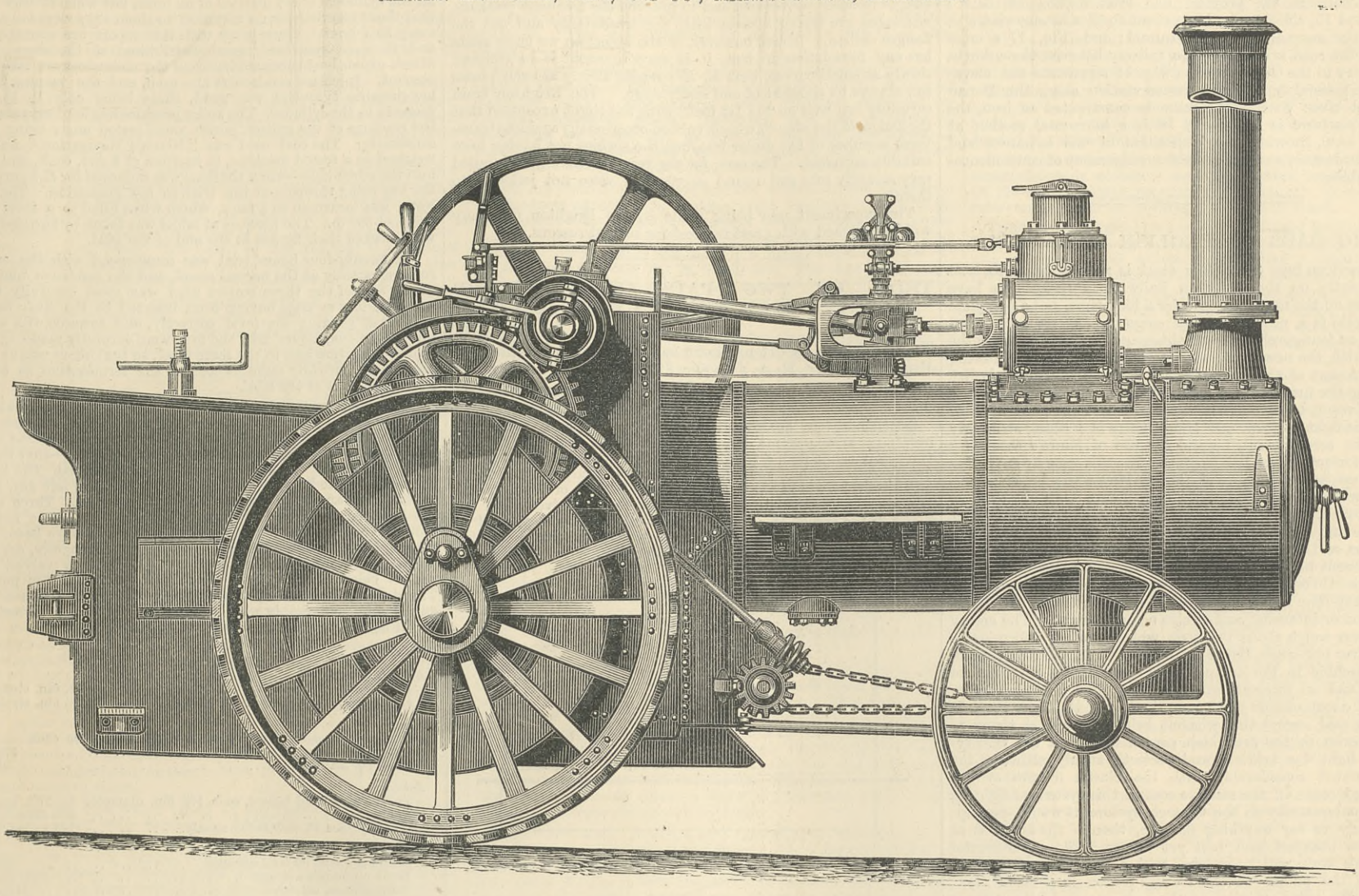
MR. J. FOGARTY, M.I.C.E., WESTMINSTER, ENGINEER

(*For description see page 419.*)



8-H.P. TRACTION ENGINE.—SMITHFIELD SHOW.

MESSRS. MARSHALL, SONS, AND CO., GAINSBOROUGH, ENGINEERS



THE VIENNA CIRCULAR RAILWAY.

No. II.

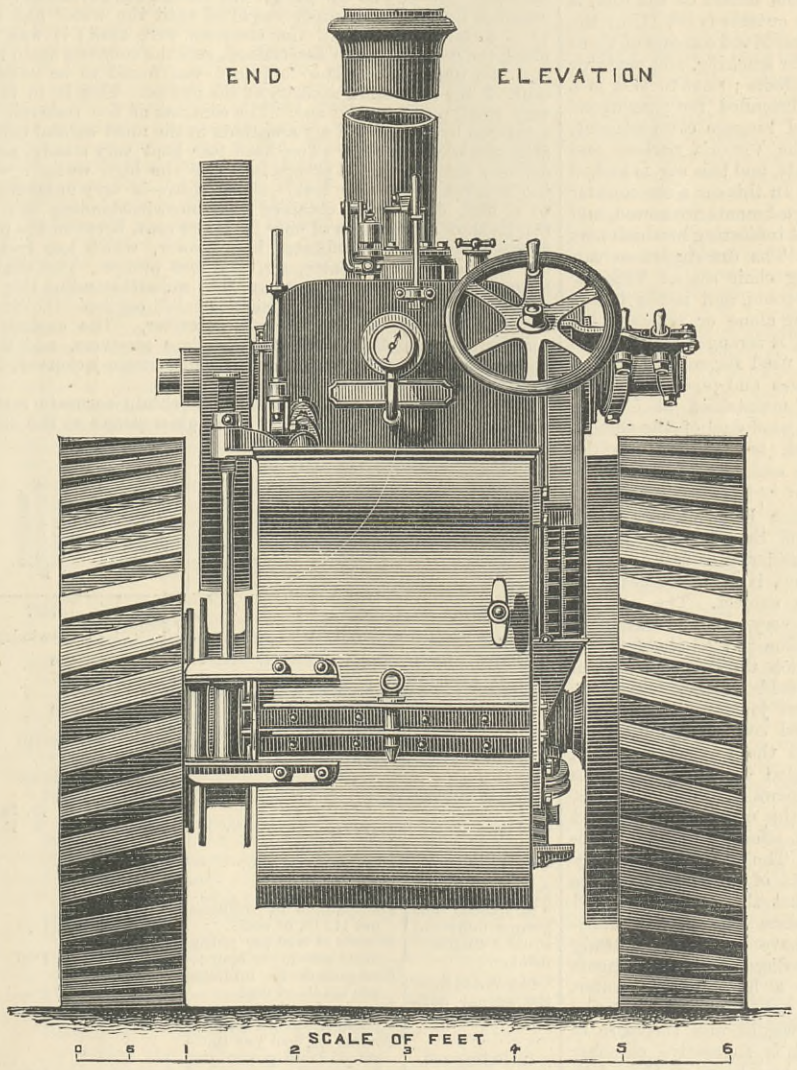
THE total length of the Ring Railway, of which a preliminary notice appeared in our last impression, is 12·844 kil., and is projected as follows :—Kil. 7·572 on viaduct supported on iron columns; kil. 0·816 on viaduct in masonry; kil. 3·243 in cutting with retaining walls; kil. 0·470 in bank with retaining walls; kil. 0·449 in tunnel; kil. 0·085 in covered cutting; kil. 0·209 on the level. There are in the above nineteen stations, fifteen of which are elevated and four sunk.

The following junctions are made with the several railways entering Vienna : (1) A branch line with double junction from the neighbourhood of zero of the main circuit running up straight along the right bank of the Danube Canal to join the Franz Josef's Railway in the direction of Nussdorf. The length of this branch is about 1·930 kil. (2) A branch with double junction, crossing the Danube Canal, from kil. 0·300 of the main circuit, to form a junction with the Nord-West Railway on the one hand, and the Nord Railway on the other, with a short branch to the military stores or Verpflegs magazine in the Leopoldstadt. The total length of these three branches is about 2·600 kil. (3) A branch line with double junction at the northern end of the projected Aspern Station in the immediate neighbourhood of the Aspern Bridge and Ringstrasse, across the Danube Canal to join the Nord Railway at its terminus, and to provide a station for the immense traffic to the Prater; about 1·400 kil. long. (4) A branch line from the southern end of the Aspern Station in the direction of the so-called Verbindungsbahn, to form a junction with the same, and by means of it, with the Wien Asfang Railway running to the Central Cemetery, with the Imperial Arsenal near the States Railway, with the State Railway itself, and with the Southern Railway or Sudbahn. The total length of these branches is about 2·400 kil. (5) A branch line with double junction from the Slaughterhouse Station at kil. 7, to join the Southern Railway at Meidling Station, the first station out of Vienna. The length of this line is about 2·246 kil. (6) A branch line with double junction from the west end of the Slaughterhouse Station, running along the left bank of the river Wien as far as the Lobkowitz Bridge, and then turning in a north-westerly direction to join the K. K. Kaisern Elizabeth Railway at Penzing, the first station outside Vienna; and (7) a branch line from the neighbourhood of the Lobkowitz Bridge, along the left bank of the river Wien to Schönbrunn and Hiezing. The lotal length of these two branches is about 4·990 kil. Therefore the total length of the network of main circuit and branches, exclusive of a piece of the Verbindings Railway, over which running powers will have to be obtained, or a parallel piece of line constructed, is about 28½ kilometres, or 17¾ miles.

From the above description of the branches it will be seen that every railway terminating in Vienna will be brought into communication, not only with the central station but also with all the other railways; and that each company will in addition to their terminus have nineteen stations in the periphery of the city, each of which more or less will answer the same purpose as the existing termini. Every part of the town within reasonable distance of the main circuit will in like manner be connected with all the other districts, and at the same time with all the railways.

By this means the city of Vienna will be directly or indirectly connected with every railway system in Austria. The importance of this, not only to the capital itself, but to the empire generally, from a strategical point of view, has recommended the scheme especially to the military authorities. The last great struggles in Europe have shown that the modern tactics of war are for the victor of the first great battle to march direct on the capital of the vanquished, and the safety of the latter can only be assured by a system of railways that will facilitate the concentration of troops from all parts of the empire at the shortest notice. The strategical position of Vienna, the central depôt of a vast military organisation, will thus be enormously improved. The arsenal and military storehouse, now almost isolated because dependent on extraneous means of transport for the removal of material, will be directly connected one with the other and with every railway in Vienna. The mobilisation and expedition of troops and other material of war to or from every part of the empire will be effected with ease and despatch. The troops themselves will be spared the wearisome march across the city from station to station, and the inhabitants not only the general annoyances and hindrances to traffic invariably occasioned by the blocking of the thoroughfares by large masses of men and the trains of vehicles accompanying them, but the special personal inconveniences attending the system of "billeting." The necessity for this tax on the inhabitants will cease when the means of direct transport without change of carriage are provided. Neither fortifications nor earthworks, neither individual bravery nor collective patriotism, are of any avail against the rapid concentration of troops, and the defence of a city or its fall will in future depend on the presence or absence of the means to throw with greater rapidity than the besiegers fresh supports on the points of attack. The maximum gradient is 1 in 60, the minimum radius 200 met., or about 10 chains. The method of construction and special treatment of certain parts of the line are shown in the accompanying drawings. Fig. 1, page 400, is a cross section of a span of 60ft., in which the cross girders are carried on the top of the main girders, where no roads have to be crossed, to shorten as much as possible the length of the columns. The nature of the ground throughout in the neighbourhood of the Danube Canal and river Wien is such that costly foundations will in every case be necessary. It is proposed, in places where the foundations will be hidden entirely below the present or altered surface to sink shafts, timber them inside and fill up with beton. Fig. 2 represents the cross section of an opening of the same span with the upper surface of the cross girders flush with the top flange of the main girder. Fig. 3 is an elevation of structure as shown in Fig. 2. Fig. 4 is a plan of the platform of road, with the position of cross girders, sleepers, planking, &c. Fig. 5 is a cross section in plan through the columns, showing method of coupling the same at half their height. Fig. 5A is a plan of the base of the columns. Fig. 6 shows a cross section of an 80ft. opening. Fig. 7 is a cross section of a 60ft. opening with special cross girders for crossing roads of a mean headway. Fig. 8 is an elevation of the 60ft. span as shown in Fig 8. Fig. 9 illustrates the ornamental viaduct over the Stubenring between the right bank of the Danube Canal and the left bank of the river Wien. Similar structures are proposed at the crossings of the approaches to the Tegethoff, Schwazenberg and Elizabeth Bridges.

The main girders are concealed by light cast iron ornamental arches to harmonise as much as possible with the neighbouring structures and to render the unavoidable crossing of such important streets rather an architectural improvement than otherwise. The main span of this viaduct, slightly on the skew, is 80ft., the height over the roadway 16ft. 10in.



MESSRS. MARSHALL'S TRACTION ENGINE.

Fig. 10 represents a cross section of the cutting in the Gürtelstrasse at its deepest point, with provision for the drainage &c.; Fig. 11 a cross section of the same at its shallowest depth; Figs. 12 and 13, cross section of embankment between retaining walls at the greatest and least depths of bank; Figs. 14 and 15, elevation and cross section of masonry viaduct; Fig. 16, the normal profile of tunnel; and Fig. 17 a cross section of the road bridges over the railway between the suburbs and the city in the Gürtelstrasse; Fig. 18 represents the elevation of the general type of an elevated station along the Donau Canal and river Wien. The same is constructed of iron, the width of platform is 16ft.; Fig. 19 is a horizontal section at platform level, showing the disposition of the entrances and exits by staircases, and the general arrangement of conveniences for the public.

LONG CARS ON ENGLISH RAILWAYS.

The American long car rolling stock is now fairly on its trial in this country on the Brighton Railway. Pulman cars have been in use on the northern lines for a long time, but a complete long car train is a novelty in this country. As we mentioned last week, an inaugural trip to Brighton and back was made on the 1st inst. with the new train, a large number of gentlemen being invited. A part of the interest which centres in this train is due to its being the first that has been fitted throughout with electric lamps. Except, however, that this is the first extensive application of this light in passenger trains, there is nothing strikingly novel in the arrangement, beyond the use of Faure's secondary batteries for providing the current. In this case twenty-nine Edison lamps take the place of the oil lamps, the brackets provided for which are utilised, and eighty Faure accumulators, as they are called, are ranged in two batteries of forty on either side of the luggage compartment in one of the cars. In going to Brighton on the 1st, thirty of the accumulators were coupled up, the current being turned on to the lamps for passing through the tunnels. On coming back sixty-eight of the accumulators were in use, thirty-four being connected in series to obtain the necessary tension or intensity, and twelve being reserved. The eighty accumulators weigh about two tons, which is rather a formidable addition over one bogie, but it is proposed to fix a small dynamo-electric machine in the compartment to be driven from one of the axles and an intermediate shaft, and then a much smaller number of accumulators will be required. Of the light there is little to be said, except that without being in the least tiring to the eyes, even in the car which contained ten of the twenty-nine, the light was brilliant and perfectly steady, although the lamps vibrated considerably with the elastic flexure of the supporting stem. Of the relative cost of this system of lighting and an equal quantity on the Pintsch system, it would perhaps be too early to say anything definite, though the latter is at present the cheapest and best yet in use. The experimental trial of this train will be watched with a good deal of interest, both from the public convenience and patronage point of view, and from the point of view of the company and the carriage superintendent. The cars have been made in America, by the Pulman Palace Car Company, with the exception of the wheels and axles, which were made at the Brighton Works, and are fitted with the Westinghouse brakes. The cars are four in number, named respectively Maud, Victoria, Beatrice, Louise. Each car is 58ft. 5in. in length, from the outside of the platforms, making the total length of the train 233ft. 8in.; the height of each car, from the top of the rail to the centre of the roof, is 13ft. 2in., and the width at the eaves outside is 8ft 11in.; the height of the gangway being 6ft. The car Maud consists of three compartments, the largest of which is for smoking, and contains twenty-two stationary seats and four chairs; next to this is a compartment holding six persons, and intended for passengers' servants; beyond this is the guard and luggage compartment, in which are the Faure batteries. The Victoria parlour and restaurant car contains twenty-eight seats, and this car is looked upon as the head-quarters of the train. In this car a bar counter has been provided, from which light refreshments are served, and electrical discs are fitted here with a bell indicating in which part of the train the attendant is required. The drawing-room car, Beatrice, contains twenty-one revolving chair seats. This car contains a ladies' boudoir and dressing-room, and is the ladies' car. It is to be used by ladies travelling alone or accompanied by gentlemen. The parlour car, Louise, is arranged similarly to the Maud, except that it will not be used for smoking. The train is heated by Baker hot water stoves and pipes, by which the temperature of the cars may be maintained at 58 deg. Velvet is used in the upholstery, and a good deal of the characteristic cabinet and upholstery finish is lavished on the interiors, but it is not the same style which marks the well-designed quiet English carriage.

The relative merits of the American long open-car with avenue from end to end of the train, and the English carriage system, have received so much consideration from public safety and prejudice points of view, that it is unnecessary to say anything in these columns on the subject. The comfort obtainable in cars on either system is very much a matter of opinion, and depends again on the value put on the freedom of movement from place to place, which the long car system gives, as well as upon the comfort in cold weather, which the heating arrangements secure. For short journeys Englishmen will probably long prefer the wide-seated comfortable carriages at present in use on our best lines, and the privacy of these; but as to privacy we shall probably be glad to give that up, as we have done in removing the old high pews from our churches. There is, perhaps, a little to be said on the question of comfort from another point of view, namely, as affected by the movements of the cars on the two systems. The old comparatively short cars rock or roll with movements of short range. The inertia of the long heavy cars is such that the movements and shocks of preponderating intensity and direction only are transmitted to the car, and hence the cars have a somewhat steady rolling motion occasionally causing some discomfort to passengers easily affected by the movements of a boat on the water. Persons so easily affected are, however, not numerous, but the fact that these long cars are of great weight, and therefore of great inertia of either motion or rest, is suggestive of other reflections as to the possible effect this may have on the safety of their running. A car with so heavy a body will tend to continue its course in opposition to the movement of its leading bogie when that enters a sharp curve, for instance, with much greater persistence than the shorter and very much lighter English carriage, and in this way a strong tendency may be set up to cause the leading bogie to leave the track, especially at crossings. We should not like to say that the heavy long car is especially liable to this, but we are reminded that a very large proportion of all the train accidents in America are derailments, which cannot be explained as resulting from any of the usual causes, such as misplaced switch, broken rails, wheels, axles, or couplings, broken bridges, spreading of gauge, accidental obstructions, cattle, or malicious. There were, for instance, no less than thirty-four unexplainable derailments during the month of October last, and more than that number from causes which were ascertained. American master car builders, moreover, find it necessary to pay great attention to the flanges of their car wheels, and to prevent the frequent breakage of flanges are trying wheels with the treads only and not the flanges chilled. Even, however, if the objection we have made has any foundation in fact, it is easy to avoid it by running slowly at small curves, that is, if running slowly at such places can always be thought of and easily done. The Brighton train certainly ran well on the 1st inst., with the slight exception that the flanges of the Maud's wheels rubbed occasionally against a transverse member of the under framing, the springs not having been suitably adjusted. The cars, for the reasons above given, sailed very steadily into and round curves, and were not jerked into them.

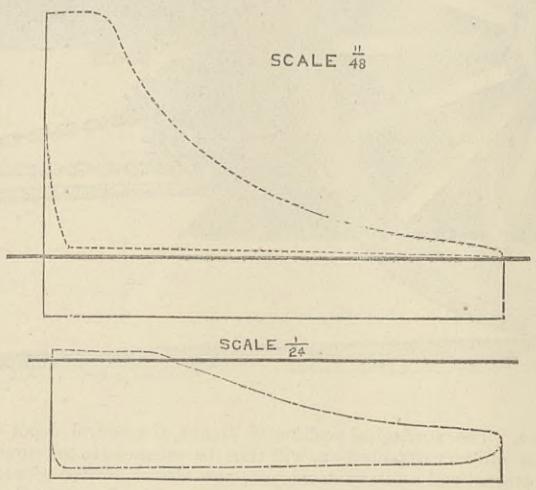
The experiment now being made by the Brighton Company will be watched with great interest for several reasons.

TRIAL OF TWO PAIRS OF COMPOUND ROTATIVE BEAM ENGINES WITH LOW LIFT PUMPS.

The following report has been sent to Messrs. Simpson, of Pimlico, by Mr. E. A. Cowper, C.E.

6, Great George-street, Westminster, S.W.,
30th November, 1881.

Gentlemen,—In accordance with your request, I made the necessary arrangements for, and on the 7th and 8th October personally conducted, a trial of twenty-four hours' duration of the machinery, which was designed, manufactured, and lately set to work by you at the Ditton Pumping Station of the Lambeth Waterworks Company, and I append the results arrived at in the tables at the end of this report. These engines are employed in lifting water some 35ft. high into a reservoir, from which the water flows by gravitation on to the filter beds.



The trial was most carefully carried out by myself and assistants, and I take this opportunity of expressing my best thanks to Mr. John Taylor, Mem. Inst. C.E., and his staff for the assistance they rendered. The slip on the pumps was ascertained as follows:—The reservoir being at first empty was filled until the water had risen to a certain mark, when the counters were read; it was then filled, the depth of water ascertained, and the counters again read, and the quantity of water delivered was found to be 94·04 per cent. of the theoretical capacity of the pumps. This is, in fact, a very small percentage of loss. The contents of the reservoir was measured by myself and my assistants in the most careful manner after the trial was over. The head was kept very steady, as the delivery outlet from the pumps is above the high water level in the reservoir. The low level—about 35ft.—is very unfavourable to a high duty being obtained; but notwithstanding this, the results show a difference of only 27·24 per cent. between the pump horse-power and the indicated horse-power, which loss includes the work of the cold water, air, and feed pumps. The engines, however, work with such economy, that notwithstanding this loss—which is less than exists in most low lift engines—the duty is very satisfactory, as will be seen hereafter. The engines are compound beam fitted with intermediate receivers, and these, together with the cylinders, are thoroughly steam-jacketted, tops, bottoms, and sides with boiler steam.

Every possible precaution was taken to obtain accurate results, counters were on both pairs of engines, glass gauges on the stand-pipes just outside the house, and efficient means for measuring the depth of water in the pump well. The indicators used were two "Richards" and two "Darkes," all of which were tested after the trial by me, and found correct. Diagrams were at first taken off all the cylinders every quarter of an hour, but when it was found that there was little or no variation in them they were only taken every half hour. Those given with this report are average ones, and show a remarkably good distribution of the steam, about fifteen expansions being made, when the clearances are taken into account. Injection condensers are used, and the vacuum in the low-pressure cylinders was good, there being only 1¾ lb. back pressure in the cylinder. The boiler pressure was kept very steady—the readings of the gauges, which were tested ones, being taken constantly. The coal used was "Nixon's Navigation," and was weighed on a tested machine, in barrows of 3 cwt. each, and taken into the stoke-hole—when the door was unlocked for the purpose—the key being throughout the trial in my possession. The feed-water was measured in a tank, which when filled to a level mark weighed 396 lb. The number of tanks was taken by two observers, who checked their figures at the end of the trial.

The twenty-four hours' trial was commenced with the engines running exactly at the normal speed, and the condition and level of the fires of the three boilers used was most carefully taken, several bricks on edge having been inserted in the fires for the purpose of gauging the level correctly, and towards the end of the twenty-four hours' trial the fires were carefully made up to a similar condition and to the same level, so that there was as much burnt and partially unburnt coal at the termination as at the commencement of the trial.

The engines were not stopped at the end of the trial, but were kept running at their normal speed for some time, no more coal being required to keep up the speed than during the course of the trial, thus proving—if further proof were necessary—that the condition and size of the fires had been correctly judged. The level of the water in the boilers was accurately taken, and left ⅛in. higher at the end than at the commencement of the trial. Three single-flued ordinary Cornish boilers were used, but they were not provided with such good furnace bars as they might have been. The pumps, of which there are four to each pair of engines, are plain plungers with air vessels over each set of delivery valves, these vessels being charged by a special air pump for the purpose. The delivery is in an open stand-pipe outside the house. The valves work remarkably well, and the engines can be driven very fast if desired without any inconvenience or danger.

Dimensions, &c.,

Engines:—
- High-pressure cylinders .. 21in. diameter by 5ft. 6in. stroke.
- Low-pressure cylinders .. .. 36in. ,, ,, 5ft. 6in. stroke.

Pumps:—
- Diameter of main pumps, of which there are two to each engine, or four to each pair .. .. 27in.
- Stroke of main pumps .. .. 4ft.

Boilers:—
- Three single-flued boilers, each 5ft. 6in. diameter by 27ft. long.
- Flue .. .. 3ft. diameter.
- Grate surface in each boiler equals.. .. .. .. 17½ square ft.

Observations:—
- Steam pressure on trial average .. .. 60lb.
- Head on pumps average .. .. 35ft. 1½in.
- Temperature, injection .. .. 51 deg.
- ,, air pump discharge .. .. 82 deg.
- ,, feed pump delivery .. .. 81 deg.
- Average number of revolutions per minute for each engine 22
- Barometer.. .. .. 30·26in.

Results:—
- Total indicated horse-power of the two pairs of engines .. .. 240·119 H.P.
- Horse-power of the water actually delivered (as measured in the reservoir) .. .. 174·71 H.P.
- Or a difference of .. .. 27·24 per cent.
- Measured quantity of water delivered by the pumps equalled 94·04 per cent. of their theoretic capacity.
- Coal used per indicated horse-power per hour including the ashes .. .. 1·6049 lb.
- Coal used per horse-power of water delivered per hour including the ashes .. .. 2·2057 lb.
- The duty of 112 lb., of coal including ashes .. .. 100,539,103 foot-pounds.
- Water fed into boilers per indicated horse-power per hour .. .. 13·397 lb.
- Water evaporated per lb. of coal including ashes .. .. 8·347 lb.
- In addition to this, the coal supplied the heat given up by the steam jackets, which was not measured on this trial as the jacket drain returned the water to the boiler.
- Coals burnt per square foot of grate per hour .. .. .. 7·136 lb.

I remain gentlemen, Yours very truly,

(Signed) E. A. Cowper.

Messrs. Simpson and Co., Engine Works,
Grosvenor-road, Pimlico, London, S.W.

Messrs. Simpson have furnished us with the following table, showing the performance of other engines made by them:—

	Chelsea Waterworks, Kingston.	Chelsea Waterworks, Kingston.	Berlin Waterworks, Berlin.	Fried. Krupp's Waterworks, Essen.	Bristol Waterworks, Clifton Extension.	East London Waterworks, Lea Bridge.	Lambeth Waterworks, Ditton; Filter engines.	Chatham Waterworks; Deep-well pumps.
Date of trial	1857	1867	1869	1877	1880	1880	1881	1881
Engineer who conducted the trial	Joshua Field.	T. Hawksley.	H. Gill.	Rühlmann and Kley.	J. Taylor.	G. Seaton.	J. Taylor.	J. Taylor.
Indicated horse-power..	—	306	—	136·47	235	185·647	238·77	69·57
Pump horse-power	—	247	120·66	*108·57	196·76	157	*172·011	55·45
Frictional horse power, including air, cold water, feed, and air-charging pumps	—	59	—	27·9	38·24	28·647	66·76	14·12
Efficiency of pumps; $\frac{\text{P. H.P.} \times 100}{\text{I-H.P.}}$	—	80·719	—	79·566	83·728	84·569	72·04	79·704
Duration of trial	hours. 24	h. m. 24 3	hours. 76	hours. 137	h. m. 7 5	hours. 12	h. m. 8 15	hours. 10
Coal used	—	c. qr. lb. 105 2 11	lb. 19,536	lb. 35,409	cwt. 33·29	cwt. 41·5	cwt. 27·25	cwt. 11·9
Description of coal	—	—	—	German.	Welsh.	North-country screenings.	Welsh.	Welsh.
Percentage of ash in coal	—	—	—	14·4	10	—	3·3	·64
Supposing that pumps delivered equal displacement. Foot-pounds in millions per 112 lb. of coal.. ..	103·9	111·35	117·9	—	98·67	90	108·841	92·2
Supposing that pumps delivered equal displacement. Pounds of coal per pump horse-power per hour ..	—	1·99	1·88	—	2·32	2·46	2·056	2·4
Calculated from the actual delivery of pumps. Foot-pounds in millions per 112 lb. of coal.. ..	—	—	112·5	93·6	—	—	103·112	—
Calculated from the actual delivery of pumps. Including ash. Pounds of coal per indicated horse-power per hour	—	—	1·97	2·37	—	—	2·15	—
Calculated from the actual delivery of pumps. Excluding ash. Pounds of coal per indicated horse-power per hour	—	1·61	—	1·89	1·94	2·08	1·55	1·92
	—	—	—	1·62	1·75	—	1·50	1·91

* This H.P. is calulated from the measured quantity delivered.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—James M'Gough, chief engineer, to the Monarch, vice Holloway, the appointment of T. J. Gissing having been cancelled; and George H. Cooke, engineer, to the Asia, additional, for service in the Cyclops, vice Laird.

Raising Sunken Ships.—In our impression for the 4th April, 1879, we gave a full description and illustrations of Messrs. Clark and Standfield's apparatus for raising sunken vessels and their cargoes. Since that some improvements have been made in the apparatus, and on Saturday last a number of gentlemen assembled in the diving pavilion at the Crystal Palace to witness the action of a pair of models of considerable size employed in raising a model ship about 8ft. in length and 2ft. in width. The experiments were successfully carried out, and indicated that the apparatus may be successfully employed in raising vessels in considerable depths of water.

RAILWAY MATTERS.

FROM a recent discussion in Vienna concerning the best office hours for the servants in railway offices, it appears the clerks at some offices begin work at eight in the morning and are dismissed at two in the afternoon.

IT is beginning to be seen that the Inner Circle Railway Completion Company will have to pay so enormously for premises and compensation in Great Tower-street and Eastcheap, that it is possible the estimates may be greatly exceeded.

MAJOR MARINDIN'S report on the Desford accident shows that it resulted from the blowing down of signals on the 14th October, and he gives a list of eighty-eight signals blown down on that day. The report is a long one, and few accidents have caused such damage to rolling stock.

A FEW days ago our daily contemporaries were telling of the bursting of the Beaumont compressed air tramway engine receivers. Nothing of the kind took place. Attached to the receiver end is a pipe and screw-down plug valve for passing the air to the engine. The thread on this plug had a pitch of ⅛in., and it had been screwed down by a long lever. The result of this was that the casing of the plug valve was cracked, and the air pressure subsequently blew a piece out of this and split the pipe attached to it.

THE proposed Esher, Hounslow, and Southall Railway, will have stations close to Sandown Racecourse, Molesey Racecourse, and Kempton Park Racecourse. Each of these stations will be reached by three different South-Western routes, namely: First, by the main line, *viâ* Surbiton; second, *viâ* Hounslow, from Waterloo or Kensington direct; third, by the Windsor line *viâ* Twickenham and the proposed Hanworth Junction, or the Thames Valley line. Messrs. H. Robinson and R. P. Birch are the engineers.

RAILWAY traffic in Germany and Austria has this year been increasing so generally as to leave no doubt as to the revival of business in those countries, the statistics include the nine months ending September last. On the main lines, State as well as private, of Germany, the increase was at the rate of 3½ per cent. On the lines running through Austria and Hungary the increase was 6 per cent.; but the mileage of these lines had also extended 6·9 per cent. The purely Austrian railways showed an increase of 4 per cent., while the length of mileage has extended 2·9 per cent. The earnings of the purely Hungarian lines showed an increase of 5 per cent., while the mileage increased 3·9 per cent.

THE St. Paul *Pioneer Press* reports that "President Villard, of the Northern Pacific, has recently completed a contract with Thomas L. Edison, for the construction of fifty miles of railroad in Minnesota during the next year, upon which Mr. Edison is to test the efficiency of his electrical engines as a motive power for railroads. It is stated that Villard agrees to pay Edison a stipulated sum for the entire road if the new power works satisfactorily, and the latter will be backed in his novel enterprise by capitalists abundantly able and willing to risk large amounts in making an experiment of the entire success of which the inventor seems entirely confident and certain." We have no knowledge of this except as given above.

OF the 969 tires which failed on our railways during the nine months ending 30th September, 50 were engine tires, 32 were tender tires, 6 were carriage tires, 44 were van tires, and 837 were wagon tires; of the wagons, 684 belonged to owners other than the railway companies; 739 tires were made of iron and 230 of steel; 33 of the tires were fastened to their wheels by Gibson's patent method, 19 by Beattie's patent, 12 by Mansell's patent, 34 by Drummond's patent, all of which remained on their wheels when they failed; 852 tires were fastened to their wheels by bolts or rivets, of which 5 left their wheels when they failed; 19 tires were secured to their wheels by various other methods, none of which left their wheels; 153 tires broke at rivet-holes, 224 in the solid, 6 at the weld, and 616 split longitudinally or bulged.

AT the commencement of last year there were, according to official reports, 5112 miles of railway in operation in Italy, with 1492 locomotives, 4544 passenger ears, and 24,093 freight cars for equipment. Their average earnings per mile, in 1879, were £1232 per mile, the working expenses £756, leaving as net earnings, £476, which is at the rate of 2·5 per cent., nearly, on the capital invested. The earnings from passengers were very nearly as great as the ordinary freight earnings, but a very large amount—nearly an eighth of the total earnings—was from the express and other freight carried on passenger trains; and there were on this system of less than 6000 miles, in the course of the year, 256 collisions and 400 derailments of trains, by which twenty-nine persons were killed and 439 injured.

THE Wisconsin Central Railway Company has made two cheap sleeping cars by converting two ordinary passenger coaches 50ft. long into sleepers. The seats are placed further apart and in pairs. There are ten pairs on one side and eleven on the other, making twenty-one lower berths and no upper ones. The seat-back arms are made about 6in. longer than the ordinary ones, with a notch to hold the backs in their usual position; the arm from the notch to the end is slotted, so that the backs of the two facing seats can be moved 12in. further apart when the bed is to be made up. Rattan seating is stretched over frames the size of the berths. These frames are carried in a closet during the day and laid upon the seats at night and the mattreses spread over them. The mattreses, bedding, and curtains are carried during the day in boxes under and between the pairs of seats, which are placed back to back. The berths are separated by curtains hung from the roof down between the seat-backs, and curtains are, the *National Car Builder* says, hung from rods in front in the usual way.

A VERY useful little time table for all Londoners and those within a radius of about 35 miles, has been published as Murray's "Complete London Time Tables, Diary, and Suburban Railway Guide," by Mr. H. Etherington, 152, Fleet-street. It contains the times of departure of all the trains of all the railways running into or out of London to places within a radius of, say, fifteen miles, and apparently all the principal places within greater distances, as Reading, Rochester, Hastings, Luton, &c. It is only 4¼in. by 2¾in., and about ⅜in. thickness. The fares are also given, and the arrangement of the engine head lights on all metropolitan trains are explained, so that anyone may know as well as the porters, or better, where a train is going as soon as its lights can be seen. Tramway information is also given, and the tables, &c., for different railways are easily distinguishable by being printed on different coloured papers. The information relating to departure of mails and sailing of steamships is of value, but the room occupied by diary pages can hardly be useful. A list of the theatres is also given with the pieces being played at each.

AN American paper gives the following particulars of a bridge which is to be built over a deep ravine near Kinzua, Pa., on the new branch of the New York, Lake Erie, and Western Railway to its coal property in Elk County. Length, 2250ft.; height, 301ft. There are two abutments, forty-four piers, and forty-five spans, twenty-two of 38½ft. each and twenty-three of 61ft. each. The stone foundations, of which there will be two to each pier, excepting the central piers, which will have three, are built in massive form, sunk 10ft. underground, and extending from 10ft. to 15ft. above the surface. There are five sets of 15ft. foundations placed along the water line, as the spring freshets in this section are severe. Near the creek a bed of quicksand was found at a depth of 10ft., and this will necessitate careful work. After the pit is dug to the regular depth, piles 30ft. long will be driven closely together until their heads are level with the floor of the pit. Upon them a flooring of heavy timber will be spiked, and upon this the stone foundation laid. This is rather awkward for piers 300ft. in height. The length of the piers from the abutments to the centre of the ravine will increase rapidly, as the descent is precipitous, being in the steepest places a fall of 22ft. in 60ft. The superstructure of the bridge will be iron, and weigh about 2000 tons.

NOTES AND MEMORANDA.

A PAPER on the electrolysis of water was recently read before the Academie des Sciéncés by M. Tommasi. In decomposing water with a single element, copper wire being used as positive electrode, and platinum wire as negative, the quantity of copper dissolved is greater than the quantity deposited on the negative electrode. This was explained by the thermal theory of electricity.

AT a recent meeting of the Academie des Sciéncés a paper was read by M. Lévy on the numerical application of the theory of maximum yield of two dynamo-electric machines employed for the transmission of power. Referring to a case discussed by M. Deprez, he shows that, by adopting different resistances, he would obtain 10-horse power at 50 kilometres, with a maximum electromotive force of 5356 volts, instead of about 7000.

THE dry distillation of wood and the utilisation and refining of the products appear to be making great headway in Germany. The manufacture of aniline requires large quantities of wood-alcohol, which is now purified much more cheaply and better than hitherto. Acetic acid is now made of a quality not alone sufficient for technical purposes but for table use. The charcoal is compressed into cylindrical blocks weighing about one-tenth of a pound. They are largely used, a contemporary says, for domestic purposes, as they burn without smoke.

IT has been proposed to avert the threatened burial of Elm by the probable fall of one of the peaks, the Risikopf, of the Tschingel Alp, by bombarding it and causing it to fall away from Elm. Unless very large shots can be sent at such a target with slow velocity we should imagine that this bombardment would be just as likely to make the peak fall the way it tends as the other. Since the above was written, we learn from a telegram to the *Times*, that the bombardment has commenced, but the general result was almost *nil*, and, as we expected, very heavy shots are now proposed to be used.

M. MAICHE has found by experiment that sounds from two separate sources can be sent and received simultaneously on one wire. He uses at the receiving station two telephones of different resistances, and at the transmitting station caused a musical box to be set going on a microphone of small resistance, whilst an induction telephone transmitter was spoken into at the same time. The musical sounds were reproduced in the telephone which had the least resistance, and the vocal sounds in the other, so that with the two telephones to the ears the music could be heard by one ear and the speech by the other.

THE coldest place on the earth is Verkovansk, in Siberia, lying in 67½ N. lat., on the river Yana. The lowest mean winter temperature is 48·6 deg. below zero Centigrade. This, then, is the cold pole of the earth in Asia; the corresponding pole in America being to the north-west of the Parry Islands; and the line joining these two places does not pass through the North Pole itself, which is thus, in all probability outside the line of greatest cold. It is noteworthy that Verkovansk, like Yakutsk, is on the mainland, a considerable distance from the Siberian coast, which possesses a comparatively milder climate.

SOME time since it was stated that oxygen was about to be manufactured in Paris by a new cheap method, for distribution to consumers for various purposes, but we have not heard anything more about it. The process was said to be based on the absorption, by baryta, at a certain temperature, of oxygen from the air, and the release of the oxygen by the baryta when heated to a higher temperature. It had been thought that baryta gradually lost its power of absorption; but the Parisian chemists said that they had overcome that difficulty. As, however, nothing seems to be done in the matter, it may be that they have not overcome that difficulty, and we are still to wait for the time when so useful a gas can be cheaply obtained.

AN autodynamic watch or clock has, it is said, been made by Mr. Frederich Ritter, Loessl. It is placed in a closed box, and does not require winding up nor to be moved, no external action being required to keep it going continuously. The watch is kept in motion by variations in atmospheric tension. The motor contains neither mercury nor any other liquid, all the parts of the watch being of solid metal. The watchwork is put in movement by a heavy weight, which remains always the same, and is appended to a roller. The function of the motor is then to provide that this weight, which acts as an accumulator, be kept constantly at the required height. The chain which carries the weight roller is a closed chain, and goes on one side through the watchwork, on the other through a winding-up apparatus, which is regulated by the motor. A compensation pendulum is employed to secure regularity.

THE following are the resolutions relating to electrical standards adopted by the International Congress of Electricians at the sitting of September 22nd, 1881:—(1) For electrical measurements, the fundamental units, the centimetre—for length—the gramme—for mass—and the second—for time—are adopted. (2) The ohm and the volt—for practical measures of resistance and of electromotive force or potential—are to keep their existing definitions, 10^9 for the ohm, and 10^8 for the volt. (3) The ohm is to be represented by a column of mercury of a square millimetre section at the temperature of zero Centigrade. (4) An international commission is to be appointed to determine, for practical purposes, by fresh experiments, the length of a column of mercury of a square millimetre section which is to represent the ohm. (5) The current produced by a volt through an ohm is to be called an Ampère. (6) The quantity of electricity given by an Ampère in a second is to be called a Coulomb. (7) The capacity defined by the condition that a Colcomb charges it to the potential of a volt is to be called a Farad. The adoption of these units for international use is to be preceded by a new and more careful redetermination of the ohm at the hands of the great physicists of all nations. And it is intended that this redetermination shall result in a standard for general adoption. Thus, remarks the president of the Royal Society, electricity will be the first of the practical sciences to be freed from all difficulties due to local standards; and it is to be hoped that this example may be followed in other sciences concerned with practical life.

IN consequence of the burning of a car during the autumn of 1879 on one of the railways in Baden, which was suspected to have been caused by nitric acid, Professor R. Haas, of Carlsruhe, was called upon by the Government to report whether that acid could produce combustion or not. In the experiments made to solve this question, the conditions which might be supposed to exist in freight cars containing nitric acid were imitated as far as possible. Small boxes of a capacity of ten to sixteen quarts were charged with variable proportions of hay, straw, tow, and blotting-paper—all of which substances are used in packing—and placed within larger boxes, while the space between them was filled with hay or tow, to prevent too rapid a radiation of heat, because the experiments were to be conducted in the open air, and the outer box at the same time represented the walls of a railway car. The material contained in the inner box was now saturated with acid, and rather tightly compressed, so that when the cover was put on it was pretty well filled. At first reddish and afterwards whitish vapours were given off, finally a distinct smoke. On lifting the cover strongly glowing patches could be seen, which rapidly increased all through the contents, and which broke out in bright flames on access of free air or gentle fanning. With red fuming acid, or with acid of specific gravity 1·48, these results were obtained very rapidly and within a few minutes. With ordinary acid of specific gravity 1·395, it required somewhat more time, and the action was less energetic in the beginning; but, in three different trials, after about twenty minutes, the same result was finally obtained, provided the *Analyst* says, that the material was packed tightly in the box, and was thoroughly saturated in its successive layers.

MISCELLANEA.

THE new dock at Bo'ness on the Firth was opened on Saturday.

THE Paris municipality has voted 75,000f. for electric light experiments at the Prefecture.

MESSRS. J. H. BURT AND CO., 37, Gracechurch-street, notify their removal to 1a, Laurence Pountney Hill.

WE learn that Mr. C. Graham Smith has been appointed engineer-in-chief to the port of Rangoon, at a salary of £1200 per year, and has left England for that town.

MESSRS. JOHN WALKER AND CO., of Maryborough, Queensland, have sent us a photograph of the launch of the Saurian dredger, built by them. Queensland is thus, to a certain extent, independent of our shipbuilding engineers.

A LARGE number of inventors are busy upon the so-called electric accumulators or secondary batteries, Edison among the number. Of the Brush battery, promised some time ago by some American interviewing reporter, nothing has yet been heard.

THE South Staffordshire Institute of Mining Engineers will soon, in all probability, have a home in Mason's College, Birmingham. The trustees of the college have invited a deputation of the engineers to meet them on the 14th inst. to arrange this.

CONSIDERABLE annoyance, the *Colonies and India* says, has been felt at the discovery that the new hopper barge, recently arrived in the colony for the service of the harbour works, can only carry 350 tons of material, instead of the 500 she was supposed to be designed for.

AT a meeting of the South Staffordshire Institute of Mining Engineers the question of the proposed mutual insurance scheme between masters and men was brought forward. A great deal of interest was shown in the matter, but the necessary documents were not ready for discussion.

THE telephone has been introduced on board the screw steamer Gloucester City, a vessel of 2150 tons gross register, which was launched a few weeks ago by Messrs. Richardson, Duck, and Co., of Stockton-on-Tees. It consists of Hunning's micro-telephone transmitter, and Harrison, Cox-Walker, & Co.'s—Darlington—receiver.

THE Royal Polytechnic Institution, which has recently closed its doors to the public, was put up for sale on Wednesday at the Mart, Tokenhouse-yard, by Messrs. Rushworth, Abbott, and Stevens. A sale was not effected, for after some slow bidding, which opened at £6000, and closed at £10,000, the property was bought in at the reserve price of £15,000.

THE Austrian North-west Shipping Company has concluded arrangements with the Midland and Great Eastern Railway Companies for through and cheap rates of freight between all Austro-Hungarian stations and London and Liverpool. It is proposed in particular to divert the Liverpool and Manchester traffic to Hamburgh and Austria *viâ* Harwich, and with this object an arrangement has been effected between the Midland and Great Eastern Companies, as well as between those companies and the Austrian Company.

WELL-FINISHED catalogues increase in number, and our ideas as to the number of different designs of hand-pumps has materially altered since our receipt of a catalogue from Messrs. Joseph Evans and Sons, Wolverhampton. The catalogue also illustrates several other kinds of pumps, such as direct-acting and hydraulic pressure pumps, pump fittings. The number of what we might call domestic pumps is such as to make choice seem a difficulty. Good and complete as the catalogue is, however, purchasers might be assisted if a few more sectional drawings were given.

THE report of Major Ford, her Majesty's inspector of explosives, on the fatal explosion in a small firework factory in Birmingham, gives the principal evidence in the case, which shows that the cause of the explosion was the employment, by one of the women operatives, of a small rusty iron wire to force the explosive mixture from the tubular part of a tundish used in filling small squibs, and which had become stopped while using a larger brass rammer. The report is a very long one, but these very long reports can only be really useful by sending them to every maker of fireworks, whether on a large or small scale.

A HOTEL, the Pelham, in Boston, U.S., with frontages 69ft. and 96ft., was lately moved a distance of 13ft. 10in., with a view to street-widening. The building is of freestone and brick, with frontages of 96ft. and 69ft., a basement and seven stories, the total height above the tramways used being 96ft. The weight was 5000 tons. The furniture was not disturbed during removal, nor were the occupants of the stores on the first floor and in some of the rooms, the various pipe connections being kept up with flexible tubes. Substantial stone and brick foundations were made for iron rails and rollers, and the building was forced to its new position by means of 56 screws operated by hand against timbers arranged to uniformly distribute the pressure against the building, which was firmly braced in the lower part. Two months and twenty days were occupied in preparation. The cost was £6000. The Pelham is a large building to move in that way, but with modern appliances it is more commonplace work than when a brick dwelling-house in Ipswich was moved 70ft., with folding wedges and greased planks, and balks, in 1848, by William Worby, without moving anything from the house, and as described in the *Illustrated London News* of that year.

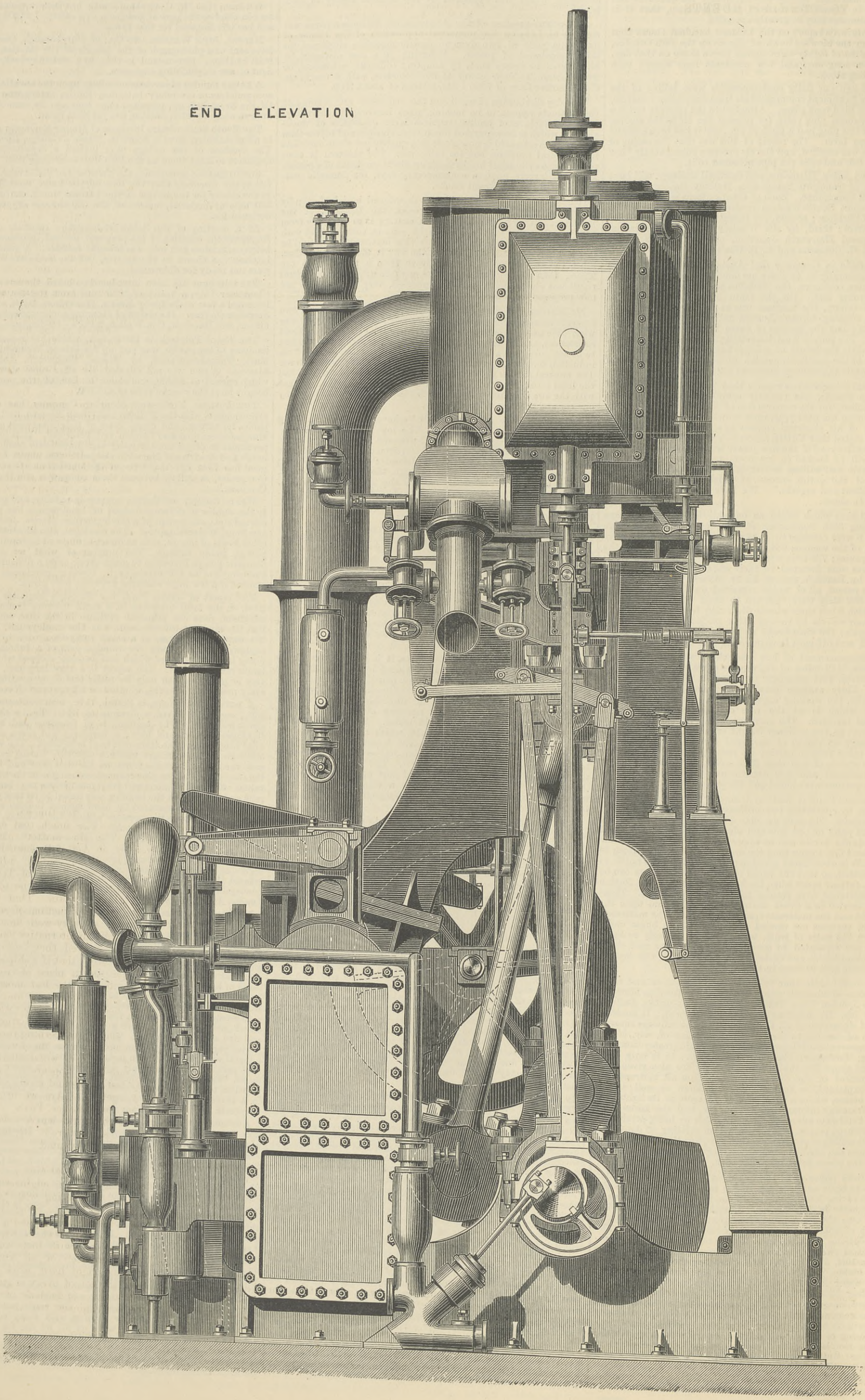
IN New York pipes are being laid for the Holley system of distributing steam for heating and power purposes from a central station. It is looked upon by some as a great boon, but others consider that a cheap heating gas, also suitable for gas engine purposes, will before long be available, with, perhaps, less danger and more facility of numerous applications. The *Scientific American* says that the boiler house is over 100ft. in height, and contains four floors of boilers, with sixteen boilers on a floor, making sixty-four boilers, having an aggregate of 15,000-horse power. The steam from these boilers is to be discharged into large pipes or separators—to separate the water from the steam—whence it passes into the street mains, of which there are five, two of 10in., two of 12in., and one of 24in. diameter. These pipes are laid in sections, connected together by expansion joints, and are lagged with a layer of mineral wool and a wooden jacket. A smaller lagged return pipe runs parallel with the supply pipe, to carry the water of condensation back to the boiler house. The steam pressure is generally relied on to force the water back, but in case of a great inclination in a reverse direction, a pump will be employed. The details of the steam meter are not made known.

AMERICA thinks she wants a lot of new ships but does not see how the orders are to be placed at home for delivery during a generation or so. A report of the United States Naval Advisory Board just issued states that the United States navy has only twenty-one ships fit to float. Of these, it is added, not half-a-dozen are fit to do anything in time of war except float, and that only on condition that they are kept out of range of the enemy. The majority of the Board report in favour of building at once forty-one ships in several classes, two of over 5000 tons, to steam fifteen knots an hour; six of over 4000 tons, to steam fourteen knots; thirteen of 3500 tons, to steam thirteen knots; and a number of gunboats to steam ten knots. It is thought that the promotion of American shipbuilding is likely to be a leading subject of the approaching Tariff Convention. The *American Protectionist* says on this subject:—"In our opinion the Protectionist ship question will be the prominent topic. It is the complement of the productive system. We thus far have been able to reduce the manufacturing and industrial preponderance of England and now must reduce her maritime preponderance. Our trade passes through England. We do a triangular business with every country, and England reaps the profit both ways on all we do, for she is the point of the triangle through which all must go. We must have direct trade with other countries, and to do this must grant certain facilities to our shippers, which can only be done by encouraging the shipbuilding interests."

COMPOUND ENGINES OF THE S.S. CITY OF RIO JANEIRO.

MESSRS. JOHN ROACH AND SON, NEW YORK, ENGINEERS.

(*For description see page* 425.)



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.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
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* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

*** *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.*

W. D.—*The roof of the St. Pancras Terminus is* 690*ft. long and* 240*ft. span. The roof is* 100*ft. high measured from the rail level.*

T. W. (Plumstead-common).—*We shall probably publish what you want. We cannot tell you where you can obtain the information.*

A CORRESPONDENT (Pleasant View, Todmorden).—*You have forgotten to send the concluding portion of your letter with your name, and your letter is, as it is, far too long. We could not find space for it.*

ουδεν.—*The plates would rapidly give great trouble by curving upwards, and thus make it difficult to keep tram-cars on the track, especially as the plates would be loosened and spikes or bolts pulled up, or their heads through the plates. Even if they remained flat objection would be made on the score of horses slipping upon them. See paper "On the Fracture of Railway Tires" in the "Proceedings" of the Institution of Civil Engineers, vol. xlvii.*, 1876.

A. B.—*The wheel is very light, but it is not too large to cast in one piece. Use a little hematite, say one-fifth, the rest Scotch pig and good scrap. Part the boss in two places by a thin loam parting piece. When the wheel is cool and before it is drawn from the mould, this parting core can be drawn and a little iron from a ladle run in, just to fill the space up not to make a union or two thin wrought iron keys may be put in. Then put on two wrought iron hoops hot. No turning will be necessary. The hoops with a little care will seat themselves. A wheel made thus will not break itself.*

W. H. (Drapper-road).—*Practice varies so much in working belts that it is not easy to answer your question. At* 881*ft. per minute, a pull of* 37·6 *lb. will transmit* 1*-horse power. The maximum load for a belt is* 300 *lb. per square inch of section. Assuming your belt to be* ·4*in. thick and* 11*in. wide, its sectional area will be* 4·4*in., and this multiplied by* 300, *gives* 1320 *lb. as the greatest strain that ought to be put on the driving side of the belt, and* 1320 *divided by* 37·6, *gives as a quotient, omitting fractions,* 35*-horse power. But from the* 1320 *lb. of pull on the driving side will have to be deducted the pull, whatever it may be, of the slack side. It will depend a good deal on the diameter of the pulley and the length of pulley rim, with which the belt is in contact. It is probable that in your case, as the belt runs so slowly and is very tight, that the strain on the driving side will not be much more than double that on the slack side, and the power transmitted will be about* 16 *or* 17*-horse power. This is the most we should expect to get out of an* 11*in. belt at the stated speed. Belts transmitting much power ought to be run at* 3000*ft. per minute at least. In practice a double belt* 12*in. wide running at* 2859*ft. per minute, gives out* 90*-horse power.*

J. W. W.—*Gordon's formulæ for the strength of columns, as constructed by himself, Stoney, Unwin, and Baker, will be found in Clark's "Rules, Tables, and Data for Mechanical Engineers," published by Blackie and Son, at* 645. *They are for*

Solid or hollow round cast columns $W = \frac{36a}{1 + \frac{r^2}{400}}$

" *square* " $W = \frac{36a}{1 + \frac{r^2}{500}}$

For solid rectangular wrought iron columns $W = \frac{16a}{1 + \frac{r^2}{3000}}$

For columns of angle, tee, channel, or cruciform iron $W = \frac{19a}{1 + \frac{r^2}{900}}$

" *solid round mild steel* $W = \frac{30a}{1 + \frac{r^2}{1400}}$

" " *strong steel* $W = \frac{51a}{1 + \frac{r^2}{900}}$

" *rectangular mild steel* $W = \frac{30a}{1 + \frac{r^2}{2480}}$

W = *breaking weight in tons,* a = *sectional area,* r = *ratio of length to diameter. The least diameter must be taken or that in direction most flexible.*

THE DISPOSAL OF ARSENIOUS VAPOUR.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged to any of your readers who can tell me the best means used at present to get rid of arsenious and sulphurous acid gases produced in the smelting of copper ores, and to prevent the noxious effects of these upon plants and animals. S. D. B.

Córdoba, November 25th.

SCIENCE AND ENGINEERING.

(*To the Editor of The Engineer.*)

SIR,—May I correct a slight error in your article on "Science and Engineering" in your issue of 2nd December. While thanking you on behalf of the inventor for according a recognition where so many have persistently ignored the authorship of the process, I beg to point out that the success of the Bessemer process by virtue of addition of spiegeleisen is due to Mr. Robert Mushet, not to Mr. David Mushet, who has been dead some years. PRACTICAL.

Sheffield, December 5th.

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MARRIAGE.

On the 7th inst., at St. Marylebone Church, London, W., WILLIAM HENRY NORTHCOTT, C.E., M.I.M.E., &c., to LOUISA MARY, daughter of the Rev. HANS ATKINSON, M.A.

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, December 13th, at 8 p.m.: Papers to be discussed, "The Conservancy of Rivers: the Fen District of England," by Mr. William Henry Wheeler, M. Inst. C.E. "The Conservancy of Rivers: the River Irwell," by Mr. Arthur Jacob, B.A., M. Inst. C.E.

CLEVELAND INSTITUTION OF ENGINEERS.—Monday, December 12th, at 7.30 p.m.: (1) List of elections since last meeting. (2) The Society of Arts New Patent Bill will be explained, and discussion thereof opened by Mr. Jeremiah Head, Middlesbrough. (3) Paper on "Mudd's Patent Pendulous Marine Engine Governors," by Mr. Thomas Mudd, Hartlepool.

SOCIETY OF ARTS.—Monday, December 12th, at 8 p.m.: Cantor Lectures. "Some of the Industrial Uses of the Calcium Compounds," by Thomas Bolas, F.C.S. Lecture IV.—Other calcium compounds and their uses. The phosphorescent sulphide. Lime soaps. Bleaching powder. Phosphates of calcium. Organic calcine salts. The hardness of water, &c. Wednesday, December 14th, at 8 p.m.: Fifth ordinary meeting. "Electric Lighting at the Paris Electrical Exhibition," by Mr. W. H. Preece, F.R.S. Sir Frederick J. Bramwell, F.R.S., chairman of the Council, will preside. Thursday, December 15th, at 8 p.m.: Special meeting. Adjourned discussion on the Patent Bill prepared by the Society of Arts. Sir Frederick J. Bramwell, F.R.S., chairman of the Council, will preside.

THE ENGINEER.

DECEMBER 9, 1881.

THE BOARD OF TRADE AND STEEL BOILERS.

ON Tuesday, the 6th inst., a case of very considerable importance to shipowners and engineers was decided by Mr. Justice Field and Mr. Justice Cave in the Court of Queen's Bench. Messrs. Sampson, Moore, and Co., of Liverpool, sued Messrs. Laws, Surtees, and Co., shipowners, of Newcastle, for the sum of £1000, the balance of an account for new boilers. Messrs. Laws, Surtees, and Co. refused to pay, on the ground that Messrs. Sampson, Moore, and Co. had made steel boilers without Government inspection, and in consequence the Board of Trade would not grant the ship to which they were fitted a certificate to carry passengers. The action was referred to arbitration some time ago, and the arbitrators found for the plaintiffs £600 instead of the £1000 claimed. But even this sum Messrs. Laws, Surtees, and Co. refused to pay, on the ground that a Board of Trade surveyor had not been called as a witness. On Tuesday they applied to have the arbitrator's award set aside, and the application was refused with costs. It will be seen that this case teaches a useful lesson to shipowners and engineers, who will do well to store up the facts in their memories.

It is a Board of Trade rule that, although steel may be used in a boiler, yet, in order to obtain a passenger certificate for a ship in whose boilers steel is used, they must be constructed under a special survey. It appears that Messrs. Laws, Surtees, and Co. had a ship in the cargo trade. They gave Messrs. Sampson, Moore, and Co. an order for new boilers for this ship, the cost of which, with some extras, came to £2343; out of this sum certain payments had been made on account, amounting to £1138; thus leaving due in round numbers £1000. After the ship had been at work about eighteen months, carrying cargo, for which she needed no certificate, they applied to the Board of Trade for a passenger certificate, which was refused. The plates, &c., were tested by Mr. Esplin, a well-known authority. The contract for the boilers was first given to another firm, who failed to complete it, and the contract was taken over by the defendants and finished by them. This is, however, of little importance. It appears that it was at first intended that the boilers should be of iron; but before any progress had been made in their construction it was decided to use steel, and no special notice to that effect was given to the Board of Trade, because the use of the ship as a passenger vessel was not then contemplated. It is not very easy to see the force of the objection raised by the defendants to paying the money claimed. They no doubt accepted steel as a satisfactory material for boilers. Is it, however, to be assumed that they understood that the makers would take care that the boilers satisfied the Board of Trade? On this point we have no information, and we must rest content to know that the defence rested on the refusal of the Board of Trade to grant a certificate. The two arbitrators and an umpire, all experts, examined witnesses, and finally awarded, as we have said, £600 instead of £1000 to the plaintiffs. Why they made this reduction we do not know. It is improbable that they awarded £400 as damages against Messrs. Sampson, Moore, and Co., for fitting a cargo steamer with steel boilers; nor is it more likely that the award was made to compensate Messrs. Laws, Surtees, and Co. for the loss of a passenger certificate. On this and several other points it is more than probable that the public must remain in the dark. The reason alleged for not complying with the award deserves attention. The defendants were dissatisfied on the ground that the surveyor of the Board who had refused their certificate had not been examined by the arbitrators, so that they were not fully put in possession of the grounds of the refusal, and the requirements of the Board in such a case which had not been observed, and the utter impossibility of satisfying them in this case without, in fact, taking out the boilers, taking them to pieces, and reconstructing them again. It appeared that early in the arbitration, it was agreed between the parties that, without further attendance by them, the arbitrators should be left to call such skilled witnesses as they thought proper, and on the part of the defendants it was sworn that they "understood," or there was "an understanding," and that they were "under the impression" that the arbitrators promised that the surveyor of the Board should be called, who had been subpœnaed by the defendants for the purpose, and who was not, in fact, called. This is tantamount to an argument that the arbitrators did not know why the Board of Trade certificate was refused. Mr. Justice Field refused to take the defendants' view of the case, and said "the Board surveyor had not been sent to because the steamer was not to be a passenger vessel, and the plaintiffs' surveyors had certified their satisfaction with the vessel, which had been for eighteen months sailing on the ocean. The certificate of the Board was withheld, not because there was anything deemed to be wrong in the vessel, but because in the case of a steamer with steel boilers the regulations of the Board very properly required for the safety of life, if the vessel was intended for passengers, that their surveyor should have had the opportunity of seeing the construction of the boilers throughout. Under these circumstances there was no real ground for the application." Mr. Justice Cave entirely concurred in this view.

The lesson taught by the case is, that if steel boilers are put into a ship, such boilers not being built under special survey, a passenger certificate may be, and will be, refused. It is by no means an unusual thing for a steamer engaged principally in the cargo trade to carry now and then more than twelve passengers; but to do this she must hold what is virtually a permit or licence from the Board of Trade. Hitherto there has been no difficulty about obtaining such a certificate. If a ship already fitted with iron boilers wants new boilers, it is quite possible that these may be either wholly of steel or that they may have steel used in places. For instance, an iron boiler may be fitted with Fox's corrugated steel flues. It may not occur to either the shipowner or the engineers that a special survey is necessary in such a case—that, in short, the boiler must be made from beginning to end under the eye of the inspector. So engineers and shipowners together go on in a kind of fool's paradise, and find, when it is too late, that their passenger certificate is forfeited. The range of the Board of Trade rule is very wide, and it might happen that some of our great Atlantic or Indian liners might have steel worked into a boiler in place of iron, and thereby lose at once their licence. We are by no means certain that there are not at this moment several ships carrying passengers with certificates which are really worthless, because steel has been worked into their boilers. It is a noteworthy fact that the Board of Trade did not bring any charge against the boilers made by Messrs. Sampson, Moore, and Co. The Board took its stand on the basis that the boilers were of steel, and had not been built under the personal supervision of a Board of Trade official, and consequently they could not be used in a passenger ship. It is well known that we do not put implicit faith in steel, but it ought also to be known that whatever the defects of steel may be, they are not long in appearing. If a steel shell will stand for eighteen months, or even for six months, it may be taken for granted that it is at least as trustworthy as an iron shell. This being the case, we confess we do not see why the Board of Trade refused a certificate to Messrs. Law, Surtees, and Co. It was not disputed that all the plates had been carefully examined. The boilers had been fully tested by hydraulic pressure. They had worked satisfactorily for eighteen months. They could have been examined minutely by an inspector, and they might, if he had thought proper, have been again submitted to the hydraulic test. It appears to us that as much safety would have been insured in this way as could have been obtained by the initial acts of inspection of a Board of Trade official. As a matter of fact the boilers of the Livadia were built under Board of Trade inspection—we know with what result! We have no desire to speak of Board of Trade inspectors in any other than high terms. But it is well-known that they receive very small pay. Are we to believe that a man with no more than a salary of £200 a year or so is really more competent to obtain good work than a superintending engineer getting four or five times the salary and probably possessing ten times as much real experience? The Board of Trade acts in this matter entirely by its own authority. There is no Act of Parliament affecting the use of steel boilers to be rigidly administered. The Marine Department of the Board of Trade is not what it ought to be, and its action would be tolerated in no other country than Great Britain. That the Board should insist on having the construction of steel boilers personally inspected may be all very well, but the Board ought, we must add, to permit an alternative survey, when boilers by actual use have proved their soundness. It appears to be a monstrous theory that if a ship should have new furnaces of steel put in in place of iron furnaces removed, she may be detained at the last moment before sailing, all her passengers sent ashore, and enormous demurrage costs incurred, because an inspector was not called in at the right time. We have heard it urged that the Board of Trade would not act thus concerning furnaces alone, to which we answer by asking where the line is drawn? Uncertainty on this point would be worse than anything. Again, the Board of Trade rule appears to be that the inspector shall not only test plates and rivets, but that he shall see the boiler put together. Are we to understand that if welded flues as, for instance, Fox's, are used, an inspector must attend at the works where such flues are made and witness their manufacture? Replies on these and one or two other points are wanted.

ENGINEERING AND FARMING.

IT is one of the advantages of an engineer's education that it makes him capable of entering with facility upon many other walks of life than that to which he has been trained. The continual practice in overcoming difficulties, the knowledge acquired as to the way in which common things are made, the familiarity with tools and with processes, the intercourse with men of all kinds and all classes, above all the downright hard work and rough discipline which falls to the lot of every engineer worthy of the name, are all of them acquisitions of the highest importance, not only to an engineer, but also to a manufacturer or a producer. It is our firm belief that a successful ironmaster, for instance, who wishes his son to be his successor, would do better by giving him the general education of an engineer than by pinning him to

the forge and the mill the moment he has left school. In the former case the lad will come to ironmaking, not as the one and only thing which he is allowed or expected to know, but as a particular branch of engineering, which his connection gives him a special inducement to follow; he will delight in applying his general knowledge to that branch, and he will master the technical details, in all probability, quite as rapidly as if he had never studied anything else. As a matter of fact, many of our most eminent "captains of industry" have served their time as engineers; and so far as manufacturing and mining is concerned the advantages of such openings for engineers are tolerably well recognised. The same cannot be said of the other great branch of production, besides that of the production of metal, namely, the agricultural, which furnishes the corn and meat necessary for our food, and the wool, hides, &c., which serve for our clothing. Hitherto the only way in which engineers have been connected with agriculture is by the making of agricultural implements; and the only engineers who have also been farmers are probably one or two like Messrs. Howard and Mr. Garrett of Leiston, who farm on a very large scale. Of late, however, attention has been turned to agriculture as a business, not, indeed, by its profits but by its losses. The old English tenant farmer, with his one or two hundred acres of land, appears no longer able to hold his ground, and the question arises who is to succeed him. Already an attempt has been made to answer it in some quarters by the establishment of limited companies for farming on a large scale. While wishing well to all such attempts, we cannot help fearing that they may in many cases succumb to those dangers which, as is now fully recognised, threaten all joint stock enterprise. What we should ourselves prefer to see is an engineer acquiring a knowledge of agriculture, and starting in it as a business, as engineers have done in iron-making, mining, and so forth. With a view to this end it is well to consider what are the essential characteristics of farming considered as a business. Every trade has its own peculiarities, and those of farming are, perhaps, especially marked. At the same time it is not so easy to ascertain these correctly, for there are as yet no limited companies in farming, and it is but rarely that the accounts of a farm see the light. Of course, also, the characteristics of arable farming and grass farming differ very widely, and yet the two are very frequently, perhaps most frequently, combined together. It is necessary, however, to consider them separately, and we shall here discuss arable farming alone. The profits of a grass farm are more difficult to ascertain, and it is generally admitted that its prospects in England are much more favourable than those of arable farming. Even with the latter the conditions differ so greatly in different parts of the country that we shall not attempt to give actual figures, though we have such in our poseession, which we believe to be trustworthy. Speaking broadly, we may say that the tenant's capital, on a well-managed farm on good soil, will not be very different from £10 per acre; that the rent will be from one-fifth to one-fourth of this amount; and that the total of the sales, or the "turnover," will at the very outside be equal to the capital, and in most cases will fall considerably below it.

The first point which challenges attention is this smallness of the "turnover" as compared with the capital invested. In an iron-making concern at full work, the sales should be at moderate prices about 200 per cent. of the capital; and in engineering works they should be at least 150 per cent. The explanation of the difference lies, of course, in the greater slowness of the farmer's operations. While a bar of finished iron or steel may often be worked out of the raw material in a few hours, and a casting or forging in a few days, the money which a farmer has laid out, say in seed and manure, remains in the soil as it were for months before it comes back to him as payment for his crops.

This smallness of the turnover appears no doubt a disadvantage at first sight, owing to the largeness of the capital which it renders necessary for a limited amount of business. It also means that the difference between receipts and expenses—in other words the margin for profit—must be much larger in the case of farming than in engineering or ironmaking. An engineer, in these times at least, would be tolerably well contented if he was sure of getting 20s. where he has spent 19s., for since he turns over his capital, say, twice in the year, this is equivalent to a net profit of 10 per cent. But if a farmer's sales are only four-fifths of his capital, he must only have paid 17s. 6d. to produce that which he sells for £1, in order to secure the same dividend. In both cases expenses of management are allowed for, and profits on capital alone considered.

If, however, the smallness of the turnover has disadvantages, it has at least counterbalancing advantages. For it follows that moderate losses—due to bad debts or defects of management—will have a far less serious effect on the farmer than on the manufacturer. Suppose that owing to some such cause the production in each case has cost 1s. in the pound more than it should do to produce 10 per cent.; then the manufacturer sells for 20s. what it has cost him not 19s. but 20s. to make, and therefore he gets no return at all on his capital; the farmer, on the other hand, sells for 20s. what cost him not 17s. 6d., but 18s. 6d.; he therefore has still a profit of 1s. 6d. in the pound, or 6 per cent. instead of 10, which is after all no such bad return. It may of course be said that this knowledge will make the farmer more careless, and less particular about the price at which he sells. We do not think so, for reasons we need not stop to discuss; but if he did so he would so far be a bad farmer, and in this article we are considering the prospects not of bad but of good farming. On the other hand the narrowness of the margin on which a manufacturer works no doubt stimulates him to special care; but it stimulates him also to use every effort to increase his turnover—since it is only by a large turnover that he can hope to make a large profit—and therefore to undertake business which is speculative or unsound.

This leads us to point out another advantage on the side of the farmer. He has nothing to do but to get the best return of produce that he can from the fields which he tills; and when he has got it, he can choose his own time within moderate limits for selling it, secure that the market will not experience any very great or rapid fluctuations. A manufacturing engineer is in a far worse plight. Generally speaking, his choice lies between making to order and making for stock. If he chooses the first, he exposes himself to all the dangers of the contract system—a system to which, probably, three out of every four bankrupt firms could trace their ruin; if he works for stock, he is liable to find his goods practically unsaleable by the time he wants to realise on them. The advantage possessed by the farmer in being exempt from these two difficulties is one which, to a man experienced in business, it is difficult to overrate.

Leaving the question of the smallness of turnover, we go on to another, which makes, perhaps, a still more remarkable difference between the conditions of agriculture and of other trades. We mean the largeness of the rent. To most manufacturers the rent paid for the premises in which their trade is carried on is a very minor item of expense—a matter of hundreds, probably, where the turnover is reckoned by tens of thousands. But a farmer's rent will usually be at least one-fourth, and often much more, of his total expenditure. From what point of view are we to look at this enormous annual charge, which is, of course, quite independent of the working expenses of the farm? To look upon it as a sort of unjust burden which ought to be removed, is as illogical as it is dishonest. The fact has come to pass under a system of perfectly free contract on either side; between landlord and tenant on the one hand, and between producer and consumer on the other. The tenant has been willing to pay the rent because he has found that, paying it, he can still reap a fair return on his labour and capital; and the consumer has been willing to buy the tenant's produce at rates which enabled that return to be realised. Without embarking on the perilous sea of political economy, we may fairly look at the rent as representing mainly the capital which has been expended on the land, in fencing, road-making, draining, &c., to bring it to its present condition; and partly also the favourable position of the land itself, as influencing the net cost and value of sales. The effect of the former is seen in the increased rent demanded for land which has been recently drained; the effect of the latter in the enhancement of the value of land whenever a railway station has been fixed in its vicinity, thereby cheapening the delivery of the produce to the consumer. Be this as it may, the rental is a fact, and the farmer who wishes to evade its payment can only do so by buying the land himself; but if he seek to do this he will find the number of years' purchase he will have to pay, even in these times, is so large that if he is fit to be in business at all he will reject the idea with contempt. The only true way to look at the question of rent is to consider a farm as a business in which landlord and tenant have jointly invested their capital, and out of which they have jointly to make an income. Supposing a manufacturer to own valuable works which he is not disposed to manage himself, he may agree with a tenant to pay him a fixed rate of interest on the estimated value of the property, and to bring in a small additional sum to form working capital. Such a case is not common, but it is not unknown; and it is exactly parallel to the ordinary case of a landlord and tenant farmer, except that the manufacturer would never accept so small a rate of interest as that which contents a landowner. A farmer, generally speaking, is in the position of a man who is able to borrow about seven-eighths of the capital required for his business at about 3 per cent., and to keep all the profits beyond this amount to himself. We think manufacturers, whether engineers, ironmasters, or in any other trade, will be disposed to think him a very enviable person. It is true that the fluctuations in profits, reckoned on so small a fraction of the total capital, are sure to be large, especially in a business dependent, as farming is, on the uncertainties of weather. But even here the farmer is not without resource. For, according to present fashions, the occurrence of a couple of bad seasons is held fully to justify a farmer for asking a reduction of, say, 20 per cent. on his rent; and the landlord is looked upon as a grasping and selfish man who does not give it without a murmur. We think a manufacturer who, having borrowed a similar proportion of his capital at a similar rate, were to demand a remission of interest on the same ground, would find his request treated in anything but a polite manner. This difference is due to the prevalence, in agriculture, of what we may call either sentiment or good feeling, according as we wish to discourage it or the reverse; a condition much to the advantage of farmers, and one which they should sedulously cultivate, for, once destroyed there, they may rely upon it that it will re-appear nowhere else.

It will be seen from these remarks that we are not among those who consider that as a business English agriculture is "played out." In rejecting that view we are glad to find ourselves in accord with so great an authority as Mr. James Howard, who in a recent speech not only contended that there was a future for English farming, but also dwelt on the fact that the present period of depression was a specially favourable one for entering upon it. Any substantial farmer prepared to take a large farm may count on arranging for a rent less by some 20 per cent. than would have been demanded ten years ago; and, as will be seen, 20 per cent. on the rental means something like 4 per cent. on the farmer's capital. At the same time we are not prepared to say that the course of events in the future will be exactly the same as in the past. That agriculture has been a good business is, in our opinion, sufficiently indicated by the conditions of management under which that business has hitherto been conducted with success. A farm of 300 acres would be considered as of a fair size in any quarter of England. But the volume of business transacted on it per annum is measured by sales amounting to, say, £3000, and a wages sheet embracing at most ten or fifteen hands all told. Yet to manage this business absorbs all the energies of a substantial farmer, whose personal expenses may fairly be put at some £200 to £300 a year. We know no other class of business which, as a rule, could possibly support such heavy expenses of management. It is no exaggeration to say that in most manufactories competent gentlemen may easily be obtained at £500 a year to manage twenty times the number of men and the amount of business here transacted. As a matter of fact, in iron-making, in mining, in cotton spinning, in weaving, &c., works of the capacity comparable to that of an ordinary farm have long ceased to exist. In engineering they only continue to flourish in country towns, or in other places where circumstances give a monopoly of some profitable trade, such as repairs. Everywhere but in farming it has long been recognised that the only businesses capable of thriving under the severe competition of the present day are those which possess ample capital, with all modern improvements as to plant and processes, and are on a scale sufficient to command the services of a manager highly trained and educated, with long experience, and commercial as well as technical capacity. No reason has ever been given, to our knowledge, why in the one solitary case of farming business on a small scale should be more instead of less prosperous than on a large one; and it would not be difficult to allege reasons on the other side. Our opinion is that if in farming, and in farming only, the *régime* of small businesses still survives, it is because competition has hitherto been less severe, and profits easier to make, than in other trades. It would seem probable that, under the altered conditions of transport, this happy condition of things is drawing to a close; and much as we shall regret the loss of the old race of English tenant farmers, we cannot but fear that they are destined to gradual extinction. Who is to replace them? To some extent, perhaps, the large limited companies which we mentioned as already springing into existence; but we would fain hope that in most cases at least their successors will be the landowners themselves. The state of things which we have ourselves witnessed in Sweden—where the landowner supplies the working as well as the dead capital for his property, cultivates his own land, burns his own charcoal, and, if he has iron mines, makes his own iron—is one which appears to us particularly suited to the future of English agriculture. The property of an ordinary English squire is usually just about the size which can be treated with advantage as a single business; and the squire himself, if he will once accept the position that farming is to be his business, and not his pastime, possesses in general just the practical qualities required for carrying it on with success. No doubt he will usually need the services of a bailiff or sub-manager, but plenty of suitable candidates for such a post will soon appear, just as plenty of managers for rolling mills or engineering works are to be had at the present day. In many cases such a place might be advantageously filled by some younger scion of the squire's own family—a class for whom it continually becomes more difficult to find suitable and satisfactory employment. There are at this moment hundreds of enterprising young landowners in England, by no means inclined to sit still and see their rents fall down to nothing. Surely some of them will be found willing to try for themselves whether agriculture, pursued under proper conditions, is so desperate a business as it is now the fashion to represent it.

THE WESTINGHOUSE BRAKE.

A LIMITED company has been formed in England and has taken over all the property, rights, and interests of the Westinghouse Continuous Brake Company, which was an American organisation. The directors of the new company are Mr. George Westinghouse, chairman; Sir Henry Tyler, vice-chairman; Sir Thomas Douglas Forsyth, K.C.S.I., and Capt. Francis Pavey. The Westinghouse automatic brake has, we are glad to say, made progress. It is now in use on fourteen railways in the United Kingdom, being fitted to 1087 engines, and 7719 carriages. In France it is in use on eight railways, and is now, or will be in a very short time, fitted to 1416 engines, and 7193 carriages. It is also in use in Austria, Germany, Russia, Holland, Italy, Sweden, India, New South Wales, South Australia, and Queensland. In the United States it was up to September the 30th, 1881, fitted to 3435 engines, and 12,270 cars. The grand total for the world is—engines, 6599; carriages, 29,562. In sixteen months, that is to say, since July 1880, there have been fitted 3322 engines, and 16,060 carriages. With the non-automatic brake, there are 2579 engines, and 11,389 vehicles fitted in the United States, principally to goods trains. Including both types, there are now fitted 9236 engines, and 41,350 vehicles. A brake which is in such extended use must be good. The experience acquired with it is enormous, and yet we find English railway companies halting between two opinions, and asserting that they cannot find a satisfactory brake. Under the circumstances this sounds like nonsense, and it is quite certain it will be impossible for any railway company to obtain by its unaided efforts during a few months, a twentieth part of the experience already gained by the Westinghouse Brake Company. Facts constitute very stubborn arguments, and the way in which the Westinghouse brake has made its way in spite of a great deal of opposition, is a fact constituting a most powerful argument in its favour.

THE NAVAL AND SUBMARINE EXHIBITION.

THE Naval and Submarine Exhibition, to be held in the Agricultural Hall next April, promises to be a complete success. The failure or success of such exhibitions depends, first, on the action taken by exhibitors; secondly, on the action taken by the public. As regards the first point, it seems to be now possible to form an estimate. We learn that a very large part of the space in the Hall has already been taken by intending exhibitors, and it is by no means impossible that at the last a considerable number may be crowded out. The names of those under whose auspices the Exhibition is being held is a sufficient guarantee that its contents will really prove interesting to engineers, shipowners, naval architects, and even to the general public. Among the names in question we find those of Lord Ravensworth, president of the Institute of Naval Architects; Mr. Barnaby of the Admiralty; Admiral Sir W. Houston Stewart, Admiral Commerell, and Sir E. J. Reed, representing the naval element; Sir W. Thomson, F.R.S., electricity; Sir W. Palliser, ordnance; and among the list of engineer patrons we find such names as those of Sir Joseph Bazalgette and Mr. Abernethy, besides many others of equal importance. It is scarcely to be doubted that such an exhibition, being practically

novel and unique, will be visited by a great many persons interested in naval and submarine engineering. The time during which the Exhibition remains open will be short, so that exhibitors' expenses need not be heavy, and the public will be spared the endless delays which have hitherto attended every international exhibition, none of which have been really complete throughout until they were on the point of closing. Much will be done—and wisely done, we think—to provide special attractions for the public in the shape of lectures which will really explain much that must otherwise remain more or less mysterious to the general public. So far as we can ascertain up to the present moment, every exertion is being made by the promoters to get up a genuine scientific exhibition, which will have nothing of the bazaar about it; and if this policy is pursued, exhibitors and visitors will alike appreciate the result.

THE WEST CUMBERLAND IRON AND STEEL TRADES.

TESTED by the number of its blast furnaces that are lit up, or by the production of its converters, the state of trade in West Cumberland would be said to be very good. There has been since autumn an increase in the demand for its production of hematite and Bessemer pig iron, and though there were stocks to some extent in the Workington district, these have been reduced, and the number of blast furnaces in operation has been added to. In the report, too, of the West Cumberland Iron and Steel Company, for its year just closed, it is stated that there has been a large addition to the output of steel, and this is, there is reason to believe, a general experience. A very large proportion of the pig iron made in the district is now being locally consumed by the steel-making firms; and as the latter are preparing themselves to supply steel in whatever form it may be needed, whether rails or plates, and as shipbuilding seems likely to grow in the district, there is ground for the belief that the steel production of the north-western county will augment, and that it will be less dependent in the future on the outside demand. It is known that the chief steel-making companies in the north-west of England have entered into very large contracts for the supply of steel, both in the shape of blooms and in that of rails, and it may be thus assumed that there will be for a considerable period to come briskness in the iron and steel trades of that district. It is worth notice that it has endeavoured to meet the requirements of modern manufactures—by, at great cost, adapting its manufactures to recent changes; early adopting, for instance, the direct process in the steel manufacture, and in other ways fitting itself for cheap production. Its one difficulty is the distance it has to bring its coke; but even this does not handicap it in competition with other districts. They have to bring their hematite ore from a distance, whilst West Cumberland obtains the bulk of its coke from Durham. It may be expected that attempts will be made to use its own coal for the local iron trade; but it cannot be said that experiments in this direction have met with very great success hitherto, as the largeness of the demand for coke at the present time from Durham proves conclusively. Still, as hinted above, there is now a very full range of production, and that is at prices that are proved to be remunerative. For the first time for a long period the chief steel making company has paid a dividend, and earned a larger one. In that better time that seems at last to have dawned for the iron and steel industries, there is thus ground for the belief that the West Cumberland district will share with that fulness which the largeness and the richness of its supplies of iron ore fitted for the Bessemer process would indicate as its deserts. It may be that in the future there may be a greater competition with the steel produced from inferior ores by the basic process; but the prospects of West Cumberland metallurgy seem still bright, and to be not only unaffected by competition, but to be profiting by the stimulus that has been given by recent discoveries and recent enlargements of the area of the use of steel.

THE HEALTH OF THE FRENCH NAVVY.

THE French Minister of Public Works intends taking parental care of the men to be employed on the extension of the existing canals and construction of the new lines of inland navigation. For this purpose he applied to the Academie des Sciences for a report, the preparation of which was entrusted to M. Leon Colin, on the measures which might be taken with a view to securing the best sanitary conditions for men so employed. This care is the more necessary as many of the districts through which the canals pass are the flat, marshy, or fen areas, where intermittent fever and other ailments are general, and productive of low stature and high death rate. From his investigations M. Colin is led to a number of conclusions, the first of which is, that in the fen districts work should not be commenced in many places at the same time, as the freshly opened-up marsh earth emits the germs of fever; and that for such work the healthy and vigorous of the men of the district should be employed. He considers that work in such districts should be suspended during July, August, and September, and that work should not go on in the very early morning or late evening hours. He also considers it essential that the night quarters for men so employed should not be on the site of the works, but in some neighbouring town or on an elevated part, and that if the works are within reasonable distance of the sea, the men should be installed in pontoon huts anchored a short distance from the beach, as it has been shown that the death-rate among men so lodged is very much less than when they remain near the works. The men should have a cold dish of something substantial before commencing work. About the employment of preventive medicines, as sulphate of quinine, M. Colin is not explicit in his conclusions, but he insists on the absolute necessity of removing a man from the works to a hospital immediately he shows signs of intermittent fever, otherwise it rapidly spreads; and from the hospital the man should not be allowed to pass without a proof that the crisis is over, though it is not necessary to insist on complete recovery. Contractors are to fill the canal as soon as possible, and in case of excavation of severely infectious soil the works should be temporarily flooded, presumably until a more healthy part of the year, and the material excavated and made into banks, or otherwise, should immediately be sown or cultivated with rapidly growing material. Such are some of M. Colin's recommendations, but we do not know how far the contractors or the engineers will be ordered to follow them. In some cases instructions based upon M. Colin's report would cause considerable delay in the execution of works; but works for the benefit of a community should not be constructed at the cheapest rate, if that involves loss of life amongst those who execute them.

LITERATURE.

A Treatise on Chemistry. By H. E. ROSCOE and C. SCHORLEMMER, Professors of Chemistry in the Victoria University, Owens College, Manchester. Vol. III. The Chemistry of the Hydrocarbons and their Derivatives, or Organic Chemistry. Part I. London: Macmillan and Co. 1881.

THE same clear manner of elucidation which we noticed as distinguishing the earlier parts of this admirable text-book characterises the present, the first devoted to the chemistry of the hydrocarbons or organic chemistry. The historical introduction with which the book opens is everything that could be desired, both as regards length and quality. In the year 1828, Wöhler made his memorable discovery of the artificial formation of urea. Cyanate of ammonia, which was considered to be a truly inorganic compound, is easily converted without change of composition into urea, a product of animal life. This first artificial production of a body hitherto only formed within the animal organism was proved incomplete, for up to that time the cyanogen compounds had not been prepared from their elements. Moreover, this formation remained for a long time the only one of its kind, and the belief in the existence of a peculiar vital force still retained a firm footing. It was still believed that urea, a substance so easily decomposed into carbonic acid and ammonia, and only excreted by the animal body, must be looked upon as standing midway between organic and inorganic compounds, and it was thought that it would still remain impossible to prepare artificially any of the more complicated organic substances. At the present time the belief in a special vital force has ceased to encumber scientific progress. We now know that the same laws of combination regulate the formation of chemical compounds, both in animate and in inanimate nature. So soon, in fact, as the constitution of any product of the organic world has been satisfactorily ascertained we look forward with confidence to its artificial preparation. Not many years ago saw the artificial formation of alizarine and the subsequent destruction of the Turkey red trade, all that colouring matter being now derived from the new and cheaper artificial process. More recently we have heard of the artificial production of indigo by Adolf Baeyer, of Munich, and already the great discovery is reported to be making considerable progress, though at present the artificial indigo is more costly than the natural dye.

Till this work appeared there was, we believe, none in which the English student of chemistry could read of the more pure historical progress of the science with its many curious incidents, such as the following:—"At the same time Liebig did not hesitate to attack the French chemists, who went too far for him, and when Dumas assumed that the carbon in organic substances could be replaced, he turned upon him, and in a satirical vein in a letter dated from Paris, and signed (*Anglice*) S. Windler (See *Ann. Chem. Pharm.*, xxxiii. 308), relates how not only all the hydrogen and all the metal in acetate of manganese has been substituted atom by atom for chlorine, but how at last even the carbon has been in like manner replaced, and that the final product, although consisting of nothing but chlorine, possessed the chief characteristic properties of the original salt!"

The history of the petroleum trade is one of the most interesting chapters in applied science, and unless we are much mistaken, is likely yet to prove still more so. Petroleum was first found in England in 1847, when a spring of dense petroleum, having a specific gravity of 0·9, was discovered in a coal mine at Alfreton, in Derbyshire. Mr. James Young succeeded in rendering it available for a period of two to three years, when it became necessary to seek another source of it. Common coal and peat were distilled, but yielded little oil; in 1850 Mr. Young hit upon the boghead coal, or Torbane Hill mineral, which was found to yield an unusually large amount of paraffin and petroleum compounds, and led to the establishment of the Bathgate Works. The oil was first bored for at Titusville, U.S., in 1859, and in 1861 Funk opened a spring which yielded 100,000 gallons of oil daily.

A number of theories have been proposed to explain the formation of petroleum springs. That which has generally gained a hold on people's minds is that it is the product of the distillation of organised materials. Byasson and Mendelejeff, on the other hand, are of opinion that it is produced by the infiltration of water into the interior of the earth, where, coming in contact with molten iron or other metals containing combined carbon, it forms petroleum, just as a similar mixture of hydrocarbons is obtained by the solution of cast iron in dilute acid. It is not pointed out by the authors of this text-book—nor, indeed, by any other writers with whom we are acquainted—that the enormous blocks of metal which Nordenskjold found in the basalt of the island of Disco, Greenland, in 1871, and which at the time were thought to be of meteoric origin, are just such masses as Mendelejeff requires to satisfy this theory. Unlike meteoric iron then contain combined carbon, just as our varieties of artificial iron do, and by the action of dilute acids, or watery vapours, at a high temperature, would yield the complex series of bodies which constitute what we term petroleum. The gas wells which accompany the oil wells are hardly less astonishing in their character; and the reader is referred to page 145 for a description of the Burns and Delameter wells, quoted from Dr. Laurence Smith.

The history of the preparation in a pure state of methyl alcohol is an interesting chapter, especially as it is now largely obtained as a by-product in the beetroot sugar industry. In this process, as in the manufacture of cane sugar, large quantities of molasses or treacle remain behind after all the crystallisable sugar has been removed. These molasses are invariably employed to yield alcohol by fermentation. But the juice of the beet as well as that of cane sugar, contains, besides sugar, large quantities of extractive and nitrogenous matter, together with considerable quantities of potash salts. In France it has long been the custom of the distiller to evaporate to dryness the waste liquor or spent-wash—vinasse—and to calcine the mass in a reverberatory furnace. In this way 2000 tons of potash are annually produced in French distilleries. For more than thirty years the idea has been entertained of collecting the ammonia, water, &c., given off when the organic matter is calcined; but the practical realisation of the project has only quite recently been accomplished, and a most unexpected new field of chemical industry thus been opened. The distillate is neutralised with sulphuric acid, and evaporated in retorts, when the acetonitril and methyl alcohol distil over. The best commercial wood spirit contains about 95 per cent. of the alcohol. A large quantity of this alcohol is also formed by digesting fir wood with water in the preparation of wood for conversion into paper. This action goes on at so low a temperature as 200 deg.

The chapters on ethyl alcohol and alcoholometry are very full and instructive; but we think we have brought forward sufficient to show that this volume is as carefully prepared as its predecessors. Here and there we find the names of chemists incorrectly spelled; these errors are, after all, but small matters.

AN AMERICAN MARINE ENGINE.

WE published last week the front elevation of a compound engine designed by Mr. H. Levrat, and constructed by Messrs. John Roach and Son, of New York, for the steamship City of Rio Janeiro. We this week give at page 422 an end view of the same engine. Our engravings have been prepared from drawings published in the *Mechanical Engineer*, a United States contemporary, to which authority we are also indebted for the following description, which we have slightly modified and abbreviated:—

"The engines consist of the usual high and low-pressure cylinders mounted on cast iron frames, which are spread at the bottom, fore and aft, to give greater stability. They are 1850 indicated horse-power, and have cylinders 42½in. high pressure and 74in. low pressure by 5ft. stroke. These are steam-jacketted in both engines. The high-pressure cylinder is surrounded by a receiver, into which it exhausts, and this gives it the same apparent external diameter as the low-pressure cylinder. The steam-jacket on the high-pressure cylinder is filled with steam direct from the boiler, and is of course next to the cylinder; the exhaust receiver is outside of this jacket.

"The manner in which these jackets are constructed is as simple as it is ingenious. The outside or shell of the receiver is in one piece, and the cylinder proper is entirely separate from it. This is a plain casting, with a ring like a flange projecting from it, some 4in. to 6in. below the top. This cylinder is bored the same as any other, and the outer ring turned concentric with it. It is then lowered into the receiver casting previously spoken of, the ring just fitting the bore of the same. In this way all the passages for the jacket are secured, the cylinder proper is of uniform thickness throughout, and, what is more, can be easily renewed or rebored, if cracked or broken, without great expense. The space vertically between the ring and cylinder head is made steam-tight against the steam in the jacket, by coils of wire rope and red-lead putty; and the cylinder head itself rests on the upper end of the cylinder proper, so that it is firmly held from rising or moving out of its place. The receiver surrounding the high-pressure cylinder terminates in a rectangular nozzle between the two cylinders, forming the steam chest for the low-pressure cylinder.

"The valves are of the usual double-ported kind, but the high-pressure valve is balanced by a peculiar device, which we are not permitted to publish. The high-pressure ports are double, and 2½in. wide each by 25in. long; the exhaust is 7½in. by 25in. The low-pressure ports are also double, 3in. each by 48in. long; exhaust ports 8in. by 48in. The valve faces are independent of the cylinder, and are cast of very hard metal, and bolted on.

"There are two independent engines attached to the main engines for the purpose of working the air and circulating pumps; the cylinder of one of these engines shows near the guide, and just under the bottom cylinder head on the right-hand side of the side elevation. These engines are connected at right angles, and also work the circulating and feed pumps. The advantages of this are easily seen, for it insures a steady uniform motion to these several details at all times, no matter how much the main engines may labour or race in a sea way.

"The air pumps are 24in. by 24in., and are worked by a beam as usual, which connects with the engines just spoken of by a link; this is shown in dotted lines in the end view of the main engines. The fly-wheel shown there is that belonging to the auxiliary engines for the air pumps.

"The starting gear of the main engines is very ingeniously arranged to effect the purpose safely, and with certainty at all times. It would be impossible to handle such large engines as the main ones by the direct-acting hand gear used for small marine engines. So the links are shifted for going ahead, or the reverse, by a small vertical engine shown in dotted lines at the extreme right of the end elevation; a front view of the starting engine is also seen in the centre of the side elevation of the main engines. Referring to the end view of main engines, it will be seen that the reverse shaft is connected to the main links in the usual way by an arm and side bar. Now when the small engine is started, and the links are screwed over, if the engineer should not stop the starting engine at the proper instant the link block might be brought up all standing. To prevent this a countercheck is attached to the link block which runs to the small engine, and at the proper place stops the small engine itself, independent of the engineer; thus after the small engine is started the link takes care of itself, so to speak.

"The screw gear shown attached to the column immediately above the starting engine is to adjust the high-pressure cut off valves. These are merely plain sides on the back of the main valve, and are worked by bevel gears in connection with right and left screws on the valve stem inside the chest. The crosshead of these engines is formed on the end of the piston rod, and is as compact and solid as possible. A T head is forged on the piston rod, and a bearing is formed by bolts and binders in the usual way. The pin works in the cross-head block, being shrunk fast in the connecting rod. The crosshead gibs are cast iron, faced with antifriction metal, and never give any trouble.

"The crank-shaft is of wrought iron—and a very handsome piece of mechanism it is, with its built-up cranks and thrust bearing.

"The shaft is made in sections, the line shaft being 14in. diameter, turned all over, in lengths of 24ft. 3in. The crank-shaft is 14½in. diameter, and the crank-pin is 13in. diameter by 16in. long. The cranks are wrought iron with counter-balances, and the whole four cranks are shrunk on their several shafts, and the crank-pins are shrunk in them. After this is done the crank-shafts, with cranks attached and ready for service, are put in the lathe and turned up on their own centres, as are also the crank-pins. This obviates any possibility of final derangement that might have been caused by shrinking the parts together.

"The thrust bearing is of the usual kind—that is, ring and collar—and is also very carefully fitted up. This bearing is 44¼in. long, and is made by turning thirteen grooves in the shaft, into which are fitted thirteen brass collars. These collars are carefully fitted by scraping to each individual groove, and are marked so that they cannot be put in any other. They are put in in halves like brasses, and the top half has an oil cup formed in it which communicates by a side hole directly with the face of the collars on the shaft, so that the latter are washed with lubricants all the time. The bearing has also a water shell surrounding it, so that at any time water can be circulated about it. On each side of the thrust bearing there are other bearings of the usual kind, which keep the weight of the shaft itself off the collars, so that all they have to do is to sustain the end push of the screw.

"The condensers are of the surface type, with 1676¾in. tubes, 3949 square feet of surface. The ends of these tubes are packed with Lighthall's compressed paper packing, and are always tight. The propeller for these engines is 16ft. 4in. diameter by 24ft. pitch, with four blades. It makes 64 revolutions per minute, with 80 lb. steam, following half stroke on the high-pressure piston. We may add what we omitted to state in another place, that the small steam chests and pipes therefrom to the top of the main cylinders are for the purpose of warming up the engines by hand previous to starting them."

THE NEW EDDYSTONE LIGHTHOUSE.

MR. J. N. DOUGLASS, M.I.C.E., ENGINEER.

We give above a view of the new and old Eddystone lighthouses—taken from a photograph published by Messrs. Long and Co., Plymouth. The last stone was laid by Mr. Douglass, the engineer of the work, in May last; two thousand two hundred stones from the De Lank quarries and High Tor have been used, weighing altogether 6000 tons. The view shows the general features of the tower very clearly. The system of construction is very similar to that adopted in the original structure.

LETTERS TO THE EDITOR.

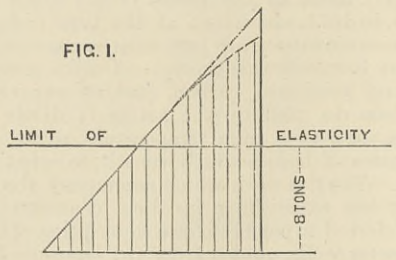
[*We do not hold ourselves responsible for the opinions of our correspondents.*]

STRAINS ON CRANE POSTS.

Sir,—The correspondence upon the above subject has evidenced such a remarkable difference of opinion as to the nature and functions of the neutral axis among men who have sufficient confidence in their views to express them in your columns, and on the part of some of such a total absence of grasp of the subject, that I have ventured to believe that a few words directed to the root of the question would prove of service to some at least of your readers. For instance, one correspondent gives an absolute rule for fixing the position of the axis which takes no regard of section or material; another expects to find the axis upon the outside surface of a structure; a third gives us a series of three puzzle pictures with the legend "Find the neutral axis," and appends a solution which, under most ordinary conditions, would find the neutral axis everal feet outside any part of the structure; and many quite fail to perceive any difference between a structure with rigidly connected parts, such as a box girder, and another in which each member is free to move without influencing the remainder.

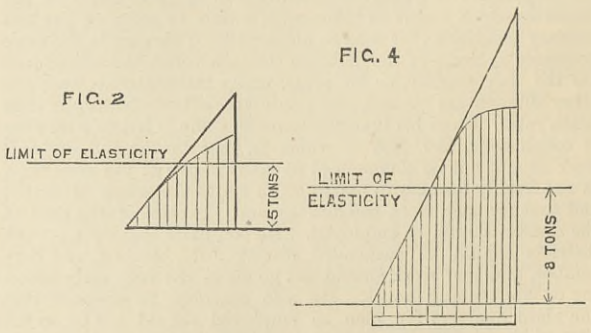
Before it is possible to ascertain the position of the neutral axis of any beam, cantilever, &c., the material must be known; its strength to resist both tension and compression, its distribution with regard to the section at which the neutral axis is to be calculated, the extent to which the material will compress or elongate under varying stress, and one other point to which I will allude further on. Though it is true that in the calculations for practice some of the above factors may be, and are, ignored, the results obtained are approximations only, and the margin of safety is trusted to to cover the error. But it is very desirable that the points at which the rough-and-ready rules depart from truth should be known and understood, for under some conditions the errors are serious. If a solid bar supported at each end and loaded in the centre, bends under the load, the lower portion of the bar is elongated and the upper portion compressed. The plane which forms the boundary between these two conditions of stress is the neutral surface, and extends from end to end of the bar. Taking any transverse section of the bar, the neutral surface would appear as a line crossing the section, and this line would be a neutral axis. Neutral axes, therefore, exist at all points in the length of the bar. The resistance of the material to strain must be the same on both sides of the neutral axis, for if the capacity for resistance were greater on, say, the tension side, the particles on the opposite side would commence to contract before the others commenced to elongate, but if none on the tension side are to elongate, but all on the compression side are to contract, the compressional layers will shear away from the tensional layers, or some of the latter will be dragged along into compression, and our assumed neutral axis is evidently not a true one. The material of the girder may be imagined to consist of layers, or laminations, running parallel with the neutral surface. Each lamina will be elongated or compressed, in direct proportion to its distance from the neutral axis. Each lamina is in a condition for exerting resisting stress to an amount depending upon the extent of its elongation or contraction, but not proportional to it. The active effect of the resisting stress exerted by each lamina is directly proportional to its distance from the neutral axis, in accordance with the common law of leverage. Of these three factors, the first and third are regular; but the second is irregular and arbitrary, and must be referred to experiment for valuation.

For the purposes of illustration I have taken the results of experiments upon cast and wrought iron, obtained at Woolwich Arsenal by Dr. Anderson, and published by him in his "Strengths of Materials." These experiments show the amount of alteration of length, as observed at every increment of a continually increasing load. I have laid down these results in diagrams, which show the salient points more clearly than the figures. In Figs. 1, 2, 3, and 4

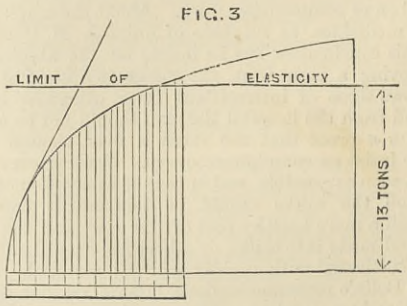


the abscissæ represent to an exaggerated scale the alterations of length, while the corresponding ordinates give the loads which produced the alterations. Had these been always proportional, the line joining the ends of the ordinates would of course be straight; the amount of curvature shows strikingly the deviation from proportion. Reference to the diagrams shows that cast iron under compression—Fig. 1—adheres very closely to true proportion, and for all practical purposes may be considered to do so absolutely, as the deviation commences much above the limit of elasticity, and is never considerable. The same remarks apply to wrought iron in tension—see Fig. 4. Cast iron in tension—Fig. 2—shows a falling away of strength at very low degrees of elongation. Wrought iron under compression shows the most remarkable results—Fig. 3; at first the load runs up very quickly with very slight alteration of length, but the initial rate is decreased from the very commencement, and long before the limit of elasticity is approached the contractions show very heavily relatively to the loads. This is the diagram which concerns us most in practice.

Returning now to our solid bar, suppose it to be of wrought iron, 6in. deep by 2in. wide, and placed on edge; further suppose that our load is sufficient to put a stress of 3·7 tons per square inch upon the outer tensional laminæ, that is nearly half the limit of elasticity; also suppose the neutral axis to be 3½in. away from the surface in tension, as in Fig. 5, there will then be $\frac{7}{12}$ in tension and $\frac{5}{12}$ in compression, and the greatest contraction will be to the greatest elongation as 5 to 7. Taking the outside tensional laminæ, its stress is 3·7 tons, due to an elongation value 7, and its distance from the axis may also be called 7. Multiplying the stress 3·7 by the distance 7, we have a value proportionate to the



moment of resistance of the outside laminæ. Set up an ordinate of this value. Moving now to a laminæ at a distance 6 from the axis, and whose extension will be 6, and taking by scale from Fig. 3 the stress corresponding to that extension—remembering that we



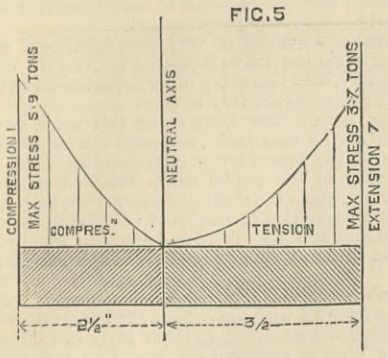
have called the extension due to 3·7 tons stress 7—multiply stress by distance again, and set up another ordinate at distance 6 from the axis; and so on for all on that side.

The distance of the outside lamina in compression is only 5 from the axis, and its contraction will therefore only be $\frac{5}{7}$ of the outside tensional laminæ extension. Find from Fig. 4 the corresponding stress to this—in this case 5·9 tons—multiply stress by distance, and set up ordinates as for other side.

Joining the ends of the ordinates, we have an irregular figure on each side of the axis, the areas of which are proportional to the moments of resistance on corresponding sides, and these areas must be equal. In the assumed case, Fig. 5, they are very nearly so, and the neutral axis is thus shown to be 3½in. above the lower surface under those conditions. Now let the load be increased till the outside tensional laminæ is strained by 13 tons per square inch; and assuming the neutral axis to be in the same place, pro-

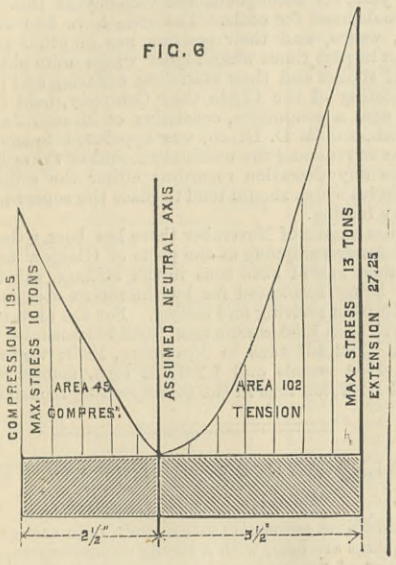
ceed with calculations as before—see Fig. 6. The maximum extension will now be 27·25, using same scale as before, and the maximum contraction 19·5; while the maximum compressional stress has risen to 10 tons only. The resultant areas are now

FIG. 5



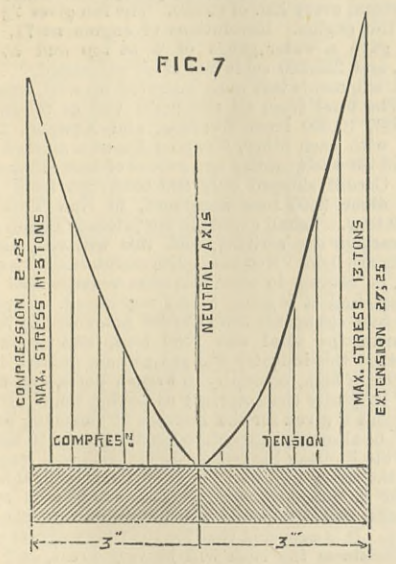
found to be as 45 to 102 instead of equal as before, and we are forced to the conclusion that the neutral axis is not now in the same position. Retaining the same maximum tensional stress, and calculating for an axis in the centre of the depth, the areas of moments are equal; and that, therefore, is the true position with

FIG. 6



the increased load. In addition, then, to fixing all the factors enumerated at the head of this letter, we must also know the amount of load if we are to be correct. In practice, however, the limit of elasticity is the critical point in consideration of stress, and if we know the position of the neutral axis for that point we may safely neglect its position for stresses of less value. This has led to the use of the rule which gives the centre of gravity of section as the axis for a wrought iron girder of symmetrical form. With wrought iron it happens to be very nearly correct, and it would be quite correct with a material which elongated, or was compressed, to precisely similar extent under precisely similar loads. Unfortunately such a material does not exist.

FIG. 7



From the foregoing it will also be seen how any departure from symmetry would affect the position of the axis, such as a thicker flange on one side; or the same result would arise from the use of a different class of material. It follows that a designer has it in his power, by selection of his material or by distribution of it, to put his neutral axis where he pleases, provided always that it must be within the two faces of the structure.

This disposes of several solutions of Mr. Pendred's difficulty. With regard to that gentleman's crane post theory, I think my argument proves that the neutral axis cannot be "eliminated;" it cannot exist on either face of a structure; that a neutral axis must always exist in a rigid structure; and that in a non-rigid structure of the nature of the safety valve and lever, or the spring-hinged crane post imagined by Mr. Seguin, a neutral axis is quite inconceivable.

One or two letters replying to my last require an answer; but this one has become so long that I will ask your permission to reply in a later issue. C. G. MAJOR.

34, Freke-road, S.W., Nov. 22nd.

FUEL ENGINES.

SIR,—I have read with interest your able article in the issue of December 2nd, having reference to fuel engines, and the various methods that have been tried from time to time which shall provide the motive power for such engines, so that they can be made independent of any gas supplies existing at present in various districts, or, rather, that shall contain in themselves the power to produce their own fuel. It has been shown that engines can be driven by other gases than coal gas, and that being the case, I believe the difficulty hitherto existing has been, if not wholly, at least to a great extent, solved by an invention lately patented by me, and of which I beg to hand an illustration herewith. In this invention a hydrocarbon liquid of light specific gravity is employed, contained in a suitably arranged chamber called for convenience the carburetter or generator. By the action of the engine attached either directly or indirectly to this carburetter, air is brought into contact with the liquid, and in its passage through the carburetter becomes impregnated with the vapour of the hydrocarbon and transformed into an inflammable and explosive gas, which is then conveyed to the engine, which at once is provided with its motive power. A governor is provided by which the quantity of air not required to be carburetted is allowed to pass off in the shape of air only, not gas, so that any tendency of the engine to race when relieved of its load is obviated. Again, the air that is passed into the carburetter can be more or less lightly impregnated with hydrocarbon, according to the requirements of the engine, and to the volatility of the liquid, which varies slightly in different temperatures by suitable arrangements provided to this end. The arrangement itself is very compact and portable, and, as the liquid can be supplied to all parts of the world, consumers have at once power at hand. In the illustration a Bisschop engine is shown, but it is equally applicable to those of other makers, the Otto, &c.

H. L. MULLER.

Birmingham, December 6th.

BOILERS AND FEED-WATER HEATERS.

SIR,—Looking over the abstracts of patents as contained in your valuable paper, it appears to me there is a revival of old manufactures, which are now turned out as patents. Take the following:—In the abstract given Nov. 4th, I find in No. 1328, Boilers, W. Arnold, a perfect sketch of a boiler I made upwards of twenty years ago, and sent to Norwich. Also in the following week's abstract, No. 1509, Water-Heaters, H. Schofield. I made a water-heater of the same construction about five years ago, and sent it to Leicester. I enclose you the sketches referred to (2), and apologise for troubling. JOHN WALLEY.

St. Mary's Bridge Boiler Works, Derby, Dec. 7th.

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

(*From our own Correspondent.*)

ON 'Change in Birmingham this afternoon, and in Wolverhampton yesterday, there was a better feeling than even a week ago. Not unfrequently December is one of the dullest months of the whole twelve, but this year this is far from being the case.

At the mills and forges full time will be run up till Christmas, and then orders will be left on the books unexecuted, which, even should they not be increased during the holidays, would, in numbers of instances, afford of themselves a fair amount of work to begin the new year with, especially as orders are still arriving, though not for heavy lots. Sheets and hoops still lead the market, so far as activity is concerned, and the probability is that they will continue to lead. £8 to £8 10s., for ordinary sheets—singles—£9 10s. for doubles, and £11 for latens, were this afternoon again the quotation of makers. Hoops were £6 17s. 6d. as a minimum up to £7 5s.

The marked bar makers are not meeting with the demand which they ought to experience if trade were in a normal condition. Messrs. Phillip Williams and Son's "Mitre" bars were still to be had at £7. This is the figure at which they have stood from the date at which marked bars generally were first brought down from £7 10s; for, unlike other brands, the "Mitre" brand was not readvanced to £7 10s. when the general putting-back subsequently took place. The firm justify the readiness with which they are prepared to accept orders direct by their experience that some merchants were offering at less money bars which they profess are equal in quality to the "Mitre" brands.

In order to encourage business, Messrs. Williams have formally intimated to customers their intention to "warehouse" their iron in future. This is a policy not adopted by any other "marked bar" house in South Staffordshire. The firm's intimation has been accompanied by a revised list of prices, from which it appears that buyers will have to pay an extra 5s. per ton, if the iron is delivered immediately from the stock instead of waiting while the iron is made.

Common—hurdle—bars were this afternoon to be had at £6 5s., but merchant bars were about £6 10s. to £6 12s. 6d. as a minimum.

Boiler plate makers still complain of the difficulty which there is in securing enough work for their mills. Less movement appears in this branch of the finished iron trade than in any other. Prices are £8 10s. for poor qualities, and £9 to £9 10s. for superior sorts.

The thin sheet makers, whose product is used for best working up purposes, and for stamping, announced that they were full of orders, and that they experienced inconvenience through the urgency of customers' needs. The quotations of such firms as Messrs. E. P. and W. Baldwin, of the Wilden Ironworks, ranged between £12 and £18, according to gauge.

Tin-plates were in a little better sale on export account, and prices of coke sorts were firmer, because of the advances in the tin market.

The Australian (monthly) mail delivered in this district this week has brought some good orders for iron and hardwares. Merchants' advices state that when the mail left Melbourne galvanised iron was being largely noticed, and improved prices were being realised. About 300 cases "Orb" had just changed hands at £22 to £22 10s. for 26 gauge. "Stork" had been sold at £21, and £22 was being asked. Other brands were also receiving fair attention. General quotations for ordinary brands of English were standing at £21 10s., and best brands at £22 10s. Bar and rod iron was also being largely dealt in, all available parcels to arrive having been purchased; quotations for these sorts up to date of departure were £9 10s. to £11.

Black sheet iron was selling steadily at Melbourne; assortments of Nos. 8 to 18 were quoted at £11, while for Nos. 20 to 26, £13 was obtained. Plate iron was in fair request, £10 to £12 being the quotations. Hoop iron for trade purposes was offered at £9 10s. Nos. 6, 7, and 8 drawn fencing wires were in better request, and sales were making at improved prices, such as £13 10s., £14, and £14 10s.

On Wolverhampton and Birmingham Exchanges this week there was slightly more movement in pig iron. Prices were strong for most descriptions. The agent for the Tredegar Company—South Wales—announced that his principals had just advised him that hematites were, in consequence of the heavy purchases by the steelmasters, worth 5s. per ton more in the market than a fortnight ago. Consequently their hematites on these exchanges stand now at 75s. Most other hematite firms quote 72s. 6d.; but the Blaenavon Company's pigs on the contrary were quoted as high as 80s. No hematites could, however, be sold at the open market rates, and scarcely even at 2s. 6d. below the quotations. Derbyshire pigs were priced at—for best sorts—52s. 6d., without sales; Thorncliffe—South Yorkshire—pigs were strong at 60s.; native all-mines were 65s. to 70s. for hot-blast sorts.

Messrs. Firmstone, The Leys, Stourbridge, are now making upwards of 3500 cast iron pipes 9ft. long, the majority of them 3in., for water purposes in Australia. The order was only received a few days ago, and the whole is to be despatched by the 18th of the present month.

The South Staffordshire Mines Drainage Commissioners find that another £25,000 must be borrowed if the work of the Commission is to be completed. At a meeting of the masters it was resolved by 16 votes to 7 to promote a Bill for raising the rates on coal and slack from 6d. to 9d.

The boring operations by the Stafford Waterworks Company, for water on the Earl of Lichfield's land, have advanced to the depth of 300ft., but as yet nothing but marl has been found. The total water supply at present is 1,200,000 gallons per day.

At a meeting of the Stafford Town Council, on Tuesday, steps were taken to obtain a loan of £10,000 for extended gasworks operations.

The proposed combined sewerage scheme for Walsall and Wednesbury is likely to come to nothing. Wednesbury wishes to act independently by adopting a filtration and precipitation process called the "Farnworth" from a district outside Wednesbury where it is working well. The Wednesbury Corporation authorities met on Tuesday. It was stated then that the Farnworth scheme would cost about £27,000—a much larger sum than the combined scheme. Opinion was much divided, and arrangements for a special meeting were made at which a formal refusal of Walsall's offers will be suggested. A united drainage scheme for Wednesbury, Tipton, and Darlaston will be considered at the same time.

The National Association of Nailmakers met at Lye, near Stourbridge, on the 5th inst., and after addresses from members of the Brassworkers' Association, resolved to form an arbitration committee, before whom all grievances could be mutually ventilated. The horse-nail makers of the Sedgley district are still persisting in their demand for an advance of 3d. per thousand. The present pay per thousand is 3s. A few years ago it was 4s. 3d.

The North Staffordshire potters at a mass meeting at Hanley have just declared that "If our employers are willing to confer with our leaders as to the reconstruction of the Board of Arbitration upon a fair basis, we are ready to assent to that course." The breaking-up of the old board they lay to the charge of unfairness on the part of the employers. The opening of the Etruria Works, recorded in my last, has led to the opening of another works; but with these exceptions the strike continues, and the trade is fast leaving the district.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—During the past week the iron market here has been characterised by an amount of animation which, so far as pig iron is concerned, has presented a marked contrast to the previous lifeless demand for the raw material. The absence of enquiry for pig iron in the face of the undoubted activity amongst finished iron makers and the steadily growing improvement in nearly all the iron-using branches of industry has, in fact, been of late an extraordinary feature in the trade, and the present demand for pig iron, which makers felt must come sooner or later, has probably been hastened by the Middlesbrough returns just published, which have shown a further large decrease in the North of England stocks, whilst the very encouraging reports from America also tend to give a buoyant tone to the market. Certainly from whatever cause it has arisen, there has been a considerable business doing in pig iron during the past week, and buyers generally are showing much more anxiety than of late to cover their forward requirements. Makers, however, following the tolerably large sales of the last few days, not only show an upward tendency in prices, which in some cases have been advanced 1s. to 2s. per ton upon last week's rates, but they are very indifferent about booking further orders over any considerable period into next year.

Lancashire makers of pig iron report a considerably increased demand, and they could sell largely into next year, but they do not care to book forward orders to the extent which buyers are offering. Quotations for local pig iron are without change from last week, but makers are very stiff at their full rates of 49s., less 2½ for both forge and foundry qualities delivered equal to Manchester, and as their present deliveries are not only taking away all their make, but fast clearing away stocks, an early advance upon the above figures is more than probable should the market maintain its present position.

In outside brands of pig iron a tolerably large business is reported. In Lincolnshire particularly considerable transactions have taken place, and in Derbyshire iron there has been a fair amount doing. The bulk of the business has been on the basis of late rates, and a considerable quantity of Lincolnshire iron has been sold at about 48s. to 49s., less 2½ delivered equal to Manchester, but at least one to two shillings is now being asked above these figures, and sales have been made at prices equal to 50s. and 51s., less 2½ for Lincolnshire and Derbyshire foundry irons. In Middlesbrough irons transactions are reported at 51s. 10d. per ton net cash delivered equal to Manchester, but these have been chiefly where buyers have been compelled to cover, as the quantity of North-country iron actually bought by consumers here is still very limited, owing to the lower prices at which local brands can be obtained.

In the finished iron trade all the makers throughout this district continue very busy, with a very good inquiry coming in for next year, which, however, is only being entertained to a limited extent. Prices all round are firmer, the comparative low quotations which were being made last week for some of the local bars being now withdrawn, and the average prices for Lancashire bar iron delivered into Manchester may be given at £6 12s. 6d. to £6 15s. per ton.

The metal market is also very firm, and following the upward movement in copper, tin, and other raw materials, manufacturers of tubes, pipes, sheets, wire, &c., are also stiffer in their prices.

Ironfounders generally are very fairly employed, both on engineers' castings and general work, but in this branch of trade prices have not yet followed to any very material extent the upward movement in pig iron.

Activity is becoming general in all the engineering branches of trade throughout this district, and the number of men out of work continues to steadily decrease. The Amalgamated Society of Engineers at the present time have not one-fourth the number of men on their books as out of employment in Manchester that they had at the commencement of the year, and of the total number of members in the district there are not now more than 2½ per cent. in receipt of out-of-work donations. As a further indication that trade is better, I may mention that Messrs. Harrison, McGregor, and Co., the agricultural implement makers, of Leigh, have spontaneously intimated to their men that after the close of the year they will restore wages to the level at which they stood prior to the last reduction, which will represent an advance of 2s. per week.

Messrs. W. and J. Galloway and Sons, of Manchester, have recently received orders from one of the large ironworks in France for the construction of exceptionally powerful rolling and cogging mill engines. For the rolling mill they are constructing a pair of horizontal rail finishing engines driving direct on to the train without the intervention of gearing. These engines are on the compound tandem system, the steam cylinders having a bore of 33½in. for high and of 59in. for low pressure, with a stroke of 4ft. The engines for driving the cogging mill are also on the compound principle with high and low pressure cylinders of 27½in. and 51in. bore respectively, and a stroke of 4ft. These engines drive the mill through a pair of spur wheels having a relative proportion of two to five, and both engines are arranged to be worked as condensing engines in connection with one air pump common to both. This pump is of the horizontal type, and has a bore of 39in. with a stroke of 4ft., and is actuated by an auxiliary horizontal engine with steam cylinder of 26in. diameter and 4ft. stroke. The same firm have also in hand a pair of powerful vertical blowing engines on the compound condensing system, which are being constructed for blast furnace purposes. In these engines the steam cylinders have a diameter of 32in. for high and of 51in. for low pressure, the air cylinders a diameter of 79in. and the stroke is 5ft. 3in.

In the face of the formidable competition which is now undoubtedly threatened by electricity as an important agent for lighting purposes, it is only natural that the gas companies should be stimulated to extra activity with the view of developing the application of gas for domestic and commercial purposes, such as cooking, heating, and as a motive power. With the object of popularising the use of gas for other than simply lighting purposes, the Ashton Gas Company has during the week been holding an exhibition of gas apparatus, and upwards of 400 exhibits have been brought together. The exhibition, though not presenting many features of striking novelty to those acquainted with recent developments in the application of gas has, however, been

interesting as illustrating the varied purposes to which it can be applied. The exhibits included heating and cooking stoves of all varieties, gas-heated baths, several gas engines, and a large assortment of burners, meters, governors, gas fittings, and gas fitters' tools. Some improvements in the cooking and heating stoves were noticeable. In one stove a complete combustion of the gas was effected by turning it into open-ended tubes, by which it became thoroughly mixed with the air entering at the same time before reaching the burners where it was ignited, and in a new American stove the ordinary ring burners were replaced by wire gauze burners, thoroughly protected from dirt and grease. In the heating apparatus, what are termed metal and platinum fires in the place of the ordinary burners, were also a feature, and a very handy tin-plate worker's fire was also shown, in which gas is substituted for the ordinary coke fire, certainly with every appearance of advantage both as regards cleanliness and less injurious effects upon the tools.

The exceptional mildness of the weather continues to keep down the demand for all classes of fuel for house-fire purposes, and most of the collieries have been put on short time, whilst there is a large accumulation of stocks. Common coals are also more plentiful, but for these there is still a fairly good demand for iron-making and steam purposes, and engine classes of fuel also move off tolerably well. Although the leading colliery proprietors are mostly holding for late rates, there is unquestionably an easier tone in the market, and for prompt delivery nearly all classes of round coal could now be bought at 6d. per ton under late rates. The average prices at the pit mouth are about 9s. 6d. to 10s. for best coal, 7s. 6d. to 8s. for seconds, 6s. to 7s. for common coal, 5s. for good burgy, 4s. to 4s. 3d. for good slack, and 3s. to 3s. 6d. for the commoner sorts.

The scarcity of vessels at the Mersey ports owing to the recent stormy weather has caused the shipping trade to be very quiet and sales have been pressed at low figures, Lancashire steam coal delivered at the high level, Liverpool, and at Garston, being offered at 7s. 6d. to 8s. per ton.

Coke is in fair demand at about late rates.

Barrow.—Although a week or two since the tone of the hematite pig iron was a little easier, this was not regarded as indicating any check or falling off in the demand, but was merely on account of the approach of Christmas, and as makers were very well sold forward, no great influx of work was expected till the New Year was advanced. This week there has been a much better tone observable in the pig iron market, and I am in a position to know that in some instances makers have considerably added to their already heavy list of orders. Bessemer qualities of iron find the largest sale; steel-makers are using this description in large quantities. Forge samples meet with a good demand. The increased inquiry has been the means of making prices firm, and makers, well sold forward, refused to do business at quoted rates. No. 1 Bessemer is quoted at 63s. 6d. per ton; Nos. 1, 2, and 3, at 62s. 6d.; No. 3 forge, 61s. per ton at makers' works. These quotations cannot altogether be relied upon as indicating the exact state of the pig iron market, as business is being transacted at higher values for all samples. I am informed that several orders have been secured for Bessemer pig at a higher rate than 63s. 6d. per ton.

The activity of the steel mills is fully up to that of the past few months, and as makers are very well sold forward, any falling off in this activity need not be looked for. The inquiry for rails is very good, and that on account of bars and plates is very considerable. Blooms are in good inquiry, and makers are putting forth efforts to meet the increased demand for this which is expected. Iron shipbuilders are active, and have secured one or two fair orders. There is every appearance of a fair trade being done next year. Engineers, ironfounders, and others unchanged since my last report. The demand for iron ore is very brisk, and likely to be so. Coal and coke doing a fair business. Shipping moderately active.

The Barrow Shipbuilding Company has secured orders for two steamers, 300ft. and 250ft. long. One is for the Royal Mail Steam Packet Company; the other for a shipping firm at Marseilles.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The miners in East Derbyshire have decided to make a simultaneous application for an advance in wages. The collieries to be included are Pilsley, Blackwell, Boythorpe, Clay Cross, Brampton, Grassmoor, Tibshelf, Staveley, Whittington, Unstone, &c. Deputations have waited upon these various firms, with the request for an advance of 10 per cent. At the smaller pits the miners have been told that as soon as Clay Cross and Staveley, the leading concerns in the district, give an advance, they would do the same. One manager, employing under 400 men, is reported to have said: "There is clearly 10 per cent. due to the men; but I want some of the larger firms to make the start, and then the advance will soon come round." In the larger establishments the miners are told decidedly that the present state of the coal trade will not justify any advance. The suggestion has been made that the whole of the men should send in their notices. Some of the colliers employed at the smaller pits are stated to have intimated that, if the colliers at the larger collieries would turn out on strike, they would contribute 20 per cent. of their earnings towards the support of the strikers. The situation seems somewhat serious, and it is to be hoped that we are not going to have any repetition of the fifty days' strike in 1876, when there was an immense amount of suffering, and a lamentable waste of capital and labour.

The South Yorkshire miners proceed with their agitation for an advance in a very desultory fashion. The Union leaders combine to say that nothing can be done with any prospect of success until union is more acceptable to the men, and at the various meetings I observe the resolutions set forth that the miners working at all collieries in the district should at once join the South Yorkshire Miners' Association "in order that they may secure the full benefit of their labour in an advance of wages in proportion to the increased selling price of coal, and prevent the evils arising from unfair and extreme competition so far as possible by faithfully adhering to the carrying out of the eight hours principle."

The decision of the Railway Commissioners in the case of the Denaby Main Colliery Company is regarded in the Barnsley district as placing most of the South Yorkshire collieries, which send coal to Hull, at a disadvantage with regard to that port. Denaby Main, from its nearness to Keadby, has the advantage of three-halfpence in the tolls, while the pit being so near the ports, most of the boats prefer loading there in preference to visiting other collieries at a greater distance. Keels loading at Denaby can take something like 75 or 80 tons, whereas they can only carry about 65 tons from most of the collieries owing to the depth of water being limited to 5ft. in some parts of the canal.

The chief constructor of the Italian Navy was recently in Sheffield. As a result, I hear that the Italian Government has just given an order for 800 to 1000 tons of iron deck armour for the Italia, divided equally between Messrs. John Brown and Co., Atlas Works, and Messrs. Charles Cammell and Co., Cyclops Works.

Messrs. Vickers, Sons, and Co., Limited, River Don Works, have of late years been doing a splendid business in their specialities—heavy castings in steel for railways, bridges, ocean-going steamers, and similar work. The result is now pretty evident in the resolution arrived at by the directors to increase their capital from £500,000 to £750,000. The extra £250,000 is entirely taken from accumulated profits and the results of a re-valuation of the work. Each shareholder receives £50 per share for every £100 held by him. £100 shares were sold on Sheffield Stock Exchange on Tuesday at £240. In only one local case is this exceeded—Messrs. Jos. Rodgers and Sons, Limited—cutlery—whose £100 shares are now at £250.

Messrs. Vickers, Sons, and Co., had the contract for the steel chains for the Forth Bridge. While the contract was pending they received nearly £7000 in various sums on account of the delay, and when the bridge was finally abandoned they had a heavy claim for compensation. In their circular they stated that the Forth Bridge Company had deposited £40,000 by way of compensation for cancelling the contract, but that they—the directors—expected to obtain "the larger claim." The value of the original contract was, I believe, £600,000.

In the lighter branches of Sheffield industry there is no change from my report of last week. The electro-plating houses are exceptionally busy on orders for Christmas, and various interesting novelties have recently been brought out. So busy, indeed, are the leading firms that they have in many cases been obliged to refuse orders which were wanted at a specified time.

A valuable trade mark in steel is about to be the subject of litigation. The mark is claimed by a large local firm, whose right to its exclusive use is to be disputed by a number of smaller firms, who have combined for the purpose.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The tone of the iron market held at Middlesbrough on Tuesday was very strong, and a distinct advance was established in all kinds of iron and iron-making materials. This was largely occasioned by the announcement at the end of last week that the stocks had diminished by the extraordinary amount of 33,000 tons. Merchants and speculators are now again endeavouring to buy up whatever they can, and hold for better prices. Consumers also are anxious to cover their contracts, and for that object are buying as far ahead as they can induce any one to sell. Smelters, on the other hand, are holding off, and refuse to contract for postponed delivery, and for prompt delivery only for such small quantities as suits them to part with. Warrant-holders are now ceasing to thrust their paper upon the market, and the consequent scarcity of warrants is causing once more a difference in price between them and makers' iron. A long-continued period of frost might probably alter the situation by stopping outdoor work of all kinds; but so long as the fine open weather lasts it is almost certain that the present firmness will continue and even increase.

No. 3 g.m.b. was worth on Tuesday from 43s. to 43s. 3d. per ton f.o.b., which is an advance of 1s. 6d. per ton during the week, and 1s. 3d. per ton since the announcement of the state of the stocks. For delivery over the first six months of next year, 43s. 6d. to 43s. 9d. are the general figures named, and are only sparingly accepted. Forge pigs are the usual 1s. per ton below foundry. iron. Connal's warrants are now worth 6d. per ton above makers' iron. The stock of Cleveland pig iron in Connal's Middlesbrough stores is 174,773 tons, being a decrease of 109 tons during the week. Shipments continue to be moderate, but deliveries inland are above the average.

The manufactured iron trade is very brisk. Although no official advance was made in the price of plates on Tuesday, still it was difficult to buy at the minimum of £6 15s. at works. The actual price was more nearly represented by £6 17s. 6d. for large and £7 for small lots. Bars and angles were £6 5s. In all cases these prices are free on trucks in Middlesbrough, and subject to 2½ per cent. discount. Puddle bars command £4 5s. per ton; old rails, £3 15s. to £3 17s. 6d.; and purple ore 20s. per ton delivered Middlesbrough.

The coal and coke markets are very firm, and in the case of most qualities supplies cannot now be obtained except at an advance of 3d. to 6d. per ton.

Ironfounders have partaken of the improvement in trade less, perhaps, then any other branch, and they still complain of unremunerative prices.

Preparations continue for the restarting of the rolling mills belonging to the Tees-side Iron and Engineering Company, and also those at West Hartlepool belonging to Messrs. Gray and Gladstone. Meanwhile it is understood that the proposed new company to resuscitate the Walker rolling miils is not likely to be gone on with.

The ironworkers have held several meetings lately to consider the sliding scale by which their wages are at present regulated, and which lapses in April next. The officials of the union have not declared their policy, but continue to advocate unanimity in supporting them, in order that they may have the more power and influence when the time for action arrives. It is probable there may be some trouble in the spring over this question, and should prices continue to rise concessions will, no doubt, have to be made.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Scotch iron trade continues in a very prosperous condition. The warrant market during the past week has been unusually strong, there being more disposition to purchase, and a large business has been done at advancing prices, the quotations having reached a higher figure than for a considerable time back. The reduction of stock of pig iron in the Cleveland district at the end of November, and the great and increasing activity in the Scotch malleable iron trade, has tended to this improvement in the market, notwithstanding that the shipping demand for Scotch pigs is not so satisfactory. The past week's shipments amounted to 8161 tons, as compared with 7131 in the preceding week, and 9452 in the corresponding week of last year. There was rather more pig iron shipped to the United States than in the previous week, but the consignments thither are dropping off. The American demand is comparatively poor, and the prices offered are not such as to stimulate this department of the trade. The continental inquiry for pig iron is quiet. It is upon the home consumption that the greatest reliance is placed, and very good sales have been made for forward delivery. Fully 3000 tons have been added to the stock in Messrs. Connal and Co.'s stores in the course of the week, and the aggregate in store now exceeds 623,000 tons.

Business was done in the warrant market on Friday morning at from 51s. 9½d. to 51s. 10½d. cash, and 52s. to 52s. 1d. one month, the afternoon quotations being 51s. 10½d. cash to 52s. eight days, and from 52s. 1d. to 52s. 1½d. one month. On Monday the market opened very firm, and a large business took place in the morning at from 52s. 6d. to 52s. 4½d. cash, and 52s. 9d. to 52s. 7d. one month. In the afternoon from 52s. 4d. to 52s. 6d. cash, and 52s. 7d. to 52s. 9d., were the prices paid. The market was very strong on Tuesday, with a good business at 52s. 6d. to 52s. 9d. cash, and 52s. 9d. to 52s. 11½d. one month. A large business was done on Wednesday up to 53s. cash and 53s. 3d. one month. The market was steady to-day—Thursday—with numerous transactions at 52s. 11d. to 53s. 3d. cash and 53s. 4½d. one month.

Makers' iron has been in good demand for home use, particularly No. 3, which has materially advanced in price. Indeed, prices all round are about 1s. per ton higher than they were a week ago. The quotations are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1. 60s. 6d.; No. 3, 53s.; Coltness, 61s. 6d. and 53s. 6d.; Langloan, 62s. and 54s.; Summerlee, 59s. 6d. and 53s.; Calder, 59s. 6d. and 52s. 6d.; Carnbroe, 53s. 6d. and 51s. 6d.; Clyde, 53s. 6d. and 50s. 6d.; Monkland, Quarter and Govan, each, 53s. and 50s. 6d.; Shotts at Leith, 60s. and 54s.; Carron at Grangemouth, 53s. 6d. (specially selected, 56s.) and 52s. 6d.; Kinneil at Bo'ness, 51s. 6d. and 50s.; Glengarnock at Ardrossan. 54s. and 51s. 6d.; Eglinton, 53s. and 50s.; Dalmellington, ditto ditto.

The shipments of Scotch pig iron for the year to date amount to 536,761 tons, as against 627,798 in the same period of last year, and 566,467 in 1879. The relative prices of warrants are at the present date 52s. 9d.; corresponding date last year, 51s. 6d.; 1879, 59s. 6d. There is an increase of arrivals of Cleveland iron to date of 36,685 tons, and for this iron, as well as for Scotch pig, there is a steady demand in the manufactured ironworks.

The malleable works of Lanarkshire and Ayrshire are exceedingly busy. In most instances the orders now on hand will take a considerable time to execute. Makers are obtaining the full prices as advanced a fortnight ago, and appear somewhat indisposed to accept new orders unless at rather better terms. There is a particularly extensive inquiry for bars.

The placing of a number of very good additional orders in the shipbuilding trade has led to increased activity in that very prosperous industry, and also aided other departments depending upon it. Marine engineers are very busy.

There has been rather more doing this week in the shipping department of the coal trade, although the shipments are about 20,000 tons behind those in the corresponding week of last year. A great many of the public works are well supplied, the coalmasters having, since the month of September, been making extensive sales in anticipation of possible trouble with the miners. Just now the market both for inland and shipping supply is completely glutted, and prices all round are easier to the extent of about 3d. per ton.

The coalmasters of Hamilton, Motherwell, Airdrie, and Slamannan have all withdrawn from the miners the advance of 6d. per ton which was conceded to them early in October. The colliers of the West of Scotland are, therefore, now all being paid at an equal rate of wages. In some quarters the men have held meetings and protested against the reduction, but they are powerless to prevent it. The quantity of coals is just now very much larger than what is required to meet the current demand, and stocks are accumulating very extensively at the collieries, while the railway wagons stand filled on the branch lines. Neither coalmasters nor miners have had much reason to complain of the condition of business this year, for throughout the whole year there has been a very active demand for coals. The men have had steady, if not very high, wages, and their position has in other respects been better than in past times when higher wages were obtained at the expense of strikes and their attending suffering and privation.

At a meeting of the Clyde Coal Company, held in Glasgow a few days ago, a committee, consisting of Messrs. James Atkins, James Keith, and A. D. Dixon, was appointed to advise with the directors as to reducing the nominal amount of the ordinary shares, or to make any alteration regarding either the ordinary or preferential shares which should tend to place the concern upon a more satisfactory footing.

During the month of November there has been a decrease in the arrivals of foreign shipping at the ports of Glasgow and Greenock of 36,997 tons. and of 3933 tons in the sailings, this falling off in the trade being accounted for by the recent storms keeping the vessels both from arriving and sailing. For the eleven months the arrivals have been 1560 vessels and 1,082,551 tons, as against 1435 vessels and 1,031,867 tons in November, 1880; while the sailings have been 1654 vessels and 1,297,182 tons, compared with 1623 vessels and 1,187,933 tons in the corresponding month of last year.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

Trade continues eminently satisfactory, both as regards coal and iron, and prices are firm, with a strong disposition to advance, for best varieties of pig and coal in particular. Some idea of the enormous drain now taking place in the Rhondda Valley was given at a large meeting of mining engineers on Saturday last, at Clydach Vale, Rhondda Valley. The occasion was the starting of a fan—Schieles—placed by the Union Engineering Company, Manchester. It transpired that from this colliery, which is most efficiently managed by Mr. E. Hayhurst, 32,130 tons of coal were despatched in the four weeks ending November 12th. This gave, working eight and a-half working hours, 1300 tons per day. It is something stronger than a figure of speech to state that at present operations in this valley, acres are literally cleared weekly. The fan at Clydach Vale works admirably. Its diameter is 14ft. 3in.; engines, duplicate, 27in. diameter and 3ft. stroke; multiplication of fan, 2·68; diameter of fly, 17ft.; pulley, 6ft. 4in.; engine made to cut off steam every 3in. of stroke. The fan gives 2⅝ revolutions to one of the engine. Revolutions of engine at 71, pressure of steam 63, gave a water gauge of 4 at top and at separation doors 2·85, and 225,280 cubic feet of air exhausted.

The coal shipments last week mounted up well, especially from Cardiff. The total from all the ports was as follows:—120,760 from Cardiff, 10,000 from Swansea, and Newport 21,278 tons. Compared with each other, Newport shows a marked superiority over Cardiff in the quantity and extent of iron shipments. Thus last week Cardiff shipped only 800 tons, but from Newport to Galveston alone 2300 tons were sent, to New York 1230, and Savona 400 tons. I shall expect to see prices of Bilbao in advance, very few cargoes are arriving, and this will tell, except where large stocks are held. Swansea quite maintains its position, comparatively, in respect to other ports as regards coal shipments; but in patent fuel it is going a long way ahead. Thus, last week the patent fuel shipments from Cardiff amounted to 700 tons, but from Swansea the total was 7280 tons, and appearances are in favour that this industry will yet assume greater importance. Freights remain high, especially to French ports, and the shipping trade may be justly characterised as paying well. In fact, every encouragement is given for the increase of steamers, and no spare capital will be allowed, I expect, to remain unused in this direction. The Taff Vale Railway has been crowded with coal wagons all the week, and the trains now may be said to be interminable, following one another in quick succession. This can be seen by the shipments, as one day last week 36,000 tons were cleared from the Bute Docks. It is expected that for the time intervening between now and Christmas the rush will be very great, and some coalowners are satisfied of a longer continuance, as they have concluded contracts to the close of 1882. Many of the principal owners, I hear, are thus happily placed, so the prospect of quiet times and falling prices is, to say the least, remote.

Now that attention has been called to Milford by the rumoured express line, it is not unlikely that a steamboat will be applied to the projected connection between that port and London by way of Llandovery, Brecon, Abergavenny, Severn Railway and Midland. It is rumoured that Mr. Talbot, Sir D. Gooch, and other large capitalists are embarked on the new express steam line to New York. Masts are not to be used. The vessels will be cigar-shaped and rush through the waves.

At a meeting of colliers in the Rhondda Valley this week, a small crop of grievances came to the front, one bearing reference to the refusal of a coalowner to allow the men out in order to attend a funeral. It transposed, however, that in a previous case, 100 men had left their work for the same purpose, yet only ten had actually attended the funeral.

It has been decided that Mr. William Abraham is to attend the Birmingham meeting to represent the Welsh colliers.

Writs of *elegit* preferred by creditors against the Gadlys Tinplate Company have been satisfied.

Prices of old iron rails are easy, and good samples are to be had from £3 10s.

The chairman of the Taff Vale Railway, Mr. Brittain, died this week. The Taff, Great Western Railway, and Rhymney are in competition to form lines to Cyfarthfa Works. I am inclined to think that the Taff Vale has the best chance. The Rhymney shareholders may not aquiesce in the investment of large capital against their own interests. The gradients of the Rhymney are said to be the easiest.

The Merthyr tramway scheme, which links a population of 30,000 to another of 25,000, is still in abeyance, and the reason alleged is that it would not pay for horses and steam would not be allowed. The gradient in some places is 1 in 15. What about an endless rope? The speculation is a good one.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

29th November, 1881.

5201. ENGINES, W. W. Tonkin, Brixton-road, Surrey.
5202. BOILERS, &c., P. J. Lynam, Raheen.
5203. FABRICS, J. Kerr and J. Haworth, Church.
5204. SAFETY TAPS, C. Stuart, Fenny Stratford.
5205. DRILLING APPARATUS, C. Stuart, Fenny Stratford.
5206. SWITCHES, E. Reynolds.—(*A. Reynolds, Canada.*)
5207. UTILISING WASTE, E. L. Ransome, San Francisco.
5208. CLOSING JARS, H. Mardon, Bristol.
5209. COATING TIN-PLATE, A. N. Hopkins, Birmingham.
5210. HYDRO-EXTRACTORS, F. Bates, Sowerby Bridge.
5211. SEWING MACHINES, J. Hunt & J. Fairfax, London.
5212. CHARCOAL, T. Hadfield.—(*R. Reddish, Bordeaux.*)
5213. HEATING APPARATUS, J. Nicholl, Halifax.
5214. CASKS, F. McClure Scott, Liverpool.
5215. HORSE NAILS, J. A. Hugget, Kensington.
5216. HYDRAULIC MOTORS, J. E. Liardet, Brockley, and T. Donnithorne, London.
5217. CRANES, &c., W. Clarke, Gateshead-on-Tyne.
5218. SPINNING APPARATUS, F. W. Fox, Windhill.
5219. NIPPERS, F. J. Chessbrough.—(*T. G. Hall, U.S.*)
5220. SLEEPERS, A. G. Browning.—(*B. Leslie, Calcutta.*)
5221. SIGNAL APPARATUS, W. Lake.—(*W. Shaffer, U.S.*)
5222. LADIES' CLOAKS, I. Lojda, New York, U.S.
5223. FABRICS, G. Pitt.—(*Fabric Ornamenting and Manufacturing Company, New York, U.S.*)
5224. WINDOW SASHES, E. V. Harris, Winchester.
5225. EXTINGUISHING FIRE, W. H. Phillips, Nunhead.
5226. COUPLING WIRES, A. W. Brewtnall, London.

30th November, 1881.

5227. RINGS, &c., J. V. Hope, Wednesbury.
5228. DAMS, &c., J. Thomas, Bangor.
5229. UTILISATION of ELECTRICITY, W. R. Lake.—(*J. S. Williams, Riverton, U.S.*)
5230. FABRICS, J. H. Johnson.—(*A. O. Delétoille and H. J. B. Lechopier, Paris.*)
5231. MOTIVE POWER ENGINES, J. Bell, Wishaw.
5232. HEATING APPARATUS, W. Hutchinson, London.
5233. UTILISATION of ELECTRICITY, W. R. Lake.—(*J. S. Williams, Riverton, U.S.*)
5234. FIRE-ALARMS, W. T. Braham, Manchester.
5235. MATCHES, J. L. Mapple, London.
5236. STEERING APPARATUS, J. Holliday, Sunderland.
5237. MOTIVE POWER, H. E. Newton.—(*L. A. W. Desruelles and C. F. Carlier, Paris.*)
5238. CABINETS, R. H. and A. S. Bishop, London.
5239. HAY-MAKING MACHINES, W. N. Nicholson and W. Mather, Newark-upon-Trent.
5240. BISCUIT BOXES, J. Pinder, Sheffield.
5241. FEEDING APPARATUS, J. H. R. Dinsmore and F. Hoyer, Liverpool.
5242. BELT CLASPS, J. H. Cofield, Birmingham.
5243. BURNERS, W. Foxcroft, Birmingham, and J. Titley, Wolverhampton.
5244. CLEANING COAL, J. Bell, Wishaw.
5245. PROPELLERS, C. Abel.—(*J. A. Andrée, Germany.*)
5246. ORES, &c., F. Glaser.—(*F. Büttgenbach, Germany.*)
5247. WHEEL PADS, J. F. Walters, London.
5248. GLASS, H. Lake.—(*J. Budd and J. Grant, U.S.*)
5249. INDOPHENOLS, O. Witt & H. Köchlin, Germany.
5250. HARROWS, J. Elkington.—(*R. Cockerell, Melbourne.*)
5251. WASHING MACHINES, W. B. Brooker, Bootle.

1st December, 1881.

5252. CLOTHES DRYER, H. J. Haddan.—(*J. Everett, Canada.*)
5253. TRICYCLES, I. T. Townsend, Coventry.
5254. PICKS, &c., T. N. Robson, Newbottle.
5255. FLUIDS, F. Wirth.—(*A. Dietsche, Waldshut.*)
5256. LUBRICATORS, J. Davis, Borough.
5257. METALS, S. Pitt.—(*H. Harmet, France.*)
5258. RINGS, J. W. Merrall, Morton, near Bingley.
5259. GAS ENGINES, J. Rhodes, Manchester.
5260. CLUTCHES, J. C. Eckardt, Stuttgart.
5261. BATTERIES, H. E. Newton.—(*E. Volckmar, Paris.*)
5262. SODA, C. D. Abel.—(*F. C. Glaser, Berlin.*)
5263. FABRICS, C. D. Abel.—(*F. Schmalbein, Cologne.*)
5264. SODA, C. D. Abel.—(*F. C. Glaser, Berlin.*)
5265. SCREWS, W. R. Lake.—(*American Screw Company, Incorporated, Providence, U.S.*)
5266. DISINFECTING, A. Clark.—(*P. Schlosser, Paris.*)
5267. DESICCATING APPARATUS, A. M. Clark. — (*P. Schlosser, Paris.*)
5268. FÆCAL MATTERS, A. Clark.—(*P. Schloszer, Paris.*)

2nd December, 1881.

5269. PURIFYING COAL GAS, J. Walker, Leeds.
5270. ROLLER MILLS, A. Stevenson, Chester.
5271. PURIFYING COPPER, F. Claudet, London.
5272. LAMPS, W. F. King & A. B. Brown, Edinburgh.
5273. CAPSULES, J. Imray.—(*C. Cheswright, Paris.*)
5274. INSECT POWDER, A. C. Henderson.—(*E. Koch and L. Schulher, Paris.*)
5275. ORGAN CHESTS, O. Dinse.—(*M. Reiter, Berlin, and G. Sander, Breslau.*)
5276. FIRE-GRATES, J. Teer, Salford.
5277. LADDERS, G. Whalley, Hackney.
5278. GAS, J. B. Spence and J. Desvignes, London.
5279. HEATING APPARATUS, T. Ivory, Edinburgh.
5280. FUSIBLE PLUGS, H. J. Harman, Manchester.
5281. IMPLEMENTS, G. P. Blake, Exeter.
5282. FANCY YARNS, E. Horsfall, Bradford.
5283. WASHING MATERIALS, G. F. Redfern.—(*H. Buczkowski, Vienna.*)

3rd December, 1881.

5284. TRICYCLES, N. K. Husberg, Stockholm.
5285. FURNACES, J. Redgate, Nottingham.
5286. ELECTRIC LIGHT, A. R. Sennett, Worthing.
5287. VELOCIPEDES, C. Beger, Berlin.
5288. WARDROBES, E. Peyton.—(*J. H. Baxter, Sydney.*)
5289. STEAM GENERATORS, W. L. Wise.—(*G. H. Babcock, S. Wilcox, N. W. Pratt and E. H. Bennett, U.S.*)
5290. LUBRICATORS, H. J. Haddan, Kensington.
5291. CHROME, W. Spence.—(*E. Werner, Warsaw.*)
5292. SPINNING COTTON, J. Leyland, Bolton.
5293. BOILERS, E. Brydges.—(*J. Schreiber and F. H. Moldenhauer, Vienna.*)
5294. FURNACES, E. Kaulbach, London.
5295. ELECTRODES, H. Newton.—(*A. Gravier, Paris.*)
5296. SULPHO-ACIDS, F. Wirth.—(*Messrs. Kalle and Company, Biebrich.*)
5297. BLACKING, H. H. Lake.—(*J. Nicolet, France.*)
5298. CRANES, W. D. Priestman, Kingston-upon-Hull.
5299. GAS, &c., PIPES, H. Green, Preston.

5th December, 1881.

5300. PUMPS, H. Fauler, Baden.
5301. LOOM PICKERS, J. Holding and E. Dutton, Manchester.
5302. DRYING COFFEE BEANS, F. Des Vœux.—(*W. A. Dieseldorff, South America.*)
5303. TELEPHONES, J. Burton, Oldham.
5304. ORGAN KEYS, H. Haddan.—(*J. Bommelaer, France.*)
5305. SADDLES, C. R. B. Hamilton, Greenwich.
5306. LEVEL, C. Beger, Berlin.
5307. OIL LAMPS, J. Darling, Glasgow.
5308. STEAM BOILERS, L. McIntyre, Glasgow.
5309. ELECTRIC INSULATION, J. Fleming, Nottingham.
5310. ALKALINE SOLUTIONS, E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.
5311. PULLEY BLOCKS, T. H. Ward, Tipton.
5312. ALKALINE SOLUTIONS, H. W. Deacon and H. Gaskell, jun., Widnes.
5313. MULES, B. A. Dobson, Bolton.
5314. SPINDLES, J. Farrar and F. H. Bowman, Halifax.
5315. GLASS, W. Clark.—(*T. Tanner, Osage, U.S.*)
5316. LIGHTING CARRIAGES, R. Laybourne, Newport.
5317. TUNNELLING MACHINERY, T. English, Hawley.
5318. BRACES, J. Imray.—(*F. Steeg, Düsseldorf.*)
5319. FIREPLACES, S. Sturm, Cologne.

Inventions Protected for Six Months on deposit of Complete Specifications.

5166. SEWING MACHINES, H. J. Haddan, Kensington.—A communication from D'Arcy Porter and T. H. White, Cleveland, U.S.—*26th November*, 1881.
5167. FABRICS, H. A. Bonneville, Cannon-street, London.—A communication from A. L. Pollet, Roubaix.—*26th November*, 1881.
5221. SIGNAL APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from W. C. Shaffer, Philadelphia, U.S.—*29th November*, 1881.
5222. LADIES' CLOAKS, &c., I. Lojda, New York, U.S.—*29th November*, 1881.
5265. SCREWS, W. R. Lake, Southampton-buildings, London.—A communication from the American Screw Company, Incorporated, Providence, U.S.—*1st December*, 1881.

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

4960. ELECTRIC CURRENTS, A. V. Newton, Chancery-lane, London.—*4th December*, 1878
4861. SUGAR REFINING, E. Hunt, Salford.—*29th November*, 1878.
4869. TALLOW CUPS, G. M. Marchant, Huddersfield.—*29th November*, 1878.
4974. HOES, S. Duffield, Willenhall-street, Darlaston.—*5th December*, 1878.
4863. SHOE RACK, H. C. Macdonald, Brighton.—*29th November*, 1878.
4892. WASHING MACHINES, H. L. Wilson and J. Clegg, Clayton-le-Moors.—*30th November*, 1878.
4698. EYES for PICK-AXES, W. Edwards, Wolverhampton.—*19th November*, 1878.
4888. LAMPS, W. E. Teale, Fern Bank, Worsley.—*30th November*, 1878.
4905. PENCIL HOLDERS, J. H. Johnson, Lincoln's-inn-fields, London.—*2nd December*, 1878.
4914. COLOURING MATTER, F. Wirth, Frankfort-on-the-Main.—*2nd December*, 1878.
4919. BREAKWATERS, &c., J. L. Clark and J. Standfield, Westminster.—*2nd December*, 1878.
4939. REAPING MACHINES, G. Spencer, Ashleyhay, Wirksworth.—*3rd December*, 1878.
5213. BINDING of BOOKS, W. R. Lake, Southampton-buildings, London.—*19th December*, 1878.
4903. MAGNETIC APPARATUS, R. Lonsdale, Mile End-road, London.—*2nd December*, 1878.
4938. SAFETY BOLT, W. Brenton, St. Germans.—*3rd December*, 1878.
4949. ELECTRIC LAMPS, C. W. Siemens, Queen Anne's-gate, London.—*4th December*, 1878.
4973. COATING METAL, L. L. Atwood, Goswell-road, London.—*5th December*, 1878.
5154. PUMPING MACHINERY, G. H. Corliss, Providence, U.S.—*16th December*, 1878.
4987. PROPELLING APPARATUS, W. R. Lake, Southampton-buildings, London.—*5th December*, 1878.
4953. UMBRELLA RIBS, J. Knott, Sheffield.—*4th December*, 1878.
4959. TORPEDO APPARATUS, C. A. McEvoy, Adelphi, London.—*4th December*, 1878.
4980. BREECH-LOADING SMALL-ARMS, S. Mills, Birmingham.—*5th December*, 1878.
4985. COMBING COTTON, T. B. Kay, Bolton-le-Moors.—*5th December*, 1878.
5005. SIGNALLING APPARATUS, J. S. Williams, Riverton, U.S.—*6th December*, 1878.

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

4108. PREVENTING INCRUSTATIONS, J. B. Deluy, Naples.—*30th November*, 1874.
4162. PYROPHONE, A. M. Clark, Chancery-lane, London.—*3rd December*, 1874.
4119. WINDING YARNS, J. and T. A. Boyd, Shettleston.—*1st December*, 1874.
341. PLATES for BRIDGES, J. Westwood and R. Baillie, Popular.—*29th January*, 1875.
4188. FURNACES, &c., T. Morgan, Cockspur-street, London.—*5th December*, 1874.
4228. MEASURING WATER, J. A. Muller, Amsterdam.—*9th December*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 23*rd December*, 1881.

3252. SHIPS' PENDULUMS, J. Short, Gladstone-street, London.—*26th July*, 1881.
3281. PURIFYING OILS, W. A. Barlow, London.—Com. from J. H. Chandet.—*26th July*, 1881.
3288. RIVETTING APPARATUS, F. A. Paget, London.—Com. from J. Haswell.—*27th July*, 1881.
3312. TREATING WASTE SAND, H. J. Haddan, London.—Com. from F. J. Motte.—*29th July*, 1881.
3313. FIRE-ARMS, W. E. Gedge, London.—A communication from M. Kaufmann.—*29th July*, 1881.
3316. SPINNING, &c., J. J. Broadbent and E. Mitchell, Bradford.—*30th July*, 1881.
3322. CONTROLLING STEAM, S. Hallam, Manchester.—*30th July*, 1881.
3328. COAL WASHING, &c., MACHINE, H. H. Lake, London.—A communication from C. Jouffray and J. Chevalier.—*30th July*, 1881.
3344. GRINDING CORN, H. H. Lake, London.—Com. from J. T., R. K., and E. H. Noye.—*2nd August*, 1881.
3347. STEAM BOILERS, H. W. Blake and J. Shepherd, Manchester.—*2nd August*, 1881.
3370. BRAKE, W. Walton, Harrytown Hall, Romiley.—*3rd August*, 1881.
3377. FIRE-ENGINES, H. J. Haddan, London.—A communication from S. B. Babcock.—*4th August*, 1881.
3380. ELECTRIC CURRENTS, W. P. Thompson, London.—Com. from J. A. Pel.—*4th August*, 1881.
3395. TREATING FRACTURES, &c., J. C. Mewburn, London.—Com. from E. Bonnefoy.—*5th August*, 1881.
3541. APPLYING COLOUR to PAPER-HANGINGS, &c., W. Clark, London.—A communication from T. Smith.—*15th August*, 1881.
3556. BREAKWATERS, &c., E. C. G. Thomas, Vizagatam, Madras.—*16th August*, 1881.
3560. UTILISING RESIDUES of SULPHURIC ACID, &c., W. Weldon, Burstow.—*16th August*, 1881.
3570. PREPARING DRAWING, &c., PAPER, D. Bogue and B. C. Le Moussu, Strand, London.—*17th August*, 1881.
3653. GRINDING ORE, &c., T. A. Readwin, Bloomsbury-square, London.—*22nd August*, 1881.
3704. CRUSHING APPARATUS, J. M. Stuart, Queen Victoria-street, London.—*25th August*, 1881.
3922. UMBRELLAS, &c., A. M. Clark, London.—Com. from F. M. C. Farradesche.—*9th September*, 1881.
3926. SECONDARY BATTERIES, J. S. Sellon, Hatton-garden, London.—*10th September*, 1881.
3987. SECONDARY BATTERIES, J. S. Sellon, Hatton-garden, London.—*15th September*, 1881.
4146. ARTIFICIAL FISHING BAITS, G. Burt, Birmingham.—*26th September*, 1881.
4364. VELOCIPEDES, A. Phillips, Birmingham.—*7th October*, 1881.
4430. BICYCLES, T. T. Harrison, Lower College-green, Bristol.—*11th October*, 1881.
4433. CABLE-TRACTION STREET RAILWAYS, A. M. Clark, London.—A communication from C. W. Rasmusen.—*11th October*, 1881.
4466. KNITTING MACHINES, W. Dexter, Nottingham.—*13th October*, 1881.
4522. SAFETY SADDLE BARS, R. Spence, jun., Richmond.—*17th October*, 1881.
4548. VELOCIPEDES, S. Hall, Harrington-street, Hampstead.—*18th October*, 1881.
4586. STOP-VALVES, J. A. and J. Hopkinson, Huddersfield.—*20th October*, 1881.
4588. FLEECE DIVIDERS, C. Pieper, Berlin.—A communication from G. J. Erben.—*20th October*, 1881.
4592. ELECTRO-MOTIVE POWER, A. Millar, Glasgow.—*20th October*, 1881.
4613. LOOMS, W. Hanson, Saltaire, near Bradford.—*21st October*, 1881.
4630. WIRE FENCES, F. C. Guilleaume, Cologne.—*22nd October*, 1881.
4640. ROASTING, GRINDING, &c., MACHINERY, J. Parnall, Bristol.—*22nd October*, 1881.
4697. ELASTIC COTTON, G. G. de L. Byron, Prince's-square, Brighton.—*27th October*, 1881.
4710. WOVEN FABRICS, O. Drey, Manchester.—*27th October*, 1881.
4718. RIVETTING MACHINES, G. D. Edmeston, Manchester.—*28th October*, 1881.
4723. SEPARATING APPARATUS, H. J. Smith, Glasgow.—*28th October*, 1881.
4792. SWITCHES, W. E. Hubble, London.—Com. from J. M. A. Gérard-Lescuyer.—*2nd November*, 1881.
5167. WOOLLEN FABRICS, H. A. Bonneville, London.—Com. from A. L. Pollet.—*26th November*, 1881.

Last day for filing opposition, 27*th December*, 1881.

2783. INSTANTANEOUS PHOTOGRAPHIC SHUTTER, C. Sands, Cranbourn-street, London.—*25th June*, 1881.
3330. ENGINES, E. A. Brydges, Berlin.—A communication from M. V. Schiltz.—*2nd August*, 1881.
3334. WIRE FENCING, W. J. Smith, Inverness.—*2nd August*, 1881.
3340. FELTING HATS, &c., H. A. Bonneville, London.—Com. from W. Baglin and J. Gray.—*2nd August*, 1881.
3341. ADJUSTING, &c., DOOR HANDLES, W. Neilson, Glasgow.—*2nd August*, 1881.
3353. CRUSHING, &c., MACHINERY, A. Lamberton, Coatbridge.—*3rd August*, 1881.
3368. BEDSTEAD, H. H. Lake.—A communication from R. T. White.—*3rd August*, 1881.
3374. WINDING MACHINES, H. J. Crawford and J. Lees, Belfast.—*4th August*, 1881.
3382. FRAMES or STANDS, G. Green, Birmingham.—*4th August*, 1881.
3392. ASBESTOS PACKING, C. J. Allport, London, and A. Hollings, Manchester.—*5th August*, 1881.
3400. ELECTRIC MACHINES, J. H. Johnson, London.—Com. from J. Mignon & S. Rouart.—*5th August*, 1881.
3402. ELECTRIC LAMPS, J. H. Johnson, London.—Com. from J. Mignon and S. Rouart.—*5th August*, 1881.
3405. TELEPHONIC, &c., APPARATUS, T. A. Connolly, London.—*6th August*, 1881.
3439. AUTOMATIC GEAR, C. Pieper, London.—Com. from Capt. C. T. Liernur.—*9th August*, 1881.
3488. SCREW PROPULSION, J. Wilkinson, Park-road, Blackpool.—*12th August*, 1881.
3508. STEADYING FLOATING BODIES, &c., J. F. C. Farquhar, Long-acre, London.—*12th August*, 1881.
3509. ELECTRICAL INTERRUPTERS, P. Ullathorne, High Holborn, London.—*12th August*, 1881.
3572. VELOCIPEDES, G. Richards, Manchester, and B. C. Tilghman, London.—*17th August*, 1881.
3668. ELECTRIC LIGHTING, W. R. Lake, London.—Com. from T. A. Connolly.—*23rd August*, 1881.
3774. SEWING MACHINES, A. M. Clark, London.—Com. from J. K. Harris.—*30th August*, 1881.
4196. SCRAP IRON, &c., W. R. Lake, London.—Com. from H. Reusch.—*29th September*, 1881.
4198. ARMOUR-PLATES, W. R. Lake, London.—Com. from H. Reusch.—*29th September*, 1881.
4245. SADDLE ATTACHMENTS, J. E. Purdon, Wellington-buildings, Chelsea Bridge.—*30th September*, 1881.
4350. SHOVELS, &c., T. Titley, Leeds.—*6th October*, 1881.
4412. PREPARING FOOD, E. Wylam, Henry-street, London.—*11th October*, 1881.
4442. SPINNING MACHINERY, T. Briggs, Manchester.—*11th October*, 1881.
4444. COATING, &c., METAL SURFACES, H. H. Lake, London.—Com. from H. Reusch.—*12th October*, 1881.
4587. PLAITING MACHINES, J. Dowling, Jewin-street, London.—*20th October*, 1881.
4646. BOTTLES, C. M. Warner, Vauxhall-walk, London.—*24th October*, 1881.
4714. SPRING MATTRESSES, &c., W. R. Lake, London.—Com. from E. Hinckley.—*27th October*, 1881.
4731. TREATING STONE, &c., J. H. Johnson, London.—Com. from G. O. Kramer and Co.—*28th October*, 1881.
4732. MERINO, &c., FABRICS, J. Kershaw, Macclesfield.—*28th October*, 1881.
4814. STEAM ENGINES, N. Macbeth, Bolton.—*3rd November*, 1881.
4871. FRAMES and TRAYS, Right Hon. W. H. E. Poulett, Crewkerne.—*7th November*, 1881.
4920. LIFEBOATS, J. T. Baharie and W. Adamson, jun., Sunderland.—*9th November*, 1881.
4922. FURNACES, A. M. Clark, London.—A communication from J. Garnier.—*9th November*, 1881.
4941. VENTILATING APPARATUS, W. Cunningham, Dundee.—*11th November*, 1881.
5166. SEWING MACHINES, H. J. Haddan, London.—Com. from D'A. Porter and T. White.—*26th November*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 2nd December*, 1881.)

2436. BREECH-LOADING RIFLES, R. Hibbert, Manchester.—*2nd June*, 1881.
2451. PENS, J. Nadal, Southampton-row, London.—*3rd June*, 1881.
2452. FANS, E. J. C. Fear, Hampton Park, Redland.—*3rd June*, 1881.
2461. PERFORMING FINGER EXERCISES, F. H. F. Engel, Hamburg.—*4th June*, 1881.
2470. DISHES and BASINS, C. Russell, Garforth.—*7th June*, 1881.
2487. MOWING, &c., MACHINES, J. A. Carles, Toulouse.—*8th June*, 1881.
2489. FISHING NETS, W. Laughrin, Polperro.—*8th June*, 1881.
2506. TUBE EXPANDERS, J. Hall and S. Thompson, Sunderland.—*9th June*, 1881.
2508. REMOVING HAIRS from FUR SKINS, Sir C. M. Lampson, Queen-street, London.—*9th June*, 1881.
2568. REGULATING APPARATUS, F. E. A. Büsche, Westphalia.—*13th June*, 1881.
2575. BARYTA, W. E. Gedge, Wellington-street, Strand, London.—*14th June*, 1881.
2589. DESULPHURATION of LIQUIDS, &c., F. Lux, Ludwigshafen-on-the-Rhine, Bavaria.—*14th June*, 1881.
2597. WIRE GAUZE, R. H. Brandon, Rue Laffitte, Paris.—*15th June*, 1881.
2605. SUN-LIGHTS, W. T. Sugg, Vincent-street, Westminster.—*15th June*, 1881.
2624. GAS COOKING STOVES, W. T. Sugg, Vincent-street, Westminster.—*16th June*, 1881.
2628. DRESSING, &c., STONE, W. W. Beaumont, Camberwell, and J. Welman, Poole.—*16th June*, 1881.
2629. COMPOSITIONS, G. A. Wright, Portsmouth.—*16th June*, 1881.
2656. GOVERNORS, J. Bourne, Richmond-road, Bayswater.—*17th June*, 1881.
2694. LAMPS, W. H. Bulpitt, Birmingham.—*20th June*, 1881.
2769. SLIDING TOOL-HOLDER, &c., W. R. Lake, London.—A communication from E. Dervaux-Ibled and G. N. Schœnberg.—*24th June*, 1881.
3152. HEATING CARRIAGES, &c., F. W. Webb, J. Reddrop, and M. H. Foye, Crewe.—*20th July*, 1881.
3243. COMBING FIBRES, G. Little, Oldham.—*25th July*, 1881.
3357. BRICKS, TILES, &c., C. Walton, Bournemouth.—*3rd August*, 1881.
3446. TREATING EXCRETA, &c., J. Haresceugh, Rochdale.—*9th August*, 1881.
3975. LAYING ELECTRIC WIRES, J. W. Smith, Edinburgh.—*14th September*, 1881.
4013. CIGARETTES, D. Nicoll, Devereux-court, Strand, London.—*17th September*, 1881.
4357. VACUUM PANS, W. R. Lake, Southampton-buildings, London.—*6th October*, 1881.
4421. TELEPHONE LINES, G. Pitt, Sutton.—*11th October*, 1881.

(*List of Letters Patent which passed the Great Seal on the 6th December*, 1881.)

2475. FASTENER, F. Reddaway, Pendleton.—*7th June* 1881.
2490. REMOVING HAIRS from SKINS, W. R. Lake, Southampton-buildings, London.—*8th June*, 1881.
2491. TIN PLATE, W. Elmore, Blackfriars-road, London.—*8th June*, 1881.
2503. GRINDING APPARATUS, P. M. Justice, Southampton-buildings, London.—*9th June*, 1881.
2507. TRUSSES, J. Mayer, Great Portland-street, London.—*9th June*, 1881.
2510. FILLING BOTTLES, R. Bardsley, Manchester.—*9th June*, 1881.
2515. TAPS and VALVES, A. Pullan and J. R. Meihé Lawrence Pountney-hill, London.—*9th June*, 1881.
2519. PACKAGES, R. R. Gray, Liverpool.—*9th June* 1881.
2520. BUOYANT ARTICLES, J. Sexton, Great Winchester-street, London.—*9th June*, 1881.
2533. LEATHER, J. Hall, Leeds.—*10th June*, 1881.
2539. CHIMNEY TOP, M. Delmard, Plumstead-common.—*10th June*, 1881.
2544. PREVENTING CORROSION in STEAM BOILERS, J. B. Hannay, Glasgow.—*11th June*, 1881.
2553. FELT HATS, W. R. Lake, Southampton-buildings, London.—*11th June*, 1881.
2561. BARS for HOLDING GLASS WINDOWS, &c., C. H. Pennycook, Glasgow.—*13th June*, 1881.
2585. MACHINE HAMMERS, H. J. Haddan, Strand, London.—*14th June*, 1881.
2600. WASHING APPARATUS, J. Boardman, Rainford.—*15th June*, 1881.
2611. DISTRIBUTING FLUID in MOTORS, &c., W. L. Wise, Whitehall-place, Westminster.—*15th June*, 1881.
2639. CONVERTER, &c., LININGS, D. Evans and A. E. Tucker, South Wales.—*17th June*, 1881.
2646. RECEPTACLES and VEHICLES, J. Wilson, North Audley-street, London.—*17th June*, 1881.
2680. MONOCYCLES, L. H. Pearce, Hammersmith.—*18th June*, 1881.
2701. CANVAS STRETCHERS, M. Lazerges, Paris.—*20th June*, 1881.
2801. CIRCULATING WATER BOILERS, F. Hocking, Liverpool.—*27th June*, 1881.
2824. RATCHETS, C. Geddes and P. Sword, Liverpool.—*28th June*, 1881.
2925. PREVENTING, &c., INCRUSTATION in BOILERS, H. A. Bonneville, London.—*5th July*, 1881.
3162. PAPER BAGS, J. H. Johnson, Lincoln's-inn-fields, London.—*20th July*, 1881.
3649. SEPARATING and CLEANING SEEDS, &c., S. Bruce, Dublin.—*22nd August*, 1881.
3708. FLOORS for SKATING, A. C. MacLeod, Shrewsbury.—*25th August*, 1881.
3863. ORNAMENTAL TILES, G. Jobson, Derby.—*6th September*, 1881.
3907. PRODUCING ROTARY MOTION, J. J. Read, Dublin. *9th September*, 1881.
4015. VELVETS, W. Mather, Manchester.—*17th September*, 1881.
4163. TREATING BREWERS' WASTE, A. G. Salamon, Clapham Park.—*27th September*, 1881.
4215. KNITTING MACHINERY, W. H. McNary, Berlin.—*29th September*, 1881.

List of Specifications published during the week ending December 3rd, 1881.

728*, 4d.; 724, 6d.; 1633, 6d.; 1681, 6d.; 1700, 6d.; 1710, 8d.; 1769, 6d.; 1778, 2d.; 1791, 1s. 4d.; 1798, 6d.; 1812, 8d.; 1824, 2d.; 1844, 6d.; 1868, 6d.; 1875, 8d.; 1877, 2d.; 1879, 8d.; 1881, 4d.; 1882, 2d.; 1883, 6d.; 1884, 2d.; 1886, 2d.; 1887, 2d.; 1889, 2d.; 1892, 4d.; 1894, 6d.; 1895, 4d.; 1897, 6d.; 1899, 6d.; 1900, 6d.; 1902, 6d.; 1903, 6d.; 1004, 6d.; 1905, 2d.; 1906, 8d.; 1907, 8d.; 1908, 2d.; 1909, 2d.; 1910, 8d.; 1916, 6d.; 1917, 6d.; 1918, 4d.; 1919, 8d.; 1920, 8d.; 1921, 6d.; 1922, 6d., 1923, 6d.; 1925, 2d.; 1926, 6d.; 1927, 4d.; 1928, 4d.; 1930, 2d.; 1933, 6d.; 1934, 4d.; 1935, 2d.; 1937, 6d.; 1938, 2d.; 1939, 4d.; 1942, 6d.; 1943, 4d.; 1947, 2d.; 1948, 2d.; 1949, 2d.; 1950, 6d.; 1951, 6d.; 1952, 6d.; 1956, 6d.; 1958, 6d.; 1960, 2d.; 1963, 6d.; 1965, 2d.; 1966, 2d.; 1968, 6d.; 1972, 6d.; 1973, 6d.; 1974, 6d.; 1976, 6d.; 1979, 6d.; 1984, 6d.; 1989, 6d.; 2004, 6d.; 2010, 2d.; 2023, 4d.; 2065, 6d.; 2075, 6d.; 2080, 1s. 2d.; 2113, 4d.; 2115, 6d.; 2198, 6d.; 3593, 6d.; 3707, 6d.; 3775, 6d.; 3777, 6d.; 3867, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

724. BOOTS AND SHOES, *L. Morton.—19th February*, 1881. 6*d.*

Openings are formed on each side of the velocipede boot, the sides of the openings being connected together by straps.

1633. MACHINES FOR SEPARATING, DRESSING, DRYING, AND MIXING, *F. J. Drechsler.—14th April*, 1881. 6*d.*

The First part relates to an improved hopper; the Second part to a blast arrangement; the Third part relates to the sieves being made to work on rollers.

1681. REELS, SPOOLS, or BOBBINS, *F. Wirth.—16th April*, 1881.—(*A communication from P. Adt III., P. Adt, jun., J. B. Adt, and E. Adt.*) 6*d.*

Spools for doubled yarn for doubling machines are made with the plugs attached in the same manner as in single warp spools, the tube being folded over the ends of the plug, and in order to make the grooves without having to turn them in the one piece, the lower head is made of two discs, to which is given the necessary form; when placed together the groove is between them.

1683. IMPROVEMENTS IN ELECTRICAL APPARATUS FOR SIGNALLING BETWEEN RAILWAY TRAINS IN MOTION AND BETWEEN TRAINS AND STATIONS, *A. M. Clark.—16th April*, 1881.—(*A communication from A. d'Auriac.*) 8*d.*

The inventor proposes to have a signalling van in every train, which should carry a battery, transmitter, and receiver, in connection with a conducting rail composed of bars of galvanised iron, on which runs a contact wheel of wood with a metal tire to receive the currents and transmit them to the receiver, or a brush or rubber may be used in place of the wheel. The sections of line between two stations are to be insulated from one another, so that trains on the same section and same line of rails may exchange signals whilst moving, or a train can signal to the station or *vice versâ*. The inventor also describes his methods of obtaining good contact between the travelling wheel and the conducting rail; and different ways of getting a good earth. The specification is accompanied by drawings of the wheel and conducting rail.

1700. CONSTRUCTION OF COMPARTMENTS IN SHIPS, *W. R. Lake.—19th April*, 1881.—(*A communication from F. W. Rainay and T. B. Rogers.*) 6*d.*

This consists essentially in dividing the hulls of ships into longitudinal compartments by means of hinged, sliding, or other adjustable partitions.

1710. AERIAL BALLOONS, *G. E. Vaughan.—20th April*, 1881.—(*A communication from Count A. Apraxine.*) 8*d.*

This relates to an aërostat composed of a main balloon and two auxiliary balloons, in combination with two reversed parachutes. Other combinations are described.

1769. Apparatus for Withdrawing Fire-damp from Mines, &c., *W. and J. Morgan.—23rd April*, 1881. 6*d*.

This consists in the combination of an inverted syphon pipe or pipes, having branches, acting alone or in combination with an exhaust chamber and exhausting apparatus.

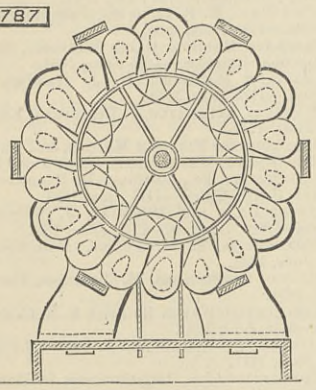
1778. Bleaching Cotton and Linen Fibres, &c., *W. Mather.—25th April*, 1881.—(*Void.*) 2*d*.

The novelty consists in the steaming of cotton or flax, fibre and yarn, and cotton or linen woven fabrics, after having been saturated with caustic soda or other chemical agent having a like effect.

1787. Improvements in Dynamo-electric Machines, *A. M. Clark.—25th April*, 1881.—(*A communication from H. J. Müller and A. Levett.*) 1*s*. 4*d*.

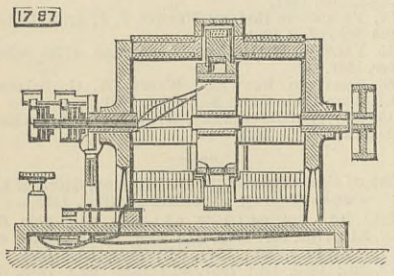
The object of the invention is to provide an improved dynamo machine for various purposes, but more particularly for use in electro-plating. The armature wheel is provided with broad flat spokes, and with openings in the periphery to create an air current and provide against heating of the coils. The invention also consists in a relay and resistance com-

1787



bined with the machine, whereby the secondary current from the bath of plating solution is made to pass through the magnets in the same direction as the main current, the relay also regulating the permanent charge of the machine. A series of switches are provided in combination with the external circuits and the circuits of the armature coils, whereby any one

1787



external circuit can be altogether shut off to permit of operating the machine with less motive power. The inventor claims to have prevented sparking at the commutator by arranging the armature coils so as to overlap the field magnets. Fig. 1 is a longitudinal sectional elevation of the machine; and Fig. 2 a cross sectional elevation.

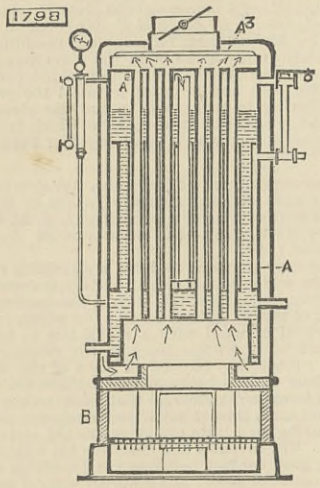
1791. Raising a Nap on Cloth, *A. M. Clark.—26th April*, 1881.—(*A communication from E. Gessner.*) 1*s*. 4*d*.

This relates, First, to means for driving the different parts of a gig mill or raising machine by one main shaft; Secondly, to an arrangement for throwing one or both of the cylinders in or out of gear without interrupting the continuous run of the cloth; Thirdly, to an arrangement whereby the speed of the cloth may be altered while raising; Fourthly, to imparting a reciprocating endwise motion to the cylinders; Fifthly, to the use of a new cleaning brush for the teasles or cards placed under the cylinders, so that the broken cards and flocks of wool cannot fall on the cloth, but fall down on the floor; Sixthly, to a continuously running grinding roller for the cards when cards are used for napping; Seventhly, to an arrangement to give more or less contact of the cloth with the cylinders; Eighthly, to an arrangement of two or more cylinders to raise the nap from the face and the back of the cloth at one time; Ninthly, to modes of arranging and mounting rotary teasles on the cylinders; Tenthly, to the construction of metallic rotary teasles; Eleventhly, to the employment of rotary teasles for circular and cross raising, whereby quite a new effect is obtained on the nap of the cloth.

1798. Steam Generators, *B. Brazelle.—26th April*, 1881. 6*d*.

This consists in the combination of a cylindrical shell A, closed at both ends, and adapted to be located above a furnace B, a fire tube or tubes A^3 traversing said shell and a steam receptacle A^2 located within the shell below the water level; also in the combination with a cylindrical shell, having closed ends, of a series of fire tubes traversing said shell, a steam chamber

1798

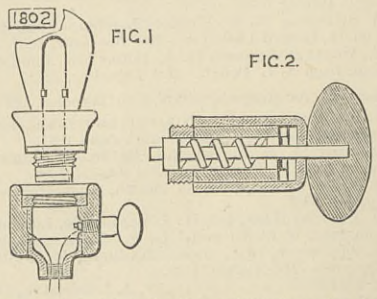


located within said shell below the water level, and a series of water tubes; also in the combination with a furnace, having an upwardly-projecting throat or outlet for the products of combustion, of a vertical shell inclosing steam and water receptacles, a fire tube or tubes traversing said shell, and a return flue or flues opening into the furnace below the level of its throat or outlet.

1802. Improvements in Electric Light and Fittings, &c., Therefor, *P. Jensen.—26th April*, 1881.—(*A communication from T. A. Edison.*) 10*d*.

The object of this invention is to provide a safe holder for electric lights, and to procure this by other means than friction between the neck of the lamp and the socket of the holder; it is an improvement on patent No. 578, dated 10th February, 1880. This object is accomplished thus:—Secured to the glass neck of the lamp is a second neck, made of insulating material, upon the exterior of which are fastened two metal bands, one clamp of the conductor being connected electrically to one band, and the other clamp to the other band; one of the bands is formed with a male screw thread. The socket is also made of insulating material, hollowed out to receive the neck from one end, and formed with a screw thread at the other, by which it is attached to any ordinary gas fixture. The socket is provided with a circuit controller as shown, which is seated in the wall of the socket, and forms the socket terminal of one of the conductors leading thereto. The part fixed in the socket is screw-threaded, and is partially hollow. Through it passes a rod carrying the contact point in

1802



its inner end, and terminating outside in an insulated thumb-piece. The outer head has two grooves extending across the diameter at right angles, one deeper than the other. These have bevelled sides, so that a pin secured to the rod above mentioned may be easily forced therefrom by force applied to the thumb-piece. A washer takes against a spiral spring on the rod, so as to force the latter in. When the rod is turned by the thumb-piece, so that the pin takes in the deeper indentation, the spring forces the rod inward sufficiently to close the circuit, while when the pin takes in the shallower the circuit remains open. Fig. 1 shows the mode of fixing the lamp in socket, and Fig. 2 gives a section of the circuit controller. Other methods of hanging electric lamps are also described.

1812. Concrete, *A. E. Carey and E. Latham.—27th April*, 1881. 8*d*.

Hopper or measuring boxes for each of the materials to be used in the manufacture are fitted or provided with hinged or sliding doors, and are fixed on or arranged to move with turntables or slides, or have turntables, or slides, or archimedian screws, or dredger buckets, or other appliances capable of delivering the materials with certainty in the required quantities on to a mixing pan or table.

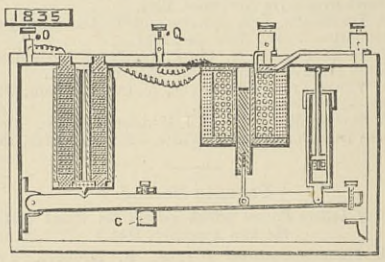
1824. Tricycles, &c., *T. Banister and S. Lees.—27th April*, 1881.—(*Void.*) 2*d*.

This relates to means for obtaining an accelerated movement of the driving wheel without the use of chains and chain pulleys.

1835. Improvements in Current Governors for Dynamo-electric Machines, *H J. Haddan.—28th April*, 1881.—(*A communication from C. F. Brush.*) 6*d*.

This invention is intended to adapt dynamo-electric machines to variable external conditions without variation in the speed of rotation of their armatures, and is an improvement on previous patents. The binding posts O Q form the terminals of the shunt circuit, and are connected with the dynamo machine. The shunt current passes from O to the piles of carbon as shown, these are inclosed in glass, and rest upon blocks of carbon electrically connected and carried by a bar of wood, pivotted to and supported by the lever; the shunt current then passes through the outer portion of the helix to the post Q. The right-hand posts are put in the working circuit of the machine, but in such a manner that the main current passes through its half of the helix in the same direction as the shunt current. Weight C is so adjusted that when the machine is working to its full capacity, and the working current is passing through its half of the helix, the inclosed iron

1835

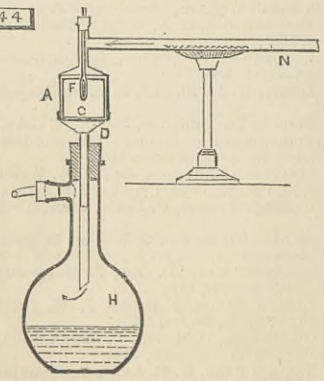


core, lifted by the axial magnetism developed in the helix, just sustains the lever and parts connected, while subjecting the piles H to no pressure. If the resistance of the working circuit be lessened the current in the helix is increased, the core drawn upwards, raising the lever and subjecting the carbou piles to a pressure corresponding to the increase of current in main circuit. The current will then be shunted from the field magnetsof the machine until the main current is reduced to its original strength. A dash pot is shown at the right hand side of the figure, filled with glycerine and fitted with a piston which retards the upward motion of lever, its downward motion can be regulated by the screw shown. The dash pot is also fitted with a valve as shown, which causes the lever to drop at once should the main circuit be broken, and the shunt resistance is also increased at the same time, thus allowing the machine to exert its full power to separate the carbons in the lamps in the main circuit, when they have come together and completed the circuit again.

1844. Filtering Chemical Solutions and Drying the Resulting Precipitates, *H. E. Newton.—28th April*, 1881.—(*A communication from D. Monnier.*) 6*d*.

Over the bottom of cylinder A is stretched some

1844



wire gauze C, and below it is a funnel D. Inside the cylinder A is a second cylinder F, between which and the wire gauze filtering paper is introduced. The funnel C leads into a flask H, in which a vacuum is maintained. The precipitate on the paper is dried by causing air entering tube N to pass down through the paper and funnel into the flask in which the vacuum is still maintained, the end of tube N being heated by a gas burner.

1852. Improvements in Electric Lighting, &c., *H. J. Haddan.—29th April*, 1881.—(*A communication from L. Somzée.*)—(*Not proceeded with.*) 2*d*.

This invention relates to the illumination of a gas flame by passing an electric current through it, and other improvements.

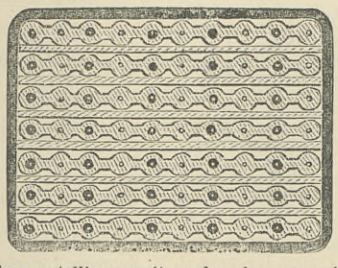
1868. Torpedoes, *W. N. Hutchinson.—30th April*, 1881. 8*d*.

This consists in projecting torpedo charges in the air, and subsequently propelling them in water; also in the means of making the torpedo charges glide under defensive nets or other obstacles, and getting below armour-plates on ships' bottoms.

1873. Improvements in Telegraph Cables, &c., *W. T Henley.—30th April*, 1881. 6*d*.

The object of this invention is to produce cables of additional strength, whilst obviating the effects of induction. The inventor insulates the wires with "ozokerited" india-rubber, and encloses them by means of rollers or dies in the insulating material. For telephonic purposes he constructs the cable so as

1873

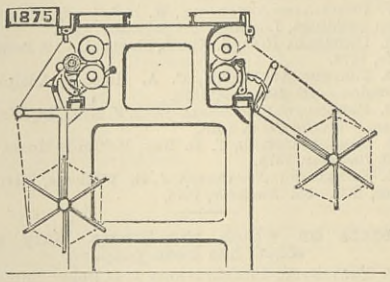


to obtain a metallic curcuit, and makes one wire of each pair of steel, galvanised or coated with zinc; the copper wire of the pair being as much smaller than the steel one as is necessary to make their resistances about equal. The figure shows several pairs superposed, with tarred felt between the layers. This cable may be laid in a trough or suspended. Several modifications of the method of combining the wires into a cable are also described and illustrated.

1875. Winding and Reeling Yarns or Threads, &c., *G. Bernhardt.—2nd May*, 1881. 8*d*.

This consists chiefly in employing two rotating drums, between and in contact with both of which the bobbin is arranged, which is to be rotated to have the yarn or thread wound upon it. It consists, Secondly, in arranging the pirn so that its bottom head, or a disc upon the spindle, or a tube upon the spindle, or the spindle itself, will be driven by the frictional

1875



contact of a rotating disc or other arrangement, this driving friction not being sufficient alone to rotate the bobbin or pirn without the assistance of the drag of the thread which is being drawn off the pirn or bobbin, and by this assisted driving the drag upon the thread being wound will be diminished, and thus a greater speed of winding can be attained. It relates, Thirdly, to an improved construction of pirns, so as to hold more thread than those of ordinary form.

1877. Wheels of Locomotive Engines used in Mines, *H. Lawrence.—2nd May*, 1881. 2*d*.

The tires of the driving wheels are formed of hard brass, gun-metal, or other mixture of copper and tin, or other metals or materials incapable of emitting sparks of rapid friction against iron or steel.

1879. Balloon, &c., *W. N. Hutchinson.—2nd May*, 1881. 8*d*.

This consists in a means of making balloons rise or sink without the loss of either gas or ballast.

1881. India-rubber Driving Belts, &c., *W. T. Henley.—2nd May*, 1881. 4*d*.

This consists, First, in the mode of manufacturing driving belts or bands consisting wholly or partly of india-rubber and sulphur, and of canvas or other fibrous material or fabric which are passed through rollers, then cured, and then treated with ozokerit, paraffine, or other suitable hydrocarbon; Secondly, in the combination of driving belts or bands consisting of outside layers of vulcanised india-rubber, and inner layer or layers of steel wires or wire gauze, with or without intermediate layers made of india-rubber and oxide of zinc and French chalk, the said belts or bands being cured and then treated with ozokerit, paraffine, or other suitable hydrocarbon.

1882. Clock for Postal Purposes, *J. Nadal.—2nd May*, 1881.—(*Not proceeded with.*) 2*d*.

This comprises a time-piece and letter-box provided with means for indicating the weight of letters and parcels, the hours of collection and delivery, the days of the week and month, the rates of postage for different countries, and other particulars.

1883. Boots and Shoes, &c., *A. Green.—2nd May*, 1881. 6*d*.

This consists, First, in the formation and method of attachment of the bellows with the boot; Secondly, in forming the back quarter in two parts, and securing the same; Thirdly, combining a strengthening piece with the boot by connecting it on the outside and back of the back quarter.

1884. Labels for Horticultural Purposes, *S. A. Varley.—2nd May*, 1881.—(*Not proceeded with.*) 2*d*.

Glass chambers are constructed, in which is placed a slip of paper or card containing the name desired, and which chamber is hermetically closed.

1885. Improvements in Electric Telephones, *W. Main.—2nd May*, 1881. 6*d*.

The First part of the invention refers to a battery transmitting telephone. This telephone consists of two "acoustic vibrators" as the inventor calls them, freely suspended from above, leaving their other edges free to vibrate. Both are hinged to an axis whose end rests in non-vibratory cushions of felt or rubber. Each vibrator is constructed of two thin boards of resonant wood connected together by a thin wooden ring, so as to leave an air space, and one of which is connected to the axis above mentioned. This plate also has a sound hole in its centre. Through these sound holes pass resistance varying contacts which are attached to the plate which is not attached to the axis, and which are made to press slightly on one another; these contacts may be made of carbon, and are connected with the battery in the usual way. A transmitting telephone of this kind is said to be extremely sensitive. In the magnetic receiver, an armature is fixed to the centre of one of the vibrators, which is acted on by a permanent magnet suspended from the axis.

1886. Clothes Washer, &c., *A. Cooper.—2nd May*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the construction of a circulating apparatus used in the washing of clothes, &c., and is applicable to like apparatus in brewing, chemical, and various other processes.

1887. Smoothing Machines, *G. W. von Nawrocki.—2nd May*, 1881.—(*A communication from O. Lange and Köhsel.*)—(*Not proceeded with.*) 2*d*.

This consists in the mode of moving a smoothing roller on a table by a screw with right and lefthanded-motion.

1889. Removing Burrs and "Spiles" from Wool, *F. Moore.—2nd May*, 1881.—(*Not proceeded with.*) 2*d*.

The machine consists of a stationary cylindrical casing suitably supported, and enclosing a rotating cylinder or drum, which is provided with a series of spikes or fingers. The lower part of the casing is made of open mesh wire cloth, or in any other manner which will allow the burrs or "spiles" to pass through. The upper portion of the casing has a number of longitudinal openings, in which are placed a corresponding number of brushes. Below the case is placed a comb, the teeth of which project through the perforated bottom. This comb is adjustable, and receives a rising and falling motion from a crank.

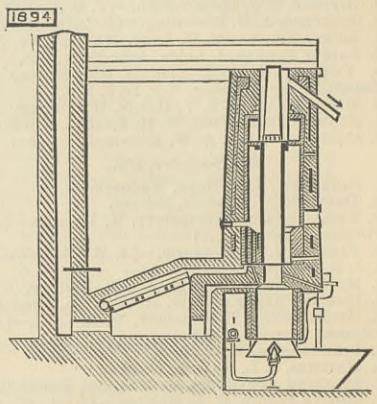
1892. Fishing Nets, *H. and S. G. Boyce and S. Callaway.—2nd May*, 1881. 4*d*.

This consists in the construction of a net with three sides, and having a bottom with the fourth side left open.

1894. Production of Combustible Gas, &c., *C. D. Abel.—2nd May*, 1881.—(*A communication from E. Langen.*) 6*d*.

This consists essentially in the method of producing combustible gas, more or less free from nitrogen, by causing a portion or the whole of the carbonic oxide with nitrogen generated by imperfect combustion of the fuel with air above the fire grate to pass into a

1894



separate combustion chamber, whereby its combustion, with a further supply of highly-heated air, heat is produced for effecting the decomposition of steam or other suitable fluids into combustible gases that are added to the other gases in the producer to take the place of those withdrawn.

1895. Surgical Instruments for the Incision of Strictures, &c., *E. A. Brydges.—2nd May*, 1881.—(*A communication from M. V. Schiltz.*)—(*Not proceeded with.*) 4*d*.

For operating on the urethra, an urethrotome is employed which acts in being advanced or pushed forward, or one which acts in being drawn back. Modifications are described.

1897. Improved Means of or Process and Apparatus for Obtaining, Storing, and Utilising Gas for Lighting, &c., *W. A. Barlow.—2nd May*, 1881. 6*d*.

This invention relates, as its title implies, to the obtaining and storing of gas for illuminating and other purposes. This is effected by electrolytic decomposition of water by means of powerful currents from a dynamo-electric machine, whereby oxygen and hydrogen can be evolved, stored, and utilised. The inventor prefers to use the Elmore machine, patented on the 4th September, 1879, No. 3565, and 22nd September, 1880, No. 3832. Arrangements are made in the main supply pipe for the prevention of explosions by means of gauze diaphragms.

1899. Kneading Machine, *D. C. McKay and A. Knox.—3rd May*, 1881. 6*d*.

This consists in the construction and arrangement in doughing machines of two or more mixing, cutting, and kneading frames provided with stirring blades, and fitted on central spindles, these frames being arranged to revolve the one within the other in the same or opposite directions to mix, cut, and knead the dough materials within the containing vessel.

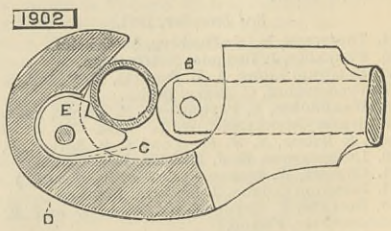
1900. Utilising Waste Heat of Kitchen Ranges, &c., *T. Jackson.—3rd May*, 1881. 6*d*.

This consists in the general arrangement or construction and combination of appliances for preventing the action of frost on water pipes and cisterns, and their adjuncts, in which such pipes, tanks, and cisterns are enclosed within shafting, through which air, heated by the waste heat of the kitchen range and of the hot pipes and tanks, is circulated, and in which the hot and cold water cisterns or tanks are enclosed in compartments fitted with movable divisions to admit heated air from such shafting or the hot vapour from the hot to the cold cisterns.

1902. Tools for Cutting Tubes or Pipes, &c., *W. Maiden and E. F. Cowley.—3rd May*, 1881. 6*d*.

A recess C is formed on the inside of the claw, and upon a pin D running across this recess parallel with the axis of the circular cutter B is mounted or suspended a peculiarly formed cam E, having one or more cutting edges formed on its surface, which cam

1902



adjusts itself to the size or diameter of pipe or other articles, and by means of its cutting edges serves to remove or cut off the burrs as they are formed by the forcing up of the circular cutters, and to reduce the strain upon the opposite of the claw friction bowls are sometimes applied working in suitable bearings at that side of the claw.

1903. Fireplaces for Dwelling Houses, *M. Ingram.—3rd May*, 1881. 6*d*.

This relates to a smoke consuming fireplace, and also to providing passages for ventilating rooms and heating air.

1904. Ornamenting Wood, &c., *A. Martin.—3rd May*, 1881. 6*d*.

This relates to improvements on patent No. 2704, dated 15th August, 1873, and consists in the general construction of the machine, and in the improved mode of heating the roller die.

1905. Electro-telegraphic Apparatus, *J. H. Thomson.—3rd May*, 1881.—(*Not proceeded with.*) 2*d*.

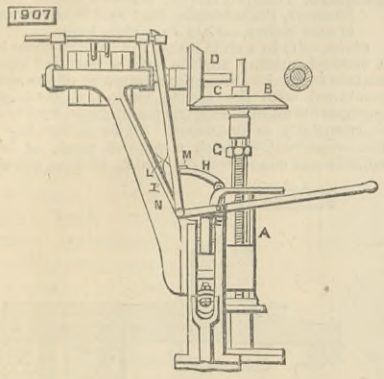
A modification of step-by-step transmitters, which received provisional protection only.

1906. ASSORTING AND BRANDING CORKS, *J. Liston.—3rd May*, 1881. 8*d*.

The essential feature of the apparatus is the combination of a rotating roller with a fixed surface of a bevelled, or rounded, or other suitable form, the two parts forming a pair, any number of which may be arranged in one machine. In a preferable modification there are two rollers, having between them a fixed piece with bevelled sides towards the rollers, the machine thus comprising two pairs of the parts. The rollers and fixed piece are placed in an inclined position, and so that there is between each roller and the fixed piece a space, which is narrow at the higher end and sufficiently wide at the lower end to let the largest corks pass through. The rollers are made to rotate with their inner sides moving upwards, and the corks being laid on at the upper end, are by the motion of the rollers caused to gradually move down the incline, until each reaches a point where the space is wide enough for it to pass through. The corks pass through in positions corresponding to their respective sizes, and are received below by separate ducts, which lead them to different receptacles.

1907. SETTING UP AND WORKING THE PRESSING BARS OF PAPER-CUTTING MACHINES, *H. J. Haddan.—3rd May*, 1881.—(*A communication from F. A. Barthel.*) 8*d*.

This relates partly to a mechanism for working the pressing beams of paper-cutting machines, consisting of frame N, shaft C with fixed and loose pulley for right and left-hand motions, and wheels B and D, in



combination with a disengaging mechanism, consisting essentially of the disconnecting lever M with spring I, lever H, with spring L and spindle A, with adjustable nut G.

1908. VEGETABLE AND FRUIT PARING KNIVES, *W. P. O'Reilly.—3rd May*, 1881.—(*Not proceeded with.*) 2*d*.

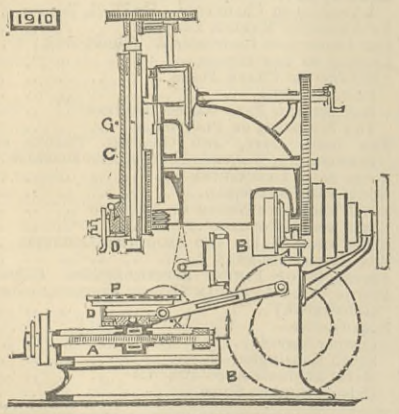
A paring knife or cutter is pivotted to two projecting lugs arranged on a circular or otherwise shaped shaft, so that the cutting edge of the paring knife or cutter is parallel to the axis of such shaft. By means of one or more suitable projections or stops, which may be either on one or both of the projecting lugs, or on the paring knife, or cutter on the shaft, a narrow fixed opening is obtained between the paring knife or cutter and the shaft through which the waste bearings pass when the instrument is in use.

1909. PRODUCTION OF MAGNESIA, *H. Wedekind.—3rd May*, 1881.—(*A communication from H. Hauenschild.—(Not proceeded with.*) 2*d*.

Burnt or powdered carbonate of magnesia or lime containing magnesia slaked to hydrates or dolomite or magnesia limestone is treated with dilute sulphuric acid or soluble sulphates of alkalies, alkaline earths, or metals in limited quantities, and the precipitates produced are separated according to their specific gravity. The sulphate of calcium thus formed is rendered more soluble by the addition of common salt, sal ammoniac, or muriatic acid, or nitric acid, and is thereby more readily supported from the precipitated magnesia.

1910. SHAPING, DRILLING, BORING, AND FACING METALS, *H. E. Newton.—3rd May*, 1881.—(*A communication from F. D. Debouttevillе.*) 8*d*.

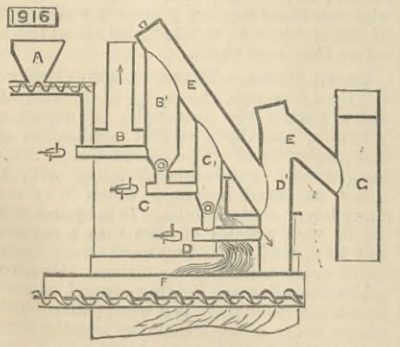
This relates to combining the ordinary tools used for working metals in one machine. A is a horizontal bench bolted to the base B, formed in one with a standard, the upper part of which is curved over, and terminates in two lugs to serve as guides to a slide C.



The bench A carries a saddle X, to which a longitudinal motion is imparted, and on it is a second saddle D, to which a transverse motion is given. On the latter is a table P capable of being revolved, and which receives the work. Slide C carries a tool holder O for planing, and a central spindle G, to which drilling tools are secured.

1916. DESULPHURISING ORES, *W. R. Lake.—3rd May*, 1881.—(*A communication from F. W. Wiesebrock.*) 6*d*.

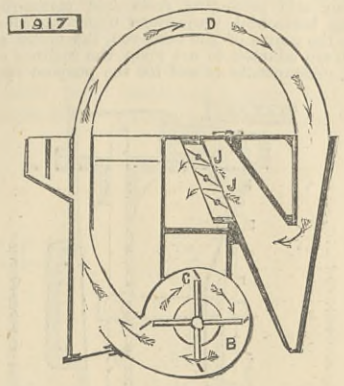
This relates, First, to a process of desulphurising ores by dropping the finely powdered ore into an



oxidising flame of a compound blow-pipe injector, the flame carrying an excess of oxygen with the blast flame, so as to highly heat the air and the ore, the supply of the latter and the strength of the blast flame being regulated, so as to carry the ore entirely through retorts or chambers into receivers where it is oxidised, while the fumes are conveyed into condensers. In the drawing the ore is fed from opper A by a screw to retort B, one end of which is open for the introduction of the blast flame, while the other communicates with receiver B¹, the bottom of which forms a hopper to deliver the ore to retort C, similar to the first retort, and connected to receiver C¹, which in turn delivers the ore to retort D communicating with receiver D¹. The latter delivers the ore to retort F, provided with a screw conveyor, and through which air flows to assist the final oxidation, such retort being situated in a furnace. The receivers communicate with a flue E leading to a condenser G, through which a stream of water flows in a spray.

1917. SEPARATORS, *B. J. B. Mills.—3rd May*, 1881.—(*A communication from J. Sternberg.*) 6*d*.

This consists, First, in providing a separator with a fan C revolving in a chamber B, which is located between both ends of an air shaft or trunk D of peculiar construction communicating with said fan



chamber, by which a combined blast and suction is formed in the air shaft or trunk; Secondly, in combining with said separator valves J for increasing or diminishing the size of the opening for regulating the force of air current through the shaft or trunk. Other improvements are described.

1918. MANUFACTURE OF CARBONS FOR INCANDESCENT LAMPS, *E. G. Brewer.—3rd May*, 1881.—(*A communication from T. A. Edison.* 4*d*.

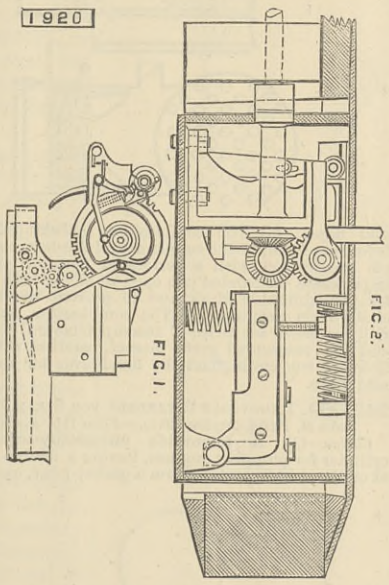
This invention relates to the manufacture of graphite or plumbago, boron, &c., for filamentary conductors. The material is reduced to powder and acted upon by great pressure and then heated at a high temperature with hydrocarbons.

1919. SELF-ACTING LATHES OR MACHINES FOR CUTTING RIFLE GROOVES IN ROLLERS, &c., *G. W. von Nawrocki.—3rd May*, 1881.—(*A communication from the Werkzeug und Maschinenfabrik Oerlikon.*) 8*d*.

This relates, First, to the construction of reversing gear; Secondly, to one mode of connecting the guide screw with the reversing gear; Thirdly, to the arrangement of double tool-holder; Fourthly, to the disengaging gear for the cutting tools; Fifthly, to the combination of parts forming a single, double, or multiple rifle grooving machine.

1920. HARVESTING MACHINES, *B. Samuelson and W. G. Manwaring.—3rd May*, 1881. 8*d*.

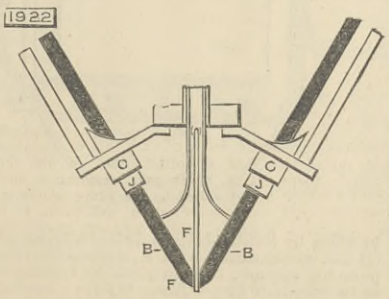
The First part of the invention consists in dividing the platform into two parts, one of which, viz., that nearest to the driving wheel, is fixed to the framework, which contains the driving mechanism, whilst the other part is hinged and also by preference clamped to this first part. The Second part relates to means to make the feeding or delivery of the cut crop to the binding apparatus of intermittent action, so as to avoid the use of additional intermittent packing devices. The Third part relates to improvements in the string binding device or apparatus, in which is employed two bevelled inclined or bell-mouthed grooved plates, held face to face by a spring, for hold-



ing the string, and in connection therewith is provided a pronged presser which thrusts the string between the plates, the grooves being at right angles to the string. The Fourth part relates to a device for discharging the sheaf after it has been bound. Fig. 1 illustrates a part end elevation taken at the back of the machine, showing the intermittent cam device and gear for operating the binding and ejecting mechanism, and the secondary platform elevating gear. Fig. 2 represents a side elevation of the string nipping, knotting, and cutting apparatus.

1922. IMPROVED CONSTRUCTION OF ELECTRIC LAMP, *J. B. Rogers.—3rd May*, 1881. 6*d*.

This relates to what may be termed a gravity lamp,



the carbons resting in guides and fall by their own weight, impinging against incombustible material as shown in the figure. B B show carbons; C J the guides; and F the asbestos or other incombustible material.

1921. REELING, SPINNING, DOUBLING AND TWISTING SILK, &c., *J. H. Johnson.—3rd May*, 1881.—(*A communication from E. Weber.*) 6*d*.

This relates to the employment, in combination with a series of threading apparatus, of a compound reel, consisting of a series of reels operating in unison, but each capable of being separately thrown out of action.

1923. SEPARATING IRON FROM CHARCOAL, &c., *D. MacEachran.—4th May*, 1881. 6*d*.

The substance containing the iron, and from which the iron is to be separated is caused to pass between the poles of magnets, or between magnetised bars or surfaces, which are adjusted or adjustable nearer to or further from each other, according to the state of the material or the quantity of iron contained therein, or according to the state in which the iron is contained therein.

1925. COOLING MILK, *J. Askew.—4th May*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to a series of globes inserted in the vessel containing the milk, and through which cold water passes.

1926. COMBINED CLINOMETER AND PRISMATIC COMPASS, *F. Barker.—4th May*, 1881. 6*d*.

This consists of a combined compass and clinometer in which the two discs or cards are mounted the one above the other, and both facing in the same direction, so as to be viewed at the same side of the case.

1927. PAVING FLAGS AND TILES, *H. Hill.—4th May*, 1881. 4*d*.

This consists in the formation of flags or slabs composed of pieces of stone united by cement.

1928. MATERIALS AND APPLIANCES COMPOSED PARTLY OF VULCANISED CAOUTCHOUC, *G. L. Scott.—4th May*, 1881. 4*d*.

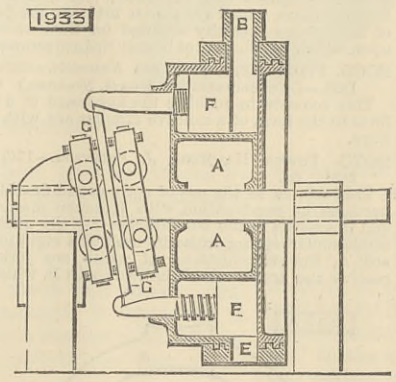
This relates to the manufacture of paper coated on one or on both sides with caoutchouc and subsequently vulcanised.

1930. VENTILATING RAILWAY CARRIAGES, &c., *F. H. F. Engel.—4th May*, 1881.—(*A communication from B. R. Ohle.*)—(*Not proceeded with.*) 2*d*.

This refers to efflux ventilating arrangements applied to railway and other carriages, the action of which is produced by the outer counter-current of the outer atmospheric air to the moving carriage.

1933. OBTAINING AND APPLYING MOTIVE POWER, *D. Woollatt.—4th May*, 1881. 6*d*.

This relates to a wheel to be driven by water or other fluid, the object being to economise the use of such fluid. A is the drum formed with an annular space in which a series of blades F are fitted radially to the axle and each provided with a hooked arm



passing through a slot in the front plate. A collar G mounted obliquely on the axle engages with these arms so as to move them outwards, their return being effected by springs, so that as they arrive opposite the supply pipe B the whole of their surface will be presented to the action of the fluid, while on returning again towards the supply pipe they will be drawn outwards through the hooked arms and collar G. E is the outlet for the fluid.

1934. MILLS FOR GRINDING GRAIN, &c., *J. H. Johnson.—4th May*, 1881.—(*A communication from W. Seck.*)—(*Not proceeded with.*) 4*d*.

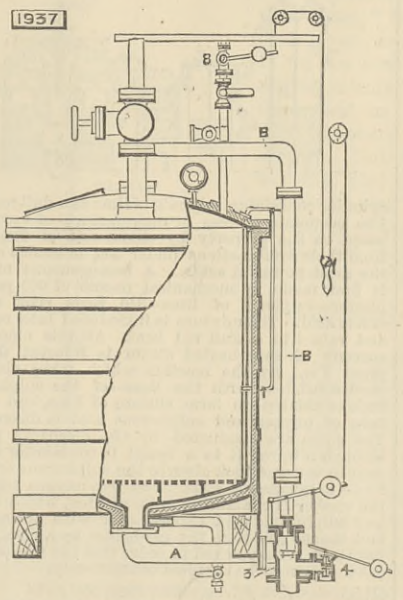
This consists, First, in the manner in which the bearings of the cylinders are arranged in the hollow cast iron side frames; Secondly, in a peculiar arrangement of friction wheels and rollers, employed in combination with levers and helical springs, to exert the required pressure upon the cylinders; Thirdly, in the employment of a peculiarly constructed scraper.

1935. INFANTS' FEEDING BOTTLE, *J. Hickisson.—4th May*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to means for preventing the escape of the contents of the bottle should the cork or stopper carrying the sucking appurtenances become detached therefrom from any cause whatsoever.

1937. BLEACHING, *C. T. Jacoby and W. Jennings.—4th May*, 1881. 6*d*.

This relates to means for preventing the chlorine liquors and the "sours" being drawn up together into the bleaching vessel, and also for preventing the liquor being drawn into the air pump used to form a vacuum, and it consists in providing the different pipes with



air valves connected with the valves by which the liquor is admitted, so that one handle closes the admission valve and at the same time opens the air valve. The admission valves are also connected with the cock on the pipe communicating with the air pumps, so that on opening either valves the communication with the pumps is closed. A and B are the pipes and 3 4 the valves for admitting and drawing off the chlorine, while 8 is the cock in the air pump pipe, a similar set of pipes and valves being necessary for the "sours" or acid liquor.

1938. MAIN AND THRUST BLOCK BEARINGS OF THE MAIN CRANK SHAFT AND PROPELLER SHAFT OF STEAM VESSELS, &c., *M. H. Gerring and R. E. Rumsey.—(Not proceeded with.)* 2*d*.

The bearings are formed with a water jacket surrounding them, through which a stream of water is passed continuously, so as to convey away heat from the bearing. In the body of each part of the bearing a hollow chamber is cast or formed, to which an inlet is provided for the admission of water, and an outlet for its escape from the chamber.

1939. BREAKING DOWN OR GETTING COAL, &c., *C. S. Smith and T. Moore.—4th May*, 1881. 4*d*.

This consists in the method of breaking down or getting coals and other materials by the introduction into bore holes of caustic lime, which after compression and confining by tamping or otherwise is brought into contact with water or other suitable liquid along the entire or greater part of the length of the charge, so as by the expansion of the lime and pressure of the steam generated to produce sufficient force for breaking down the mineral.

1943. IMPROVEMENTS IN SYSTEMS OF ELECTRIC LIGHTING, *E. G. Brewer.—4th May*, 1881.—(*A communication from T. A. Edison.*) 4*d*.

This relates merely to an arrangement of circuit and lamps, whereby lamps of different candle power may be used. The resistances and surface areas of carbons are regulated by a normal standard.

1947. LIQUOR FRAMES, &c., *W. Sherwood.—4th May*, 1881.—(*Not proceeded with.*) 2*d*.

The relates to a means for locking or securing the bottles in the frames.

1948. MANUFACTURE OF DIRECTION LABELS, *A. Gorse.—4th May*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to machinery for the manufacture of labels from rectangular pieces or tabs of paper, paper cloth, linen, or other materials, to one end of which pieces a metallic eyelet is fixed.

1949. KNITTING MACHINES, *E. A. Brydges.—4th May*, 1881.—(*A communication from E. G. Wege.*)—(*Not proceeded with.*) 2*d*.

This relates to an arrangement for preventing breakage of the hooks or needles, to facilitate the removal of the meshes, and to enable the machines to be made considerably lighter than at present.

1950. IMPROVEMENTS IN TELEPHONIC APPARATUS, *W. R. Lake.—4th May*, 1881.—(*A communication from L. Maiche.*) 6*d*.

This invention applies to microphonic apparatus a separate vibrating plate or disc for each contact piece.

1951. SEWING MACHINES, *M. D. and T. J. Denne.—4th May*, 1881. 6*d*.

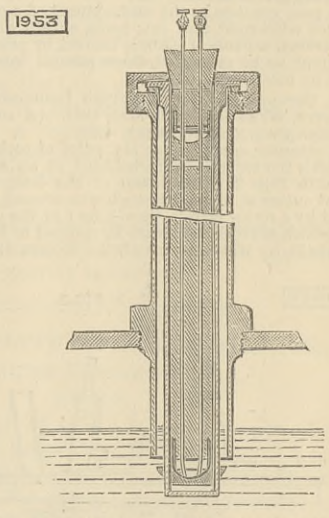
The essential feature of the invention consists in the employment of a fixed back rest in a running or gauge stitch sewing machine.

1952. FEEDING BOTTLES, *J. Thomas.—5th May*, 1881. 6*d*.

This consists in constructing a feeding bottle or the cork or stopper thereof with a flute (or its equivalent) therein, so that the suction tube may be supported between the neck of the bottle and the cork or stopper thereof.

1953. AN APPARATUS FOR CONTROLLING THE LOWEST HEIGHT OF WATER LEVEL, AND THE MAXIMUM TEMPERATURE IN STEAM BOILERS BY THE MEDIUM OF ELECTRICITY, *C. Pieper.—5th May*, 1881.—(*A communication from R. Schwartzkopff.*) 8*d*.

This apparatus consists of two tubes, the one fitting in the other as shown. The centre tube is provided with two wires insulated from one another. At both ends of the tube are porcelain cups through which the wires run, and rings of easily fusible metal, as shown



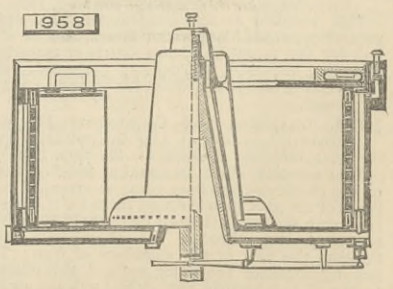
in section in the figure. The wires are connected externally to an alarum and battery. When the water level sinks below the edge of the outer tube, steam will enter the space between it and the inner one, and by its heat melt the upper ring of fusible metal, which will run into the porcelain cup and make contact between the wires. When, on the other hand, the steam pressure, and therefore water temperature becomes excessive, the lower ring will be melted and produce the same results. This apparatus is fixed into the side of the boiler, leaving about 4ft. projecting to keep it cool.

1956. RESPIRATORY APPARATUS FOR USE UNDER WATER, *W. R. Lake.—5th May*, 1881.—(*A communication from A. Khotinsky.*) 6*d*.

This consists, First, of cylinders or reservoirs for containing oxygen; Secondly, of a purifying chamber or compartment for the carbonic acid and aqueous vapour; Thirdly, of a collapsible apparatus or bellows for storing the air exhaled from the lungs after its purification; Fourthly, of an arrangement which permits the air in the interior of the apparatus to have a pressure equal to the exterior pressure; Fifthly, of devices for regulating the pressure and for controlling the supply of oxygen, according to the depth of the diver's immersion and to the capacity of his lungs.

1958. CENTRIFUGAL MACHINES, *C. D. Abel.—5th May*, 1881.—(*A communication from E. Langen.*) 6*d*.

This relates, First, to the use of a packing device for centrifugal drum covers, consisting of an annular elastic packing introduced in a groove in the covers and pressed against the wall of the drum by the cen-



trifugal action of a heavy body; Secondly, to the construction of centrifugal machines whereby the liquid steam, or gas for acting on the contents of the drum is caused to pass from chambers into an annular space

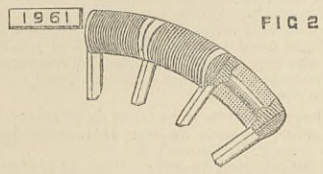
outside the perforated wall of the drum, whence it is caused to penetrate inward through the contents of the drum by the differential action of the centrifugal forces, which may or may not be aided by pressure applied to the said liquid, steam, or gas.

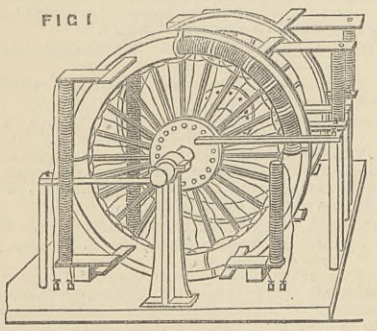
1960. METALLIC UPPERS FOR BOOTS AND SHOES, *H. J. Haddan.—5th May*, 1881.—(*A communication from C. J. Tisserand.*)—(*Not proceeded with.*) 2*d.*

This consists in the combination of metal lined with stuff, felt, or other convenient material to be used for uppers in lieu of leather uppers.

1961. IMPROVEMENTS IN MAGNETO-ELECTRIC MACHINES, *G. Paget-Higgs.—5th May*, 1881. 10*d.*

These improvements relate to modifications in the





armature, and the arrangement of field magnets. The machine will be best understood from the drawings.

1963. PENCIL CASES, *G. W. von Nawrocki.—5th May*, 1881.—(*A communication from J. Faber.*) 6*d.*

This consists partly in a pencil case of the combination of an outer tube with a washer hinged to the inner side thereof, and with a movable rod working between the outer tube and an inner tube fixed thereto, one end of the rod being connected to the washer, and the other end having a head, which by a spring is pushed away from the outer tube so as to place the washer in a slanting position, and jamb the pencil.

1965. VENT PEG, *A. Whicker.—5th May*, 1881.—(*Not proceeded with.*) 2*d.*

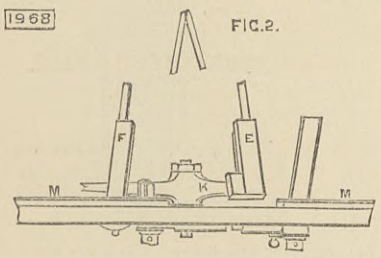
The body is made of a conical tube closed at its larger end or head. In the head is a deep annular groove, in which is placed a strong ring of vulcanised india-rubber. At one side of the annular groove a cross passage is made. This cross passage opens at one end into the central passage in the tubular body of the vent peg, and at its other end into the annular groove. It is through this cross passage that a communication may be established or cut off between the external air and the interior of the cask or barrel.

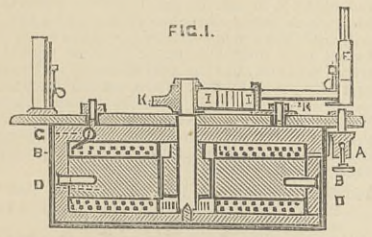
1966. WATER-METERS, &c., *W. Jones.—5th May*, 1881. —(*Not proceeded with.*) 2*d.*

One part consists in the employment of a cylinder provided with inlet and exit ports, within which are two pistons, capable of sliding therein by pressure of the liquid to be measured, these pistons being connected by means of a rod.

1968. IMPROVEMENTS IN ELECTRIC LIGHTING APPARATUS, *W. R. Lake.—5th May*, 1881.—(*A communication from N. Bouliguine.*) 6*d.*

The inventor arranges for six pairs of carbons on one plate, the carbons being inclined at an angle, as shown in Fig. 2. The action of the lamp is, the current enters at A, goes through wire around magnet D, and by a screw G to B, thence by I to the arms K, upon which are carbon-holders E, opposed to holder F on plate M, by which means all the holders like F are





connected. The current passing causes the magnets to act on the armatures, and the pair of carbons offering the lowest resistance gives the light, which passes from pair to pair according to the variation in the resistance.

1972. APPARATUS USED IN COMBINATION WITH ACOUSTIC INSTRUMENTS, *F. Wirth.—6th May*, 1881.—(*A communication from A. Rettig.*) 6*d.*

This relates to improvements on patent No. 1014, dated 9th March, 1880, and consists of improved holders and fasteners for holding fast in any desired position the head or mouth of the sound pipe; also in improved holders or attachments for fastening the hearing apparatus on the head or shoulders, and in dispensing with the sound board.

1973. PRESSES OR APPARATUS FOR STAMPING, ENDORSING, MARKING, OR PERFORATING PAPERS, CHEQUES, &c., *H. C. Gover.—6th May*, 1881. 6*d.*

This consists in the combination of a stamp or presser mounted on parallel levers, and of a hinged bed for the reception of the article or material to be stamped, endorsed, marked, or perforated, the said bed forming also the medium for operating the stamp or presser.

1974. CHAMBERS FOR CONDENSING FUMES FROM ROASTING ARSENICAL AND SULPHUROUS PYRITES, *H. N. Lay and H. Bulford.—6th May*, 1881. 6*d.*

This consists, First, in forming flues in the walls of the chambers, the flues being so arranged that currents of air may pass through them for the purpose of removing the heat absorbed by the said walls from the fumes passing through the chambers; Secondly, forming the roof of the chambers of iron; Thirdly, bracing together the outer walls of this chamber by means of bars or rods passed through the air flues in the transverse walls.

1976. STOVE AND FIREPLACES, *J. Carrick.—6th May*, 1881. 6*d.*

This consists in the use in combination for heating purposes of a portable receptacle, basket, or grate, and a glazed chamber enclosing the same and provided with a cone-mouthed or equivalent formed chimney, the arrangement being such that the fuel does not come into contact with any of the walls of the chamber.

1979. FUR GARMENTS, *W. H. Beck.—6th May*, 1881.—(*A communication from F. Jungmann.*) 6*d.*

This relates to the combination in a special way of a collar or tippet, a boa, and a muff.

1984. CUTTING OPEN TIN CASES, *H. Knight.—7th May*, 1881.—(*Complete.*) 6*d.*

This consists in the arrangements and combinations of a grooved guide and a grooved guide formed at the fulcrum end of the side of the lever, a side guide fixed at the side of the loose fulcrum piece, a fulcrum piece grooved in the centre and opened at one end, a solid fulcrum piece with a cutting edge at right angles, a solid fulcrum piece with no cutting edge, a grooved wheel with cutting edges at right angles, a half-circle formed out of the solid metal grooved at right angles forming two cutting edges, a cutter having two cutting edges at right angles, two circular flanges fixed so as to form a groove, a fulcrum piece with a flange, a fulcrum piece with a roller, a fulcrum piece with a bent pin, a fulcrum with a screw, flat head, a bent flange attached to the loose fulcrum piece, a fulcrum piece made separately with a mortice.

1989. FASTENINGS FOR ALBUMS, SCRAP BOOKS, &c., *S. Posen.—7th May*, 1881. 6*d.*

This consists in forming the knob or stud of clasp fastenings for albums and like articles hollow, and fitting the same with a lock or locking device.

2004. TREATMENT OF SEWAGE FOR PRODUCING SOLID MATTER THEREFROM, &c., *H. Collet.—9th May*, 1881. 6*d.*

This consists in the method of separating the solid and liquid constituents of sewage, and collecting the solid ingredients as a scum by the application of vitriolic powder or equivalent substances, such as alkaline silicate with iron or zinc sulphate and sulphuric acid, or such as fluorides of silicon or boron, or hydro-fluosilicic acid, aided by substances containing tannin or substances of an absorbent character.

2010. WARMING APPARATUS, *H. J. Haddan.—9th May*, 1881.—(*A communication from A. H. Godefroy.*) 2*d.*

This consists in the application of an air supply pipe passing from the hearth to the interior of the chimney, and provided with a valve or other regulating device.

2023. REGULATOR GAS BURNERS, *H. Zwanziger.—9th May*, 1881.—(*A communication from J. Janky and J. and C. Rimanoczy.*—(*Complete.*) 4*d.*

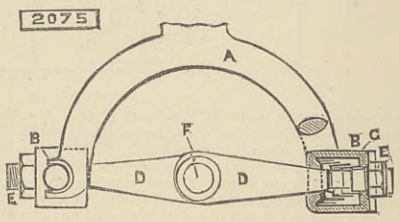
This consists essentially of pieces of Bengal cane suitably prepared and hardened, and inserted into shells or cases, which are placed into the gas-burners or into pieces specially adapted for their reception, upon which the burners or burner tips are screwed.

2065. PIANOFORTES, *G. W. von Nawrocki.—12th May*, 1881.—(*A communication from G. Neuhaus.*) 6*d.*

This consists in making the key-board of a pianoforte in the form of a concave circular arc with radial keys.

2075. POWER HAMMERS, *J. Patterson.—12th May*, 1881. 6*d.*

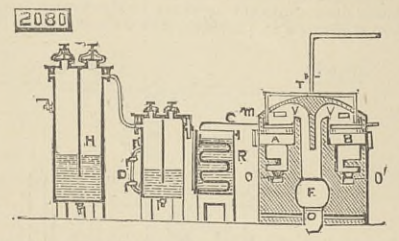
This relates to the use of springs and flexible connections in combination with hammer mechanism, and it consists in the substitution for the quarter or semicircular spring hitherto used of a rigid metallic arc A, the terminations of which are forked to receive the trunnions of the two shells B, which con-



tain the spiral, volute, or other springs C, resting on the bottom of the shells, and which act on the hammer through the flexible connections D pivotted beneath the centre of the arc on pin F, from which the hammer is suspended. The springs C can be adjusted by the nuts F.

2080. MAKING OXYGEN AND HYDROGEN, &c., *A. M. Clark.—12th May*, 1881.—(*A communication from N. A. Hélouis.*) 1*s.* 2*d.*

The drawing shows one example of the apparatus for the production of the gases. The furnace may contain any suitable number of retorts, but for greater clearness three only are shown, two A A for the manufacture of oxygen, and one B for the manufacture of hydrogen. Each retort is surmounted by a cast iron pipe *m* which communicates at the rear end with the inner end of the retort, and at the front end with the steam-pipe T from a boiler for supplying superheated steam to each retort. O O¹ are flues for conveying away the gaseous combustions to the shaft; V V are flues; F, furnace chamber. Hydrogen, carbonic oxide, and carbonic acid are passed into a



cylinder containing sulphate of lime at a dull red heat. The economic process of manufacture of oxygen is based on the property by silicic acid of displacing from their combinations under the influence of heat the most powerful acids. A homogeneous mixture is first made by mechanical means of 660 parts of plaster—sulphate of lime—340 parts river sand—silicic acid. The mixture is introduced into retort A and raised to a dull red heat. At this moment a current of superheated steam is injected through pipes T*m*. By the reaction which takes place the sand combines with the lime—of the sulphate of lime or plaster—to form silicate of lime, and a mixture of oxygen and sulphurous acid is disengaged. The gases are conducted by the discharge pipe C through a worm R to a vessel D containing caustic soda in water, which absorbs the sulphurous acid and forms sulphates of soda. The free oxygen traverses the washer H containing milk of lime, which retains any sulphurous acid carried over with the oxygen, and thence passes to the gas-holder by a pipe. Two retorts A are employed in order that the washers and gas-holder may be supplied continuously.

2113. SODA, *E. Solvay.—14th May*, 1881. 4*d.*

This consists in the manufacture of ammonia soda, the process of violently agitating the bicarbonate of soda in the decomposing or calcining apparatus heated exteriorly.

2115. INSTRUMENT FOR CURLING, WAVING, AND FRIZZING HAIR, *J. Careless.—14th May*, 1881. 6*d.*

This consists essentially of three light bars or strips of metal jointed together at one end, so as to be capable of opening out from one another or of being brought parallel to one another, and so constructed that they may be fixed together when required.

3867. PENHOLDERS AND PENS, *J. G. Hester.—6th September*, 1881.—(*Complete.*) 6*d.*

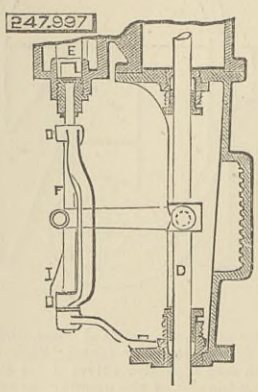
This consists in combination with a penholder, open or bored centrally from end to end, of a reciprocating ejector, adapted to confine the pen at one end, and extended at the opposite end beyond the end of the holder.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

247,997. VALVE GEAR FOR DIRECT-ACTING ENGINES, *George H. Reynolds and Thomas J. Ryder, New York, N.Y.—Filed July 5th*, 1881.

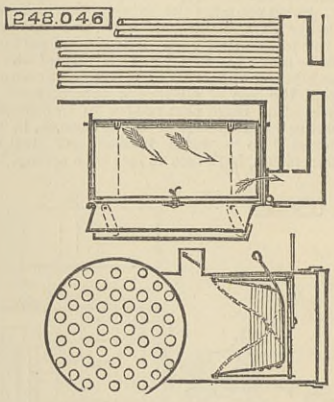
Claim.—(1) In a direct-acting engine, the combination, with the piston-rod and a valve and rod adapted to be oscillated or turned, of a yoke attached to the valve-rod and having inclines upon opposite sides, and an arm projecting from said piston-rod and having horizontal projections upon opposite sides above the centre of the valve-rod, the under sides of which are adapted to act upon the inclines on said yoke, substantially as and for the purpose specified.



(2) In a direct-acting engine, the combination, with the piston-rod and a valve and rod adapted to be oscillated or turned, of a yoke attached to said rod and having inclines on its upper surface, and an arm projecting from said piston through and above said yoke, and provided with horizontal projections on opposite sides and above the centre of the valve-rod, which overhang the sides of the yoke and are adapted to act upon the inclines thereon, substantially as and for the purpose specified. (3) In a direct-acting engine, the combination of the piston-rod D, the valve E, the rod F, the yoke I, having inclines, and the arm H, projecting through said yoke, and provided above the sides of said yoke and above the centre of the valve rod with a transverse pin and rollers, substantially as specified.

248,046. FURNACE FOR BURNING STRAW, *Edgar W. Loomis, Racine, Wis., assignor of one-half to the J. I. Case Threshing Machine Company, same place.—Filed June 1st*, 1881.

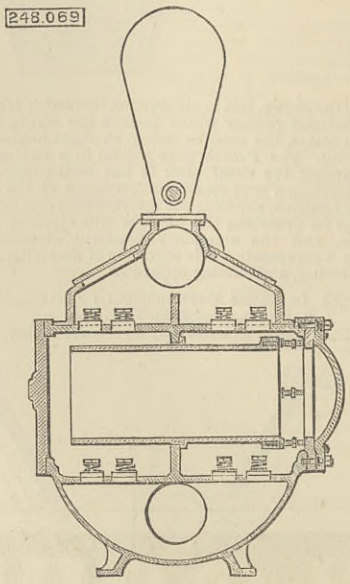
Claim.—(1) The combination, substantially as before set forth, of the supplementary fire-box, the vertically suspended hinged flaps therein for shaking the straw fuel. (2) The combination, substantially as before set forth, of the supplementary fire-box, the vertically suspended hinged flaps therein for shaking the straw fuel, and the curved rod for simultaneously operating



said flaps. (3) The combination, substantially as before set forth, of the supplemental fire-box, the ash-pit constructed with a perforated bottom, and an imperforate suspended pan open at one or both ends, for the admission of air and to prevent the falling cinder from escaping. (4) The combination, substantially as before set forth, of the supplemental fire-box and the suspended grate thereof, together with the links for suspending and the hand-lever for shaking said grate.

248,069. REMOVABLE CYLINDERS FOR STEAM PUMPS, *John H. Vaile, Dayton, Ohio.—Filed 11th April*, 1881.

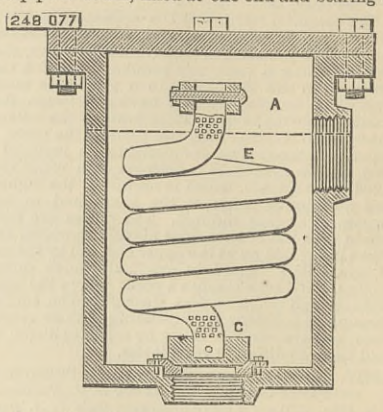
Claim.—(1) A removable universally-adjustable cylinder for pumping engines, having a double flange at or about its centre to form a gasket-joint, and held



in place by locking-bolts, substantially as set forth. (2) The combination, with a removable cylinder for pumping engines, held in place by locking-bolts, of an intermediate disc or flange to form a bearing resistance for said bolts, substantially as and for the purpose specified.

248,077. STEAM TRAP, *William O. White, Lake Village, N.H.—Filed April 2nd*, 1881.

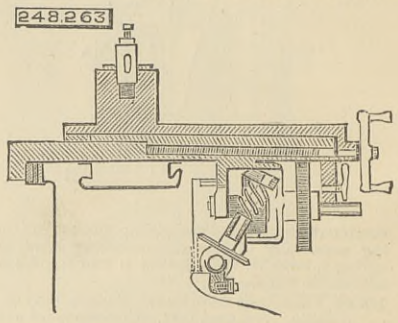
Claim.—(1) A steam trap composed of a close vessel A, having a water-discharge valve C, and an inclosed coiled pipe or rod E, fixed at one end and bearing the



valve C on the other end, operating substantially as and for the purpose herein specified. (2) The combination, with the water-discharging valve C, of a perforated spiral tube E, operating substantially as and for the purpose herein specified.

248,263. TURNING LATHE, *William Sellers and John Bancroft, Philadelphia, Pa.; said Bancroft assignor to said Sellers.—Filed July 19th*, 1880.

Claim.—(1) In a slide lathe, the flat-top shear having a vertical guiding surface and a bevelled clamping surface for maintaining the alignment of the spindles, combined with the saddle having vertical guiding surfaces for maintaining the parallelism of its traverse, substantially as described. (2) In a turning lathe, the combination, with a puppet head, of a dead spindle and coned wedges which inclose, clamp, and



release the spindle at two separate places in the puppet head, substantially as and for the purposes set forth. (3) In a turning lathe, the combination, with a puppet head, of a dead spindle, a clamping screw, and coned wedges which inclose, clamp, and release the spindle at two separate places in the puppet head, substantially as and for the purposes set forth. (4) In a turning lathe, the combination, with a dead spindle, of a coned wedge, a clamping screw, and packing blocks, substantially as shown and described.

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