THE PARIS ELECTRICAL EXHIBITION.

No. XVI.

THE Department of the Ministère de la Marine exhibited a series of electrical machines for the investigation of the problems connected with the discharge of ordnance—that is, the velocity imparted to the projectile and the pressure developed on the bore, as well as the velocity of the recoil of the carriage. Stress is laid on this branch of work, because the method of investigation might be applied to mechanical problems which may arise unconnected with gunnery.

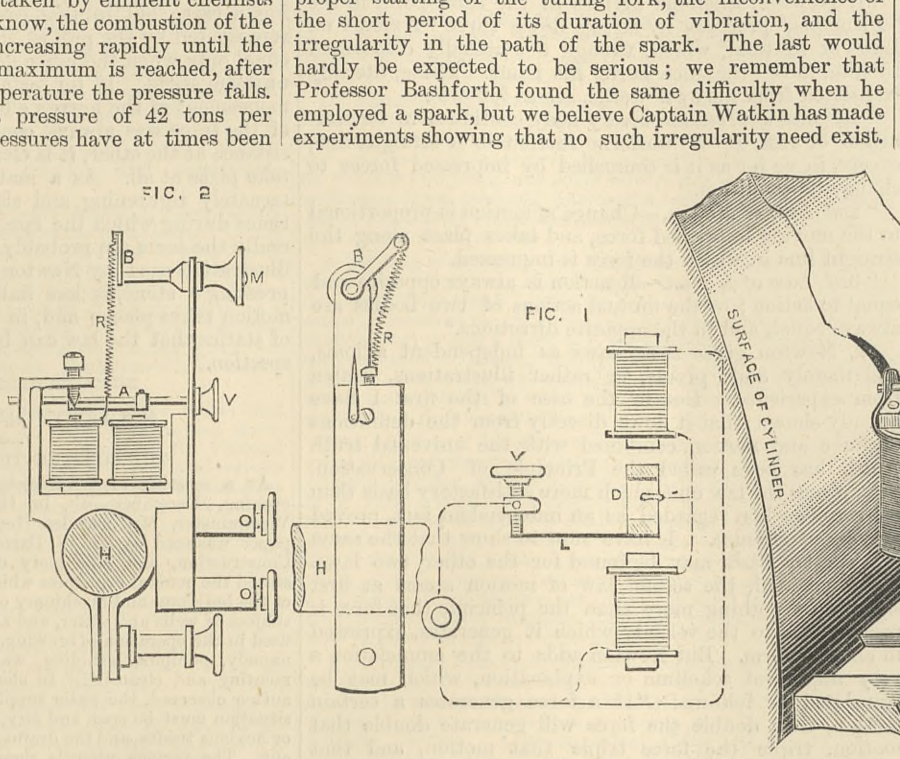
The investigation of the behaviour of powder ignited in a closed vessel has been undertaken by eminent chemists from time to time. As we all know, the combustion of the powder developes pressures increasing rapidly until the whole is consumed, when the maximum is reached, after which with the decrease of temperature the pressure falls. Noble and Abel obtained a pressure of 42 tons per square inch. Much higher pressures have at times been obtained, but chiefly of a local character, due to wave action, it is thought in the bore of a gun. The motion of the projectile—which increases the space in which the charge is consumed—alters the conditions of the problem, to say nothing of the rapid escape of gas through any openings due to windage or the vent. Under such conditions abstract investigation is not attempted, but rather the registry of the pressures developed, and the velocity imparted to the projectile and to the gun on its carriage. Until the last few years the investigations were chiefly as to the following points:—(1) The velocity imparted to the shot at the muzzle; (2) the velocity imparted to the gun and carriage; (3) the pressure on the bore at different places, which was ascertained by means of Rodman's pressure gauges. This consisted of pistons inserted in holes drilled through the piece at different points having pointed ends, or knife edges, on the exterior, butting against copper, into which they were driven a certain distance by the pressure of the gas in the bore. The amount of this pressure was afterwards measured by forcing the point or knife edge the same distance into similar copper by the application of weight. The results of Rodman's investigations determined the form of American guns, a form which has been likened to a soda-water bottle externally, which, for rapid burning powder, was approximately correct, no doubt, although the application of a statical standard of pressures to the question involves error, because velocity and momentum are always imparted to the piston employed. We have not noticed the work of Bernoulli, Robins, Euler, D'Arcy, Cavalli, Rumford, or others; our object is not to give a historical account, but merely to arrive at the proper platform in the progress of this branch of investigation to enable us to discuss briefly some of the instruments exhibited.

The first serious attempt to deal with the velocities at various points in the bore of a gun was made by our own Committee on Powder—*vide* THE ENGINEER of the spring of 1871—by means of the chronoscope of Captain Andrew Noble. This instrument hardly admits of being briefly dealt with, and we do not propose to say more about it here than to point out that the chief objection that has been urged against it is the employment of toothed wheels in its multiple gear. It did very good work, however, and the velocities obtained by its use agreed well with the pressures registered at the same time. For the pressures Captain Noble substituted a crusher containing a cylinder of copper, which was set up by pressure in place of Rodman's pressure gauge.

We can hardly pass on to the examination of the foreign instruments exhibited without observing that for the determination of velocities at many points in a trajectory by means of one instrument, the Bashforth chronograph is very complete. Theoretically, Watkins' instrument is beautiful. Practically, however, that of Major Boulengé is found most convenient for taking the velocity between two screens in flight. This consists of two heavy bobs held up by electro-magnets in close proximity to one another. The longer and larger is sheathed in soft zinc. It is freed on the shot passing through the first screen. The second one drops on the shot reaching the second screen, and this one liberates a cutter which marks the zinc coat on the first one. The line thus cut, when both bobs are liberated together, being ascertained by practice, corrections for time occupied by the cutter, &c., are eliminated, and the work becomes so simple that velocities can be taken at the rate of about one every two minutes continuously by the hour. Boulengé's instrument is employed by all continental powers as well as ourselves. At the present moment, we believe, we have about five at work in the Royal Arsenal at Woolwich.

To return, however, to the more ambitious work of investigating the behaviour of charge and shot in the bore of a gun.

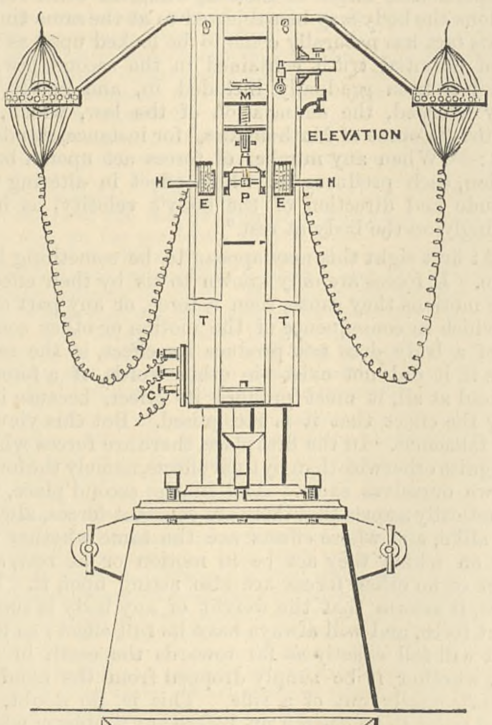
In the latter end of 1871 Captain Schultz designed an instrument with a revolving cylinder—in fact, a chronograph, on the smoke-blackened surface of which are traced zigzag or sinuous lines, made by a pen attached to the arm of a tuning fork. The trace itself, depending on the known note of the fork and the rate of revolution of the cylinder, tells what the latter is; the zigzags, or rather sinuous bends are made every five hundreth part of a second. The cylinder has a slow movement of translation in the direction of its axis, which causes the sinuous line to describe a spiral course. The pen is placed in circuit with a Ruhmkorff coil, of which the primary circuit is interrupted by the passage of the projectile past pieces of iron screwed normally through the gun. Thus sparks are made in the secondary or induced current, which mark the cylinder, and which have their position afterwards determined and measured with the aid of a microscope. The following objections are urged by the reviewer in the *Annales Industrielles* (M. Chenut), whose description, with the figures, we propose to follow. The difficulty is in the proper starting of the tuning fork, the inconvenience of the short period of its duration of vibration, and the irregularity in the path of the spark. The last would hardly be expected to be serious; we remember that Professor Bashforth found the same difficulty when he employed a spark, but we believe Captain Watkin has made experiments showing that no such irregularity need exist.



MARCEL DEPREZ CHRONOGRAPH.

The Schultz chronograph has been greatly altered by M. Marcel Deprez. In the modified instrument, instead of Fomault's current breaker a blade L is attached to an arm of the tuning fork—see D, Fig. 1. When at rest the blade L is in contact with the screw V. When the fork is vibrating of course contact is made and broken continually. A stud of insulating material is employed to limit the play of the blade L when in motion. M. Marcel Deprez, like Professor Bashforth, substitutes mechanical means for the induction spark. For this purpose he has a steel pen fixed on an electro-magnet, which traces an unbroken line on the cylinder unless the current is interrupted, when the pen is drawn slightly to one side by a spring, making a bend in the line on the cylinder whose form depends on the relative velocities of cylinder and pen. The lateral movement of the pen is stopped by a stud, so that the spiral line is moved a little to one side when the current is broken, and returns to its original course when it is made again—see Fig. 2. It may be seen that very light pens and armatures are used. In the complete chronograph six recorders are fixed on the same straight edge from the revolving cylinder. M. Dumoulin Froment exhibits a Schultz chronograph modified by Marcel Deprez, with a cylinder so long as to take twenty recorders. There the cylinder has no movement in the direction of its axis, the recorders moving instead. The revolution in the cylinder is prolonged sufficiently to enable records to be taken at points of the trajectory during the entire flight of a projectile. The velocity of rotation of the cylinder can be varied at will, and arrangements are made for putting the various necessary currents quickly in action for any special operation.

FIG. 3.



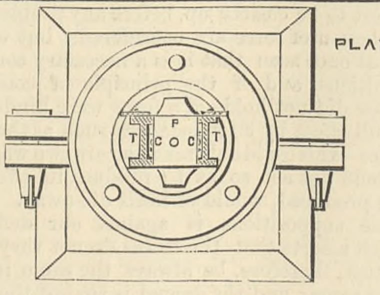


FIG. 4.—BIANCHI'S CHRONOGRAPH

M. Bianchi has an instrument depending on gravity, shown in Fig. 5. It will be seen that a weight P—of about 10 kilogrammes—falls between copper guides attached to the iron pieces T T. The weight P, when up, is held by a hook on the movable cross piece M. On the horizontal bar—H in Fig. 3—on the weight P, are carried a number of recorders—E E in Fig. 3—of Marcel Deprez's special construction—*vide* Fig. 5. The reels are 7 millimetres in diameter and 9 millimetres in height. The shaft A is attached to a spring R, with tension adjusted by the winch and crank B M. The pen is fixed on the extremity of the shaft A. The recorders are made to fix easily to the bar H. The spiral wires permit the weight and recorders to descend without difficulty. The recorders trace lines on two smoke-blackened vertical planes of nickel, as the weight falls, the instants of the phenomena being marked by the bends or "v's" made by the interruption of current and momentary action of the spring on the pen. The instrument allows of a time of fall of a little over half a second.

To apply this to ballistic experiments a special "conjunctor" is used, which need not here be described. The desired record of phenomena of ignition of charge in a gun can be obtained on the scale or plane by proper arrangements, and it is said that the $\frac{1}{50000}$ part of a second can be measured. M. La Rona has an instrument for testing the descent of the weight by gravity. The gravity chronograph may be employed to test the time occupied by an electric tube in firing a charge by placing the "conjunctor" in the electric circuit which fires the tube, and upon the falling weight an "interruptor" in a circuit broken by the actual flash of the tube when fired.

The measurement of the duration of combustion of a charge is made in a certain sense—that is to say, the instant when the tube is fired is recorded, and that when the projectile begins to move. This interval is found to be about $\frac{1}{100}$ of a second.

The recoil of the piece and the time of passage through the bore of a piece are of course suitable questions of investigation for the gravity instrument.

THE FOUNDATIONS OF MECHANICS.

By WALTER R. BROWNE, M.A.

No. IV.

53. *Measurement of Motion.*—I have already observed that we cannot speak properly of the quantity of a motion, but only of its intensity, and that to the intensity of motion has been given the special name of velocity. Now, when we say that one body has a greater velocity than another, we simply mean that it is passing through a greater distance than the other in the same time. But space and time are both capable of measurement. Hence, if we can measure any interval of time, during which we know that the velocity remains constant, and can also measure the interval of space which a body travels over during that time,* then the ratio of the space to the time, as thus given, is a proper measure of the velocity of the body. If we are sure that the velocity does not alter appreciably during a unit of time, *e.g.*, one second, it is convenient to take that as the interval of time in all cases; and we then measure velocity by the space passed over in one second. But in practice nearly all velocities are constantly varying, and then we must adopt the usual mathematical expedient, and assume an interval of time so short, that the variation of velocity in that interval vanishes. If s be the symbol for space, and t for time, the symbolical expression for velocity will then be, by the ordinary notation of the differential calculus, $\frac{ds}{dt}$.

54. *Measurement of Matter.*—With a view to this object, Newton, in the introduction to the "Principia," introduced the well-known conception of "mass," and in this he has been followed by all subsequent writers. Probably many students have felt some difficulty in studying this conception, from the apparent obscurity as to its measurement. Mass, according to Newton, is the quantity of matter in a body, and is the product of its volume and its density. As volume and density are both things of which we have a tolerably clear conception, this language assists us, no doubt, in arriving at an idea of mass as a *thing*; but as we have no direct means of measuring density, it fails to establish a definition of mass as a term. Newton accordingly states explicitly that mass is to be measured by

* If we measure the space by the distance between two points, as is usually the case, we must take care to see that these points have neither of them altered their position, during or since the motion, with reference to whatever is assumed as absolutely fixed, *e.g.*, in terrestrial measurements, to the earth on which we stand.

weight; but he gives nothing but experimental evidence to support this statement. On our definition of matter the question becomes perfectly clear. Matter being defined (for the purposes of this treatise) as a collection of like centres of force, the quantity of matter in a given volume simply means the number of centres of force contained in it, just as the quantity of shot in a given bag simply means the number of pellets. This then would be the *absolute definition* of mass; and the absolute mode of measuring mass would be to count the number of centres. But from their immense multitude and smallness this is impossible, and some more practical method is to be sought for. Now since all centres act on each other alike, and with forces which are the same at the same distance, it follows that if we can isolate a point, or centre of force, and place it so that it is at practically equal distances from all centres in a body, then the force which the body exercises on this point will be simply the force due to one centre multiplied by the number of centres, and therefore will be proportional to that number. The force exercised between the point and the body would then be a measure of the body's mass. Now we cannot isolate a single centre, but practically we can treat the earth as a standard isolated body for this purpose, and we measure the mass of any other body by the force existing, under standard circumstances, between it and the earth—in one word, by its weight.

55. *Measurement of Force.*—We have seen that the solar system, considered mechanically, is a collection of like centres of force or points, acting on each other by like laws, which vary with the distance. Let us now consider a single point, as related to any number n of other points, which are all at the same distance from it, and form, in fact, an element of the surface of a sphere, of which it is the centre. It is evident that the force existing between any one of these points and the first point will be the same; and therefore the total force acting between the first point and the element will be proportional to the number n of points, *i.e.*, by the last definition, to the mass of the element. If these forces are left to themselves, then, taking the central point as fixed, the element (since force causes motion) will move towards it or from it with ever-increasing velocity. But suppose another force to act directly upon the element and keep it at rest, or moving uniformly: then this force must balance the force existing between the element and the centre, and therefore it must be proportional to the mass of the element. Hence we see that where the velocity is unaltered force varies as the mass. But we have already seen, from the definition of Force, that when the mass is unaltered force varies as the velocity caused in a given time. Hence, by the ordinary law of proportion, when both are altered, forces vary as the mass acted upon multiplied by the velocity caused in a given time. Now the product of the mass by the velocity of a body is called the Momentum, and forces when they act to produce motion in bodies are called Moving Forces; and we may therefore state the conclusion at which we have arrived by saying that Moving Forces are measured by the momenta which they generate in a given time. This is the principle laid down by Newton in Definition VIII., and in many later works announced as the Third Law of Motion.

56. On this system, the proper, or absolute, mode of measuring force would be to isolate two centres of force, place them at the unit of distance from each other, and observe the value of $\frac{d\,s}{d\,t}$ at the first instant after they began to move. This would form an absolute elementary unit of force; and the force acting between a centre of force and a body, in any other case, would be found by multiplying this absolute unit by the number of centres in the body—in other words, by its absolute mass—and by the function of the distance which expresses the law of the forces. It is obvious that this process is impossible. As in the case of mass, we must resort to the standard furnished us by the earth on which we live. We begin by taking a certain piece of matter—such as the standard pound at Greenwich—which we agree to regard as a unit of mass. The weight of this pound, taken at Greenwich—since the force exercised by the earth may differ at different places—we take as the unit of weight. Any force, so long as it produces no motion, is measured by the number of such pounds which it will support—in other words, by the number of units of weight which it will balance. This is the measure of statical force, and its unit is the weight of a pound.

57. Again, if we consider forces as acting always on a unit of mass, and if we suppose that there is no force acting in the opposite direction, then these forces will be measured simply by the velocities which they generate in a given time. This is the measure of Accelerating Force, and its unit is a unit of velocity generated in a unit of time. In England the unit of velocity is 1ft. per second, and since gravity, or the attraction of the earth, generates a velocity of 32·2ft. per second in one second, we say that the value of the accelerating force of gravity is 32·2.

58. Thirdly, if forces act on different masses, and produce motion in them, then the forces are measured by the product of the mass and the velocity, or by the momentum generated in a unit of time. This is the measure of Moving Force, and its unit is a velocity of 1ft. per second, generated in a mass of 1 lb. weight. Here, as before, we must consider that there are no forces acting in the opposite direction. In other words, the measure of moving force is only the measure of the unbalanced part of a force. The balanced part of a force is to be measured by statical standards only.

59. It remains to say a word about the relations of Mass to moving force. Since moving force is measured in any particular case by the mass moved, and by the velocity generated in a second—which latter is always 32·2, or g—the moving force of gravity on a mass M will be represented by Mg. But the statical and moving force must clearly be proportional to each other, since they are the same things acting in different ways; and hence, if W be the weight of the body in pounds, we must have W = C Mg, where C is a constant. It is convenient to make this constant unity, so that we may write W = Mg; and this is done by assuming the unit of mass—which has not been fixed—to be the mass of $\frac{1}{32 \cdot 2}$ of 1 lb., instead of simply the mass of 1 lb., as would otherwise seem more natural.

60. *Laws of Motion.*—We have now defined the things with which our science is mainly concerned—Motion, Force, and Matter—and have shown how each of these is in practice measured with sufficient accuracy to make a true science of them possible. We are thus at last in a position to go further, and consider the leading principles of that science itself.

61. Newton, when he arrives at the same point in the "Principia," proceeds by laying down three "Axioms on Laws of Motion," which, though not actually discovered by him, have ever since borne his name. These, literally translated from his own words, are as follows:—

"*1st Law of Motion.*—Every body continues in its condition of rest, or of uniform motion in a straight line, except in so far as it is compelled by impressed forces to change its condition.

"*2nd Law of Motion.*—Change of motion is proportional to the moving impressed force, and takes place along the straight line in which the force is impressed.

"*3rd Law of Motion.*—Reaction is always opposite and equal to action; or the mutual actions of two bodies are always equal, and in the opposite directions."

62. Newton gives these laws as independent axioms, and merely adds proofs, or rather illustrations, drawn from experience. But in the case of the first I have already shown that it flows directly from the definitions of force and motion, combined with the universal truth which has been called the Principle of Conservation. This places the law on a much more satisfactory basis than it occupies when regarded as an independent fact, proved only by experience. I have now to show that the same or a similar basis may be found for the other two laws. As enunciated, the second law of motion seems at first sight to be nothing more than the principle that force is proportional to the velocity which it generates, expressed in another form. But Newton adds to the enunciation a very important scholium or explanation, which may be translated as follows:—"If a force generates a certain motion, then double the force will generate double that motion, triple the force triple that motion, and that whether it be impressed at the same time and instantaneously, or gradually and successively. And this motion (since it is always directed in the same straight line as the generating force), if the body was already in motion, is added to the previous motion where it is in the same direction, or subtracted from it where it is in the opposite direction, or is obliquely combined with it if the directions are oblique, and is compounded with it according to the direction of each."

63. It will be seen that Newton here contemplates, as a fact involved in his second law, though not explicitly stated, that each force acting on a body will produce its full proportionate effect of motion, whatever other forces or motions the body may be subjected to at the same time; and this fact has naturally come to be looked upon as the new and essential truth contained in the second law, so that it has been gradually included in, and finally has entirely usurped, the enunciation of the law, which, in Goodwin's "Course of Mathematics," for instance, stands as follows:—"When any number of forces act upon a body in motion, each produces its whole effect in altering the magnitude and direction of the body's velocity, as if it acted singly on the body at rest."

64. At first sight this may appear to be something like a truism. If forces are only known to us by their effects, *i.e.*, the motions they cause, then a force, or any part of a force, which in consequence of the motion or other conditions of a body does not produce its effect, is the same to us as if it did not exist—in other words, if a force is recognised at all, it must produce its effect, because it is only by the effect that it is recognised. But this view is doubly fallacious. In the first place, there are forces which we recognise otherwise than by their effects, namely the forces which we ourselves exert. And in the second place, the law practically asserts that there are constant forces, always acting alike, and whose effects are the same whether the matter on which they act be in motion or at rest, and whether or no other forces are also acting upon it. For instance, it asserts that the weight of any body is such a constant force, and will always have its full effect; so that a bullet will fall exactly as far towards the earth in one second, whether it be simply dropped from the hand or fired horizontally out of a rifle. This is, no doubt, an essential point to be cleared up, before any problems which involve the action of force are considered; but when thus stated, it is at once seen that it is a necessary consequence of our definitions, and of the principle of conservation. For if the law did not hold—if a force were hindered from having its full effect by circumstances, such as the presence of other causes—this could only take place in two ways: either the force would not act so as to produce its effect, or the effect, being produced, would of itself die away. Now the first of these suppositions is against our definition of matter, which asserts that the forces do not vary with the time, and must, therefore, be always the same if the distances be the same; and the second is against the principle of conservation, which asserts that effects live. Hence the second law of motion is not an independent principle, but a necessary consequence of facts already arrived at.

65. The same may be said of the Third Law. Since any centre of force acts on any other with a force which is always the same if the distance be the same, and since the distance between two centres must be the same in whichever direction it is measured, it must follow that if either of these be called the Action, then the other, or the Reaction, must be equal and opposite to it. The same holds true of the action between any centre and a group of centres, or a body; and similarly of the actions between one group of centres, or body, and another. Thus the Third Law follows at once from the definition of Matter. But it is necessary to point out, even at the outset, that we must be capable of analysing the action between any two bodies into the actions between the individual centres of which they are composed, and of calculating the sum of these actions, before we can say what the net action and reaction between two given finite bodies really is; and this requirement, which can rarely be fulfilled in practice, makes much caution requisite in the application of the law. Thus when a shot strikes a target, the forces of action and reaction induced by the shock are no doubt equal and opposite; but their exact nature of distribution who shall calculate? Most of the cases which are cited as illustrations of the law are so under special circumstances only. Thus Newton himself uses the illustration of a horse drawing a cart; but in that case the reaction and action, as represented by the pull at the two ends of the trace, are equal only when the horse and cart are alike moving with uniform speed. If, for instance, it were true at the commencement of the horse's effort, so that his pull at one end of the trace was always counterbalanced exactly by a resistance at the other, it is clear that the start would never take place at all. As a matter of fact, the traces are alternately tightening and slackening continually, and the times during which the speeds of the horse and cart are really the same are probably indefinitely short. The other illustration used by Newton, which is that of the finger pressing a stone, is less liable to mistake, since then no motion takes place; and, in fact, it is only in the domain of statics that the law can be used without much circumspection.

SOCIETY OF ENGINEERS.

THE CONSTRUCTION OF BREWERIES.

AT a meeting of the Society of Engineers, held on Monday evening, December 5th, in the society's hall, Victoria-street, Westminster, Mr. Charles Horsley, president, in the chair, a paper was read by Mr. W. Barns Kinsey, "On the Arrangement, Construction, and Machinery of Breweries." The author first stated the general principles which should govern the arrangement of the buildings and machinery of breweries; he then treated the subject of wells and water, and afterwards described the machinery used in the operation of brewing, which he divided into six sections, namely, pumping, grinding, washing, boiling, cooling, and fermenting and cleansing. In choosing the site of a brewery, the author observed, the water supply should be first considered. The situation must be open and airy, out of the influence of gasworks or noxious trades, and the drainage perfect and ventilated throughout. The various utensils should command one another where possible, and advantage taken of sloping ground. The carriage of material to and from the brewery is important; a railway siding or canal alongside would therefore be an advantage. It is advisable to place the coolers, coppers, and hop-back in a distinct building, so as to keep the brewery free from steam. The tun-room should have its windows facing the north, and be built with hollow walls, the roofs being boarded, felted and tiled; slab plaster is better for ceilings, being lighter and more durable. Concrete forms an excellent material for walls, floors, and cellarage. Wells and water; good water is essential to a brewery, the constituents being of importance, whether the beer to be brewed has to be used speedily or kept for a prolonged period. The absence of saline matter renders water unfit for brewing. The position of the well should be governed by the surroundings, and every care taken to prevent percolation of drainage or surface water, which generally contains organic matter. This may be accomplished by lining the well with cast iron cylinders, or with concrete, or concrete tubes, or by boring from the surface and lining the bore with cast iron pipes, telescoping one within the other, and testing the quality of water at various depths, the space between the various pipes being afterwards filled in with cement.

The water, or "liquor," has nearly always to be pumped, and in some cases the wort or beer also; the pumps should always be large enough to save the machinery from being worked for pumping only. The water is stored in a vessel called a cold liquor back, which should be the highest utensil in the brewery. It is essential to have the natural cohesiveness of the grain destroyed in such a way that the water may have free access to every particle. Various methods have been tried, but crushing between rollers is preferred. It has been found in practice unadvisable to construct mills for crushing more than thirty quarters per hour, and in large breweries there are therefore several mills. Mashing is the most important part of brewing, as by it the brewer extracts the saccharine principle from the malt. It differs somewhat according to the use to which the worts are to be put. It is performed in a vessel called a mashtun, generally constructed of oak staves with Danzig fir bottom. In position it should be commanded by the hot liquor back or copper, and be fitted with a mashing apparatus either self-acting or worked by steam-power. The wort is boiled both by steam and direct fire heat, and it is a debated point which system is the best. It would seem that for a soft brewing liquor the fire copper is the best, while the steam copper, from its ease of manipulation, cleanliness, and convenience of erection, has much to recommend it. The wort, after boiling, is discharged into a vessel called a hop-back, which is fitted with a false bottom for the purpose of straining it from the hops; it then either runs or is pumped into the coolers. These coolers are rectangular shallow vessels, generally constructed of Danzig deal; they should be placed in an airy situation, with movable louvre boards at the sides if possible. As they would require to be of large area if depended upon entirely for cooling, they are supplemented by a refrigerator, which is either of horizontal or vertical construction, the wort passing through or over the surface of pipes or chambers in a thin stream, the cold water circulating within the apparatus.

The fermenting tuns may be either round or square, and made of oak, Danzig fir, or slate; the wort runs into these vessels from the refrigerator, and yeast is added. It is important to keep an even temperature during fermentation; every tun is therefore fitted with an attemperator, consisting of coils of copper pipe, through which water is made to circulate. Skimming has been much practised of late years, by which means the fermentation is completed, or very nearly so, in the fermenting tun. This is best accomplished by means of a skimming apparatus, which collects the yeast into a trough below. The tuns must be sufficiently above ground to enable cleansing casks to be placed beneath. These are required, when the beer is not skimmed, to remove the particles of yeast and glutinous matter that are held in mechanical suspension, and which, if allowed to remain, would cause acetous fermentation. In some breweries union cleansing casks or pontos are used for this purpose. Yeast presses or filters, cask lifts, cask washing, and steaming apparatus, and sack hoists and elevators for malt and hops, are also part of the necessary plant of a brewery. Lastly, the engines and boilers should be of ample power, and of the simplest construction, the Lancashire double-flued boiler being the most suitable for brewery work.

THE VIENNA CIRCULAR RAILWAY.

WE give at page 436 views of stations on this line, our description of which we shall resume in an early impression. Our engraving this week may be regarded as supplementing that published on page 418. We shall describe it next week.

RAILWAY MATTERS.

AN American company is making proposals to the Transvaal Government to construct the Delagoa Bay Railway. It is reported, says the *Colonies and India*, that England has offered to give the telegraph line to the local Government.

IN our impression of the 28th October, we referred to a new tramway locomotive made under the patent of Mr. Matthews, of Victoria-street, Bristol, at the Kingsbury Ironworks, Ballspond. This locomotive was sent to Liverpool for competitive trial, and we are now informed that the engine has been running in Liverpool with very successful results.

AT the conclusion of his report on the accident which occurred on the 15th October last between Blaenau-Festiniog and Tan-y-Grisiau, on the Festiniog Railway, when part of the train left the rails near a diamond point, Major Marindin remarks that "this is the first accident to any passenger train which has taken place upon this line since it was opened more than sixteen years ago."

M. PAPON, a deputy for the department of the Eure, has introduced into the Chamber of Deputies a bill for the immediate purchase of the whole of the French railways by the Government. The scheme provides for the division of the great lines into sections of 2500 kilometres, each of which is to be managed by a company under the general supervision of the Ministry of Public Works. M. Papon's proposal is already meeting with considerable opposition as it ought.

THE construction of the Canada Pacific Railway is being rapidly pushed on, and the "grading" is complete as far as Gopher Creek, fifty miles west of Brandon. During the month of September an average of over three miles a day was "graded," or an aggregate of ninety-three miles. From October 19 to October 24—five days—nine miles of track were laid, or an average of nearly two miles a day. One hundred miles of the southern and western branches will be ready for the ties and track-laying early in the spring. It is expected that the harvest of southern Manitoba will be carried next year by rail.

THE Marseilles correspondent of the *Daily News* writes that several Frenchmen, living at Sfax, in Tunis, have formed themselves into a committee, under the presidency of Dr. Fernand Laffitte, with the intention of carrying out the suggested railway across the Sahara. A superior commission has been appointed to examine the means of uniting the Senegal with the Niger and Algiers with Timbuctoo by a railway, and of uniting by a combination of railways the two large African colonies, However, the Trans-Sahara Railway will give access only to a very limited part of the Soudan.

A SERIOUS landslip took place last week on the Great Northern Railway, near the Hose Tunnel. The cutting at this spot runs through a hill, and the embankments in some instances reach a height of 60ft. A luggage train had just passed through when one side, for a distance of 80 yards, suddenly slipped down. The effect is described as singular. The soil, which had been weakened by the weather, rushed underneath the metals, raised them to a height of 10ft., and threw them to the opposite side, thus entirely demolishing and blocking the line. It is estimated that 10,000 yards of the material had slipped, and very large gangs of men have been employed night and day in removing it.

THE Midland Railway has refused, it is said, to carry the new big bell for St. Paul's from Loughborough to London, on account of its weight exceeding the carrying powers of any of their trucks. The *Colonies and India* thinks that the directors of this and other English railways might take a hint from the "cars" employed on the Canadian railways, where a "new combination box-car" has lately been introduced which will carry 30 tons of freight. It lately took a load of 9800 bushels of wheat, weighing 48,000 lb., the whole of which was unloaded in one minute; after which it carried 16,080ft. of green lumber, weighing 70,000 lb., in one journey; and followed this up by taking the enormous load of 1000 bushels of barley.

IN reporting on the collision that occurred on the 24th October, at the Pannal junction, on the Leeds and Thirsk branch of the North-Eastern Railway, between an express passenger train, travelling at high speed, and a goods train which had been approaching the junction from an opposite direction, Col. Yolland says: "There is not any doubt whatever that the collision was entirely due to the gross carelessness of the engine-driver of the goods train engine, in having run forward until his engine stood foul of the down passenger line of the short connecting branch line to Crimple junction. Many similar collisions have been occasioned by engine drivers continuing to run forward, in the expectation of the signals standing against them being taken off at the last moment."

FROM the report on the accident on the Great Western Railway referred to below, it appears that it is considered safe to work the block system with a much less margin of safety than is considered necessary upon many other lines. Under their regulations "line clear" without any reservation or caution can be given when there is an obstruction on the line a certain distance, specified in each separate case, inside the home signal, which distance in the case of Ely was 107 yards. Upon some lines, in such a case, the line would have been blocked, and on others the train would have been allowed to move forward only with a caution. As at present worked, the block regulations upon this line do not sufficiently provide for the safety of the public.

IN reply to a correspondent enquiring as to the gauge of American railways, the *Railroad Gazette* says that the "Travellers' Official Railway Guide" gives the name of each railroad company, preceded by figures giving the gauge of the roads. While the 4ft. 10in. gauge has almost completely disappeared, there is an enormous mileage of 4ft. 9in. road, including the whole immense system of the Pennsylvania Railroad Company, from New York, Baltimore, and Washington in the East, to Chicago, St. Louis, and Louisville in the West, and several other important roads. There are some also of 4ft. 9¼in. and 4ft. 9½in. gauge. The changes that have been made in reducing the difference between the 4ft. 10in. and the 4ft. 8½in. gauge have generally been made gradually, and it is not easy to trace them always; the more so as companies whose tracks are fitted for standard gauge often report them of 4ft. 8½in. gauge, when in fact they are ½in. or ¾in. wider.

THAT the value of continuous brakes depends upon the intelligence and quickness of the man into whose hands the brakes are placed is shown by the collision which occurred on the 19th October, at Ely station, near Cardiff, on the Great Western Railway. In this case as the 7.15 a.m. down goods train from Cardiff to Stormy was crossing to the down line from the up line at Ely station, having been shunted to allow a down passenger train to pass, it was run into by the 2.45 a.m. up Irish express train from New Milford to Paddington, which was running about 2¼ hours behind time, the Irish packet having been delayed by bad weather. The point at which the driver of the express states that he first saw the home-signal at danger is no less than 670 yards from the point of collision. As Major Marindin says in his report, it was quite apparent either that the driver did not take steps to stop his train so soon as he says he did, or that the continuous brake with which a large proportion of the train was fitted did not act well. Major Marindin made three experimental runs with a train similar in all respects to that which was in collision, applying the brakes, &c., at the point indicated by the driver as that at which he had done so upon the day of the accident, and the following are the results: First run—Speed 51½ miles an hour. Engine reversed, and tender brake only applied. Train ran through Ely station at 18 miles an hour, and stopped in 58½ chains. Second run—Speed 52 miles an hour. Engine reversed, steam brake on engine and tender brake applied. Train stopped 33 yards beyond the point of collision. Third run—Speed 46 miles an hour. Engine reversed, steam brake on engine, tender brake, and vacuum brake applied. Train stopped in 262 yards. It thus appears that the driver did not take action so soon as he states that he did, and probably not until within 300 yards of the point of collision.

NOTES AND MEMORANDA.

THE surface of cast iron may be softened for turning or planing by immersion for twenty-four hours in a solution of one part aquafortis to four of water.

GLYCERINE, with a few drops of alcohol, is better than most oils for oilstones. For sharpening very small tools such as gravers nearly all glycerine, or glycerine with the addition of but a few drops of alcohol, is best.

M. MOUCHEZ, director of the Observatoire in Paris, is making arrangements for taking meteorological observations at an elevation of 2300 metres by means of a captive balloon. The balloon will be charged with ordinary coal gas. These observations are intended to facilitate the calculation of atmospheric refractions.

THE following figures, giving the yield per acre on Australian farms, are of interest:—The average of wheat per acre was 14½ bushels, being one bushel less than the year before. Maize stood at 35 bushels per acre, one-third of a bushel less; barley, at 20 bushels, or 1½ bushels less; oats, 19 bushels, being 4 bushels less; potatoes, 2⅔ tons, as against 3¼; and hay, ⅓ ton.

ON Saturday last the centre arch of a bridge over the Lune, known as Caton Penny Bridge, near Lancaster, fell with a crash. The bridge was built by private enterprise about seventy years ago, and consisted of three arches. It has been in a dangerous condition for the past two years, and about twelve months ago all vehicular traffic over it was stopped. Last session a clause was inserted in an Act of Parliament authorising the justices to rebuild the bridge at the expense of the county.

IT has long been taught that humid air acts as a conductor of electricity. Recent experiments of M. Marangoni throw doubt on this, for he finds that a Leyden jar heated so as to prevent condensation of moisture on its glass walls and thus arrest surface conduction gives as long a spark as in the driest air. When, however, the precaution of heating the walls of the jar is not taken, the moisture condenses on the latter, and forming a thin film of water, causes a silent discharge which might be mistaken for a slow discharge through the conducting air.

THE addition of kerosene oil will greatly assist in preventing sperm oil from gumming. *Calvert's Mechanics' Almanack* says:—"Thoroughly mix 100 parts oil with 4 parts chloride of lime and 12 of water. Now add a small quantity of the decoction of oak-bark, to destroy all traces of gelatinous matter still remaining, and allow the impurities to settle. Next, agitate the clear part with a little sulphuric acid, settle once more and wash to remove the acid, which should never be permitted to exist in any oil used on machinery. If oil becomes rancid, boil it along with water and a little bicarbonate of magnesia for fifteen minutes or so, until it loses its power to redden litmus paper."

A GOOD deal of correspondence has recently appeared in American papers on chilled iron lathe tools, which, it seems, are largely used in the Altoona shops of the Pennsylvania Railway Company. Two of the cast iron tools used at Altoona have been sent to the Franklin Institute. A correspondent of the *American Engineer* says:—"I saw them in use under feeds and cuts that would demoralise steel tools, especially on hard sand corners in castings, and am told that the piecework hands use them in preference to steel." These chilled iron tools are said to be made of a special mixture as follows:—3950 lb. "Clove Spring" No. 3 iron; 1400 lb. good railway scrap; 250 lb. steel rails. We do not know what is the characteristic of "Clove Spring," but it is probably a close grey iron.

MR. HENRY HUSSEY VIVIAN has found that the one-thousandth part of antimony converts first-rate best selected copper into the worst conceivable, so bad as to be only fit for brass, and that one four-thousandth part makes it unfit for anything but inferior brass purposes and below the quality known as tough ingots. He discovered that one eight-thousandth part reduces it from "best selected" to "tough ingot" quality, and that one sixteenth-thousandth sensibly deteriorates the copper. Mr. Vivian states that one-thousandth part of nickel, cobalt, bismuth, arsenic, or phosphorus reduces "best selected" to "tough ingot," while nickel and arsenic in combination and mixed in the proportion of one five-hundredth make copper unfit for brass, thus showing that two substances in combination may produce a far more hurtful effect than either of them separately.

THE following recipes for coppering and bronzing zinc are said to produce very good results:—Prepare a solution of 15 parts of blue vitriol and one of 19 parts of cyanide of potassium, then mix both solutions together. Incorporate this liquid well with 160 parts of pipe clay, and rub the resulting semi-fluid mass, by means of a linen rag, on the previously cleaned object. For bronzing, take 15 parts of verdigris, 19 of cream of tartar, and 30 parts of crystallised soda, reduce them to powder, and dissolve them in the necessary amount of water. Mix this liquid together with 160 parts of pipe clay, and then proceed as above directed. Another process is as follows:—Take 15 grammes of blue vitriol, 20 of calcined soda, and mix them well with 32 cubic centimetres of glycerine, and mix the paste obtained with 80 grammes of pipe-clay. It is then ready to be applied as before stated.

A SIMPLE form of photometric balance has been invented by M. Coulon, who ralls it an *athermanous* photometer, as being acted on only by luminous rays. Its principle is that a radiometer, whose temperature is constant, turns solely under the influence of light. The apparatus consists of a radiometer bulb fixed in the middle of a cube-shaped metallic case, having four lateral apertures, closed with glass, through two of which light can be sent horizontally, traversing the bulb, while the two others allow observation of the bulb. The case is filled with water, which, through four vertical tubes, screened from the bulb, and surmounting spirit lamps, is heated to a temperature above that of the radiant heat of the sources to be measured—in practice about 100 deg. suffices. The bulb contains, *in vacuo*, a disc movable round a vertical axis; the half disc on one side of this axis being black on its two faces, the other white. When a single source of light acts on the bulb from one side, it attracts the white half and repels the black, so that the disc turns edgewise to the light, and presents one side to the observer. If another equal light act simultaneously on the other side and at the same distance as the first, the counteraction results in the disc presenting its sides to the light, its edge to the observer. Where unequal lights are compared, one may always, by shifting one of them, bring the disc into the second position just specified, and by then measuring the distances, ascertain the ratio of the intensities.

IN a report on rivetting in locomotive boiler work, made by a committee of the American Master Car Builders' Association, we find the following. The operation of "driving" rivets consists in placing a set on the end of the rivet, and sledging it down to form the head, the operation requiring two men to sledge, one to hold the set, one to manage the holder, and a boy to heat the rivets. "The rivet is not struck direct by the sledges at any time during the operation of driving, but the head is formed entirely by driving the set down squarely on the end of it. To drive a rivet requires about twenty-four blows with the 9 lb. or 10 lb. sledges at the rate of about eighty blows per minute; a flatter, with a face about 1½in. square, is then placed on the lap alongside the rivet, and given five or six blows to close the sheets together; the set is then placed on the rivet-head again, and given five or six more blows and the rivet is finished; the whole operation of driving requiring about thirty-five seconds of time to the rivet. In practice we find that a rivetting gang will drive in the seams of the shell of a boiler, an average of thirty rivets per hour, or 300 per day, and in the seams of the fire-box, in throat and back sheets, dome, mud-ring, braces, &c., an average of about twenty-two rivets per hour. This includes the time necessary for taking out bolts, drifting holes, adjusting the tools and the work. In hand rivetting two rivetters will drive, on an average, taking the whole boiler, only about 125 rivets per day, or 12½ per hour."

MISCELLANEA.

THE 81-ton gun has been successfully landed at the Admiralty pier, Dover.

EXPERIMENTS with the electric light, with a view to street illumination, have been made in Adelaide.

THERE are now a hundred telephones in operation in Sydney, constructed and maintained by the Telegraphic Department.

THE deep drainage system is being carried out in Adelaide. Out of a sum of £200,000 voted by Parliament, £166,000 has been expended.

THE defence works which have been for some time in progress at Landguard Fort, near Felixstowe, have now been substantially completed. The works have been carried out under the direction of Major Bowe, R.E.

WE have received a copy of *Calverts' Mechanics' Almanack and Workshop Companion* for 1882, which, as usual, contains a great quantity of information very useful not only to artisans and apprentices, but to many others.

THE committee announce that the new inventions not patented, exhibited at the Smoke Abatement Exhibition, are protected by special provisions of the Board of Trade. They also state that inventors having apparatus of which models cannot be prepared in time for exhibition may send in drawings of the same.

THE steamship India, the last addition to the fleet of the British India Steam Navigation Company, constructed by Messrs. William Denny and Sons, of Dumbarton, is 4065 tons burthen, and the dimensions are—length 390ft., breadth 42ft., and depth 31ft. She is propelled by engines of 3000 indicated horse-power, and maintained on trial a mean speed of 14½ knots.

THE man who will render cranks unnecessary will confer a boon on the nation. In a few years cranks cost nearly as much as some of the ships that want them. Serious cracks were discovered last week in the necks of the midship high-pressure crank of the Jumna, as well as in the after crank. A spare crank is always kept in hand at Portsmouth, but, though it has been determined to work night and day to get it ready, the fitting of the excentrics and other parts will take about a month to complete.

THE Barnsley Town Council have resolved to continue the electric lighting experiments for twelve nights longer. There was a mishap at the commencement of the experiments, when the engine would not work. A member of the Council stated that he found the men in charge of the engine "helplessly and dangerously drunk;" that an obstruction had been placed in the chimney, and that, on a second occasion, the water taps had been tampered with, so that they could not be properly turned.

IN our notice last week of the Smithfield Club Cattle Show, we omitted to refer to the show catalogue. This was not an intentional omission or slight, because we think that some reference should be made to the results of labours bestowed on a good catalogue, and especially one of the articles exhibited in a show of such importance as is the yearly collection of machinery in the Agricultural Hall. We therefore hasten to supply the omission, for as a catalogue of such an exhibition it is without exception the most incomplete, badly arranged, and useless catalogue published for any purpose.

A SERIES of experiments is being carried out at Portsmouth with the object of selecting the best dynamo machine for the working of "search" lights on board ship. Three machines are under trial. The D Gramme, which supplies a single light of 20,000-candle power; the C T Gramme machine, which provides two lights of 10,000-candle power each, but which can be coupled up so as to give a single powerful light equal to 22,000 candles; and a new Brush machine, which supplies a stronger search light, but with additional engine power. Each machine is driven for four hours, and careful observations are made for the purpose of ascertaining the respective horse-power required—diagrams being taken every quarter of an hour—the amount of resistance, the consumption of fuel, and the comparative illumination of the lights.

A FATAL accident occurred at Hatfield House, the residence of the Marquis of Salisbury, which is lighted with 117 lights, partly on the Brush system, worked by an engine of 16-horse power, placed in the sawmills some distance from the house. For some distance the line wires are run along the garden wall, three feet from the ground, and for some distance are not protected. A few days ago a labourer was at work in the garden, assisting to lay a telephone wire, and was sent to ease the wire at the corner of the brickwork to prevent it getting cut. While he was absent the linesman heard the wires shake, and on looking round saw the deceased lying on his back, and on going up to him found he was dead. It is supposed that the deceased slipped, caught hold of the uncovered wires to save himself, and was immediately killed by the shock.

THE New York correspondent of the *Standard* states that two substantially-backed enterprises which propose to reduce the passage across the Atlantic to five days are attracting much attention. "Jacob Lorillard says the Express Line will carry only cabin passengers between New York and Milford Haven; the vessels will be elegantly fitted up, and the rates extremely high. Captain Monland, of the Cunard steamer Batavia, in association with a person named Oliver, proposes to construct vessels without masts, with the decks completely domed, so as to enable a vessel constructed upon this novel design to dash through any sea. Auxiliary screws would be relied upon in case of the disabling of the main screw. Both companies are reported to possess unlimited capital, and they propose to use vessels of exclusively American construction."

THE very valuable monthly report by Messrs. W. Crookes, F.R.S., W. Odling, F.R.S., and C. Meymott Tidy, F.C.S., to the President of the Local Government Board, on the composition and quality of daily samples of the water supplied to London, continues to show that our supply from the Thames is better than the water from many of those which elsewhere in this country are supposed to be perfection. In their remarks on the results of their analyses of the water as supplied during November, they say "the results show that the quality of the water supplied by the London companies continues to be excellent, notwithstanding the unfavourable condition of the rivers consequent on the heavy rainfall of the month. The aëration of the water is abundant, and its freedom from organic matter but little less complete than during the summer months."

MAYRHOFER'S system of pneumatic public clocks adopted throughout Vienna, and to some extent in Paris, as illustrated and described in our impression for the 29th June, 1877, is likely to be introduced into London by Mr. Mayrhofer, of 21, Rue Royale, Paris, who has made considerable improvement in his system since we described it. He now employs electric currents in connection with the pneumatic system. In the new system the clocks of a city will not stop in the case of the breaking of a pipe, stoppage of a central clock, or other accident, as every clock is now supplied with works of its own, and will continue to go—for fourteen days or more—when once wound up and set in motion. They receive every hour or at even longer intervals an impulse coming from the electro-pneumatic relay, by which they are at the same time regulated and further wound up for the amount of one hour; and in case this impulse by accident should not arrive, they will nevertheless continue to go without interruption. This peculiarity secures for the new system the possibility of being applied over a much larger area. In the system as adopted in Vienna, the pneumatic impulse is necessary 1440 times within twenty-four hours, *i.e.*, the net of pipes must be filled with air 1440 times in order to keep the clocks in movement which are intercalated in this net, while in the new system the pneumatic impulse is only necessary twenty-four times in twentyfour hours, and therefore only about $\frac{1}{60}$ part of the not unimportant expenses for the compression of air will be required.

THE VIENNA CIRCULAR RAILWAY.

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

(For description see page 434.)

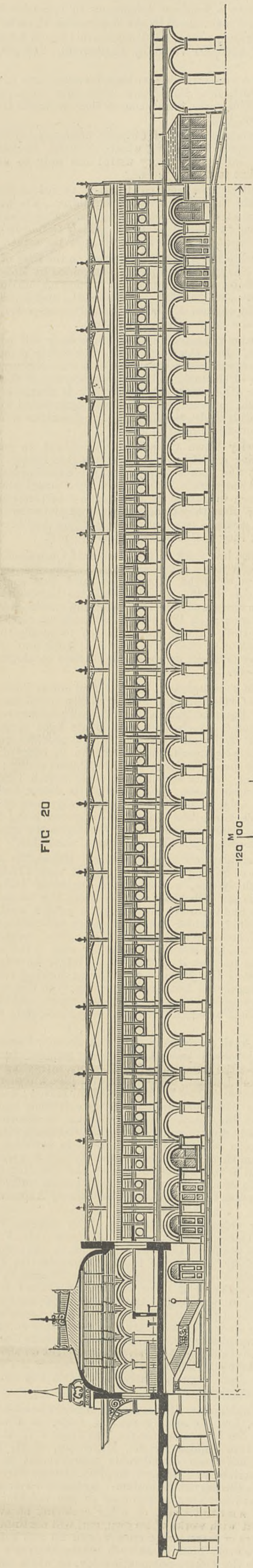


FIG 20

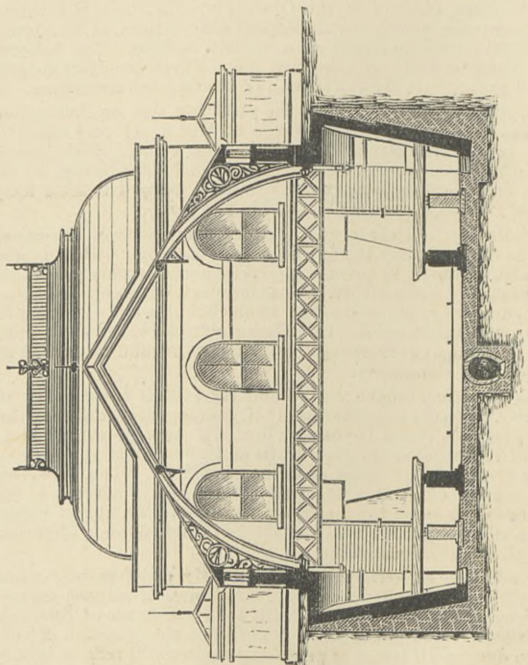


FIG 22

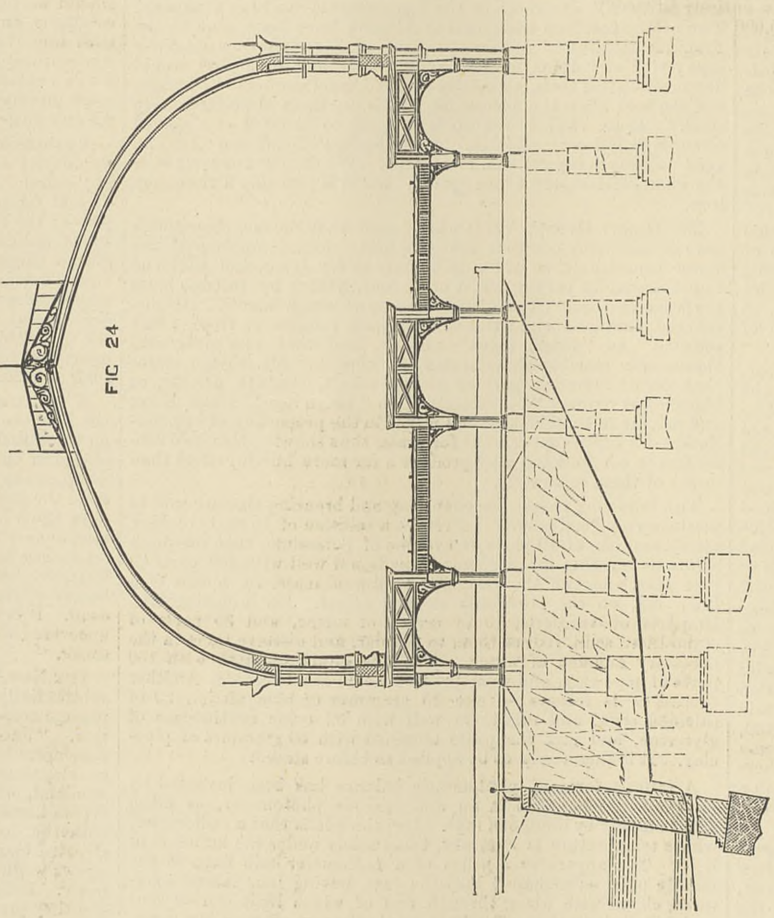


FIG 24

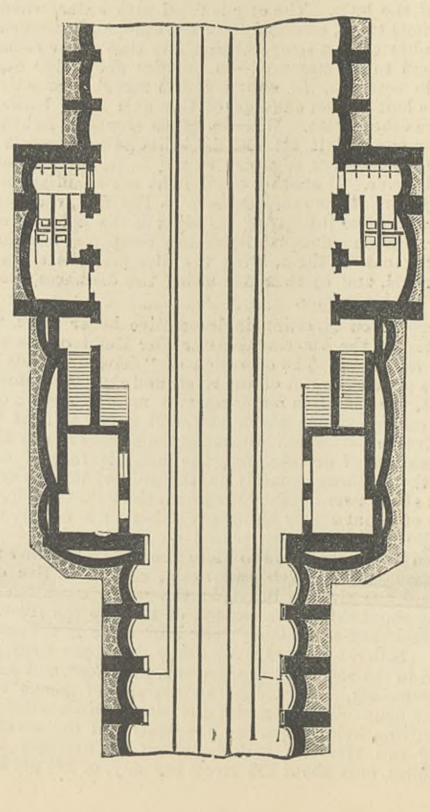


FIG. 21

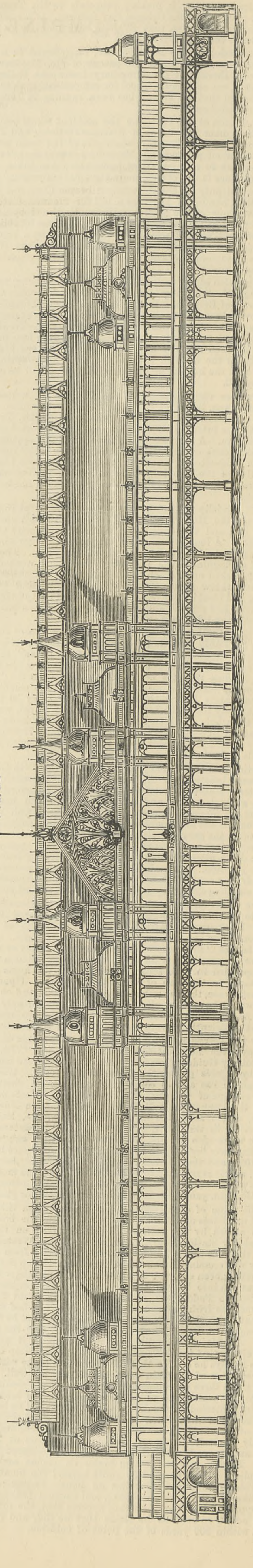
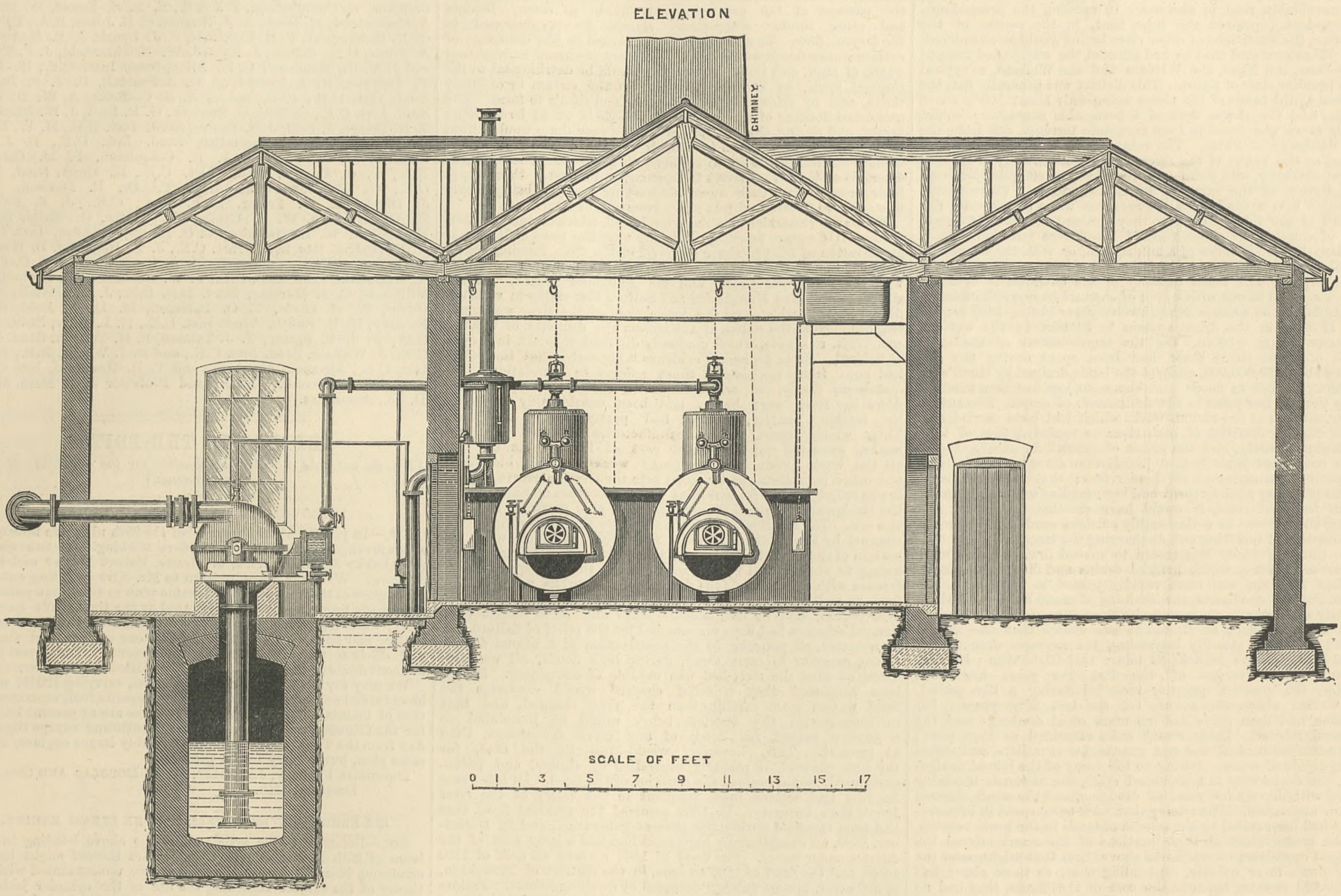


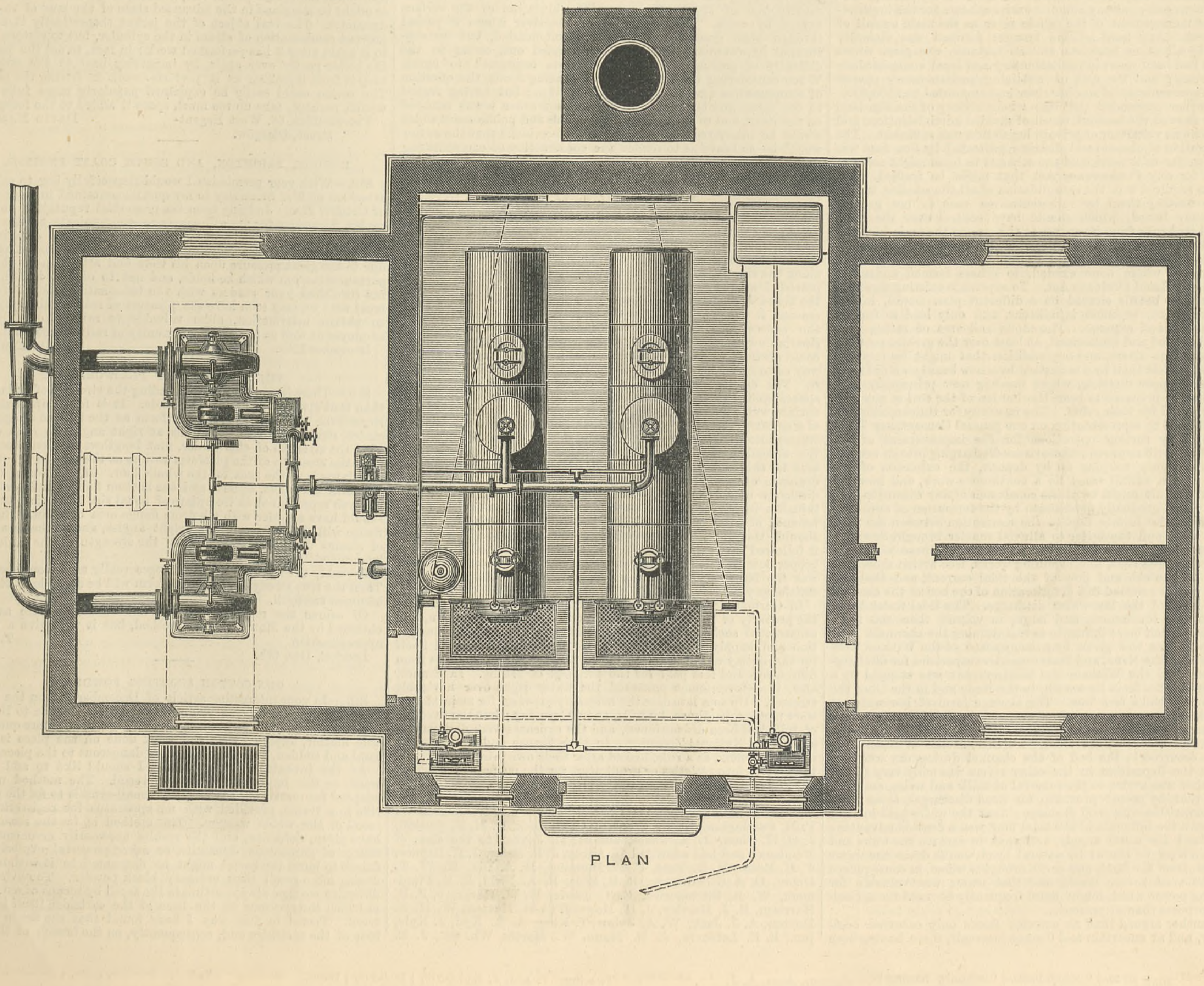
FIG. 23

PUMPING ENGINES, CANTERBURY SEWAGE WORKS.

MESSRS. GWYNNE AND CO., LONDON, ENGINEERS.

(*For description see page* 443.)





THE INSTITUTION OF CIVIL ENGINEERS.

THE CONSERVANCY OF RIVERS.

At the meeting on Tuesday, the 6th of December, Mr. Abernethy, F.R.S.E., president, in the chair, two papers on the above subject were submitted. The first, relative to "The Eastern Midland District of England," by Mr. W. H. Wheeler, M. Inst. C.E., was read in an abridged form; and the second, which dealt with "The River Irwell," by Mr. Ar. Jacob, B.A., was unavoidably read in abstract. In opening the proceedings, the president expressed the hope that, in the course of the discussion, the conditions of other river basins would be considered.

Mr. Wheeler stated that he had selected the water-shed drained by the Ouse, the Nene, the Witham and the Welland, as typical of one peculiar class of rivers. This district was generally flat, the elevation at the heads of the rivers being only about 300ft. above the sea, and the strata were of a permeable character; consequently there was freedom from mountain torrents, and from the rapid discharge of water. The rainfall was small; the industry pursued on the banks of the rivers was almost entirely of an agricultural character, and there was, therefore, no complication from the pollution of the streams by manufactories. These rivers discharged into a sandy bay, where there was a considerable rise and fall of the tide. Together they drained about 5719 square miles of country, of which 668,241 acres were fen-land. Their total length was 416 miles of trunk stream, or with the tributaries 872 miles, giving 8155 acres to a mile of the former and 4315 acres to the latter. The mean capacity of the channels in ordinary floods was equal to one square foot of channel to every 816·6 acres. The rainfall on an average of the twelve years ending 1880 ranged from 17·39in. in the driest seasons to 34·48in. in the wettest, the mean being 26·05in. On the improvement of the main outfall of these rivers there had been spent during the last century about £2,000,000, and yet the lands drained by them were constantly subject to floods, and enormous loss had been incurred during the last few years in the destruction of crops. The author gave particulars of the various works which had been carried out, and of the peculiarities of each river as regarded flow of tide, discharging capacity, and the effect of rainfall in causing floods. It was contended that divided jurisdiction acted prejudicially on the efficient management of these rivers; that if the immense amount of money already spent had been applied under one general system for each river, it would have resulted in putting and keeping these rivers in a thoroughly efficient condition, and made them capable of receiving and discharging the largest floods.

The cause of floods was traced to subsoil drainage, the more efficient condition in which arterial drains and ditches were kept, (so that the rain was more rapidly passed to the rivers), the destruction of woodlands, the draining of meres and lakes, which formerly acted as reservoirs, and also to an increase in the rainfall. From statistics kept at Boston it was shown that the annual rainfall had been steadily increasing, the averages over a long period having been: 1826-40, 22·45in.; 1841-60, 23·25in.; 1861-80, 24·39in. The average of the last five years had been 29·04in., the greatest quantity recorded during a like period, and 5·62in. above the average of the last fifty years. No provision had been made for the more rapid discharge and the increased rainfall. Bridges and weirs remained as they were; while sufficient control was not exercised over millers, and others having rights of water. Owing to the decay of the inland navigations, the works were in a neglected state, the channels becoming choked with deposit for want of dredging, and the weeds allowed to grow unchecked. The money that had been spent in improvements had been raised by the owners of lands in the lower reaches, and the conservators of these portions of the rivers offered the strongest opposition to any works above them that might send the water down more quickly, contending that, as those above had contributed nothing towards the cost of the works, they had no claim to take advantage of them. Even in "The Fens," where Conservancy Trusts existed, these were so split up into bodies having control only over sections of each river, that it was impossible to carry out any comprehensive scheme for the improvement and management of the whole river as the main outfall of the district. Any local scheme brought forward was violently opposed by all other interests, and an instance was given where £100,000 had been spent in parliamentary and legal contests alone on one river; and the cost of obtaining parliamentary powers for the improvements of another river had amounted to £150,000.

The author contended that the whole history of the Fen-land drainage showed the baneful result of divided administration, and taught that no voluntary or private legislation was sufficient. The administration of the several districts protected by Fen Acts was efficient so far as it went, and the schemes in force might serve as a model for any Conservancy Act that might be framed. But what was required was the consolidation of all the smaller trusts, and the uniting them by representatives sent to one general Conservancy Board, which should have control over the main river and its banks from its source to the sea, as the main highway for the discharge of water from the whole basin. The management of the interior drainage should be left to the trusts already in existence, or, where none existed, to others formed under the powers of the Land Drainage Act. To supersede existing organisations by new boards elected on a different plan would, in the author's opinion, be most injudicious, and only lead to further complications and expense. The mode and area of rating were now well defined and understood, at least over the greater portions of the four Fen rivers, and any addition that might be required would be less felt than by a tax raised by a new board on a different basis. The upper districts, where flooding now principally took place, must be prepared to bear the burden of the cost of any new works required for their relief. The necessity for the consolidation of all interests by representation on one general Conservancy Trust was shown by further operations for the improvement of the outfalls being still required; these rivers discharging into an estuary which was slowly warping up by deposit, the extension of the training of the outfall must be a continuous work, and however perfect the result might be at the conclusion of any extension, the channel would gradually deteriorate by the formation of sand-bars and deposit, the former due to the contention between the flood and ebb tides, and the latter to alluvial matter brought down by the river. With reference to the character of these works the author considered that, in all training works, free action should be allowed to the ebb and flow of the tidal current, and that any choking of this resulted in a deterioration of the bed of the channel and the level of the low-water discharge. The tidal water being constant and continuous, and larger in volume than the fresh water, had much more influence in maintaining the channels. An example of this was given by a comparison of the Witham with the Ouse and the Nene, and their respective capacities for discharging floods. In the Witham the tidal current was stopped by a sluice eight miles from its mouth, in the Nene and in the Ouse the tidal current had a free flow. The average level of low water of the same flood over a period of seven days was 16ft. 6in. above low-water spring tides in the Witham, 7ft. 7in. above in the Nene, and 5ft. 6in. above in the Ouse. Further, in the Witham large deposits occurred in the bed of the channel during dry weather, whereas the deposition in the other rivers was only very slight. The author was averse to the removal of mills and weirs, and contended that, by proper provision for flood discharges, these were quite compatible with good drainage; that the water held up in a river above the influence of the tidal flow was a decided advantage to the land for water supply, and that to remove the weirs and allow the river to run at its natural level would drain the water too much from the land, and cause droughts worse in consequence than the most severe floods, and that water was valuable for obtaining power which might more frequently be used for agricultural purposes than at present.

The author argued that as extreme floods only occurred occasionally, and at uncertain and distant intervals, there having been only twelve severe floods in the district treated of during the last thirty years, it was necessary to adapt the channel of the river to a normal discharge, and also for the reception of these occasional floods. This could be done by a modification of the system of wash-lands adopted by the Dutch engineers for the drainage of the Fens. The main channel being made of sufficient capacity to carry ordinary floods, the sides above this height should be laid at a slope sufficiently flat to allow of the growth of grass, and the feeding of sheep and stock in the summer. The protecting banks should be set sufficiently far back to allow room for the passage of the greatest floods likely to occur. Bridges and other similar obstructions should be proportioned to the largest flow. To adapt the main channel to the discharge of extraordinary floods would not only involve enormous expense and waste of land, but the abnormal size would be detrimental to the channel itself, by the sluggish pace of the stream in ordinary times, and by allowing weeds to grow and shoals to form. The occasional flooding of the washes at the sides would be of little injury, and during the greater part of the year these would afford valuable pasturage. Even to provide for the discharge of a continuous rainfall of 0·25in. in twenty-four hours would require the channels of those four rivers to be enlarged to nearly three times their present size, their mean discharging capacity being nearly now equal to 0·094in. of rain every twenty-four hours.

Mr. Jacob remarked that the river Irwell, which drained a water-shed of 311¾ square miles, took its rise near the town of Bacup, at an elevation of 1325ft. above the level of the sea. Passing southwards it was joined by several affluents, the principal of which were the Roch, the Croal, and the Bradshaw Brook. As the stream approached Manchester and Salford the valley in which it flowed became wider, and the inclination of the river was much reduced. Near the source of the stream the declivity of the bed was 176ft. to a mile, which gradually diminished to 4ft. in a mile at Salford. From geological evidence it appeared that the valley had been from pre-historic times subject to inundation. The disastrous floods, to which Salford and the district lower down the river were liable, had been considerably increased by foreign matter, which had partly filled the bed. This, which came from manufactories situated on the banks, consisted for the most part of furnace cinders, but all the waste products from paper works, dyeing, bleaching, and other industries had been cast into the river unreservedly, and it was only by watchful care that the Corporation of Salford, and the Bridgwater Navigation Company were able partially to check the evil. The erection of weirs, as well as the narrowing of the channel by the erection of mills and other buildings upon the margin of the river, had increased the tendency to flooding. Thus, owing to the natural characteristics, and the subsequent interference with the channel, the flooding of the urban parts of Salford, as well as of the rural districts extending from Salford to Warrington, had of late become more and more destructive. Several schemes had been propounded for the relief of Salford and Manchester, all pointing to the construction of a tunnel of sufficient capacity to carry away, during high floods, all water in excess of what the river-bed was capable of containing. It had been suggested that a relief channel would discharge the flood waters more rapidly than the river channel, and that in consequence the districts below would be inundated to a greater extent, for floods of any given dimensions, than at present. This, however, would not be the case, for the new channel, if properly controlled by sluices, and judiciously used, would prolong the duration of the flood. Of late years flooding had become more frequent in the valley of the river Irwell than formerly. In 1866 occurred the greatest flood that had been recorded during the present generation, and in December, 1880, an exceptionally high flood had laid a large area of the district under water. The flood of 1866 covered an area of 1100 acres, and the flood of 1880 an area, in the district of Broughton, of 300 acres, almost entirely occupied by dwelling-houses. Besides the recommendation to construct a tunnel for the discharge of surplus water, cutting off some of the bends in the river and dredging the channel were suggested, as well as the construction of sluices, to reduce the elevation of the surface caused by weirs. The embanking of the river where it passed through open ground was further recommended, but no substantial improvement had yet been carried out, owing to the difficulty of getting the several interests concerned to agree. When considering the best means of abating floods, the question of compensation reservoirs was not forgotten; but having regard to the large number of manufactories and other works situated on the river, and to the railways and canals and public roads which would be interfered with, it soon became evident that the outlay would be so heavy as to render the construction of compensating reservoirs unadvisable.

Any communication dealing with river conservancy in its purely technical details only would be imperfect, and some reference was necessary to the principal points likely to arise regarding the constitution and administration of conservancy boards, as well as the definition of conservancy districts, and the incidence of taxation to cover the outlay on works. Conservancy boards hitherto had usually possessed control over only a limited area of country along the stream, and had no jurisdiction over pollutions, which passed down the course of tributary streams into the river which the board were charged to conserve. For this, as well as for other reasons, it was expedient that the water-shed area should become the conservancy district. The rights and responsibilities of riparian owners over tributary streams were well defined; no one could abstract water, or otherwise deal with a stream, in such a way as to inflict injury upon others who had the privilege of using it. The erection of houses, the construction of streets, open spaces, and passages, and the laying of sewers for the removal of surface water and sewage, all tended to affect the natural streams of a country, either by polluting them, or delivering the surface waters into them too rapidly. Again, one of the chief objects of the agriculturist was to remove surface water from the land, and to this end he deepened and improved ditches and other drainage outlets. These operations could not fail to affect the discharge of a river, and, this being so, there could not be any injustice in taxing upland owners to some extent for the maintenance of river works and the prevention of flooding. They should, therefore, be represented on the conservancy board, and it followed that expediency pointed to the water-shed line as the proper boundary for a conservancy district, unless the area enclosed was too large to admit of the administration of the board being satisfactory.

In Germany, the main streams of the country were generally the property of the State, which exercised control over them, and constructed such works as were necessary to preserve the navigation and supply water-power. The Government recouped itself for the outlay out of tolls taken on the floatage, as well as from millowners and fees paid for the privilege of fishing. In France, also, the Government possessed the water right over navigable streams. Up to a late date the necessary expenses for maintenance were met, or partly so, by tolls, as in Germany; but the exaction of tolls had been discontinued, and the expenses were now chargeable to the National Treasury. In both France and Germany the riparian owners, as a rule, looked after their own interests, forming themselves into societies or syndicates, for the purpose of carrying out and maintaining the necessary protection works.

It was announced that the Council had recently transferred W. T. H. Carrington, A. C. Cregeen, G. G. Dick, D. M. F. Gaskin, J. G. H. Glass, J. A. Jones, and H. B. Joyner to the class of Members; and had admitted H. Abbey, J. R. Baass, J. H. Baynes, T. H. Beare, H. R. Best, C. Z. Bunning, H. A. Dix, H. W. T. Dixon, O. A. G. Edwards, R. E. Ellis, F. A. Field, B. K. Finnimore, W. R. Fitzmaurice, E. C. Foote, H. W. Hargrave, F. R. Harrison, R. J. Hartley, J. H. Howard, C. H. Hutton, W. H. S. Hutton, A. J. Jack, W. A. Johns, T. King, A. A. Kyd, J. Kyle, jun., E. E. Lefébvre, J. R. Mann, W. Martin, Wh. Sc., J. E. Mitchell, W. Osmond, C. S. R. Palmer, H. H. Parkinson, A. R. Penny, H. W. Pewtress, J. M. Philpot, T. Ravenhill, J. C. D. Raper, J. S. Roper, A. B. Rumball, W. C. S. Rumble, J. Ross, N. Scorgie, R. Smith, jun., R. C. Taylor, F. S. Thomas, T. Thomson, A. Torode, A. L. R. Verdon, J. K. Æ. Verschoyle, W. H. M. Walsh, H. F. Waring, and M. Wilson, as Students.

At the first monthly ballot of the session, F. A. Abel, C.B., F.R.S., his Grace the Duke of Devonshire, K.G., F.R.S., and the Right Hon. Earl Granville, K.G., F.R.S., were elected Honorary Members; R. N. Boyd, F.R.G.S., J. W. Buyers, M.A., E. A. Cameron, G. Cunningham, F.R.S.E., E. R. S. Escott, W. Evans, A. Greenwood, H. Hack, A. J. Hughes, C. B. Jones, B.A., T.C.D. G. N. R. Lambert, T. B. Lightfoot, F. J. Lynch, J. E. McAlpine, A. Noble, C.B., F.R.S., J. Russell, W. E. Thursfield, J. F. Tyler, and J. Wells, Members; C. H. Allen, Stud. Inst. C.E., H. Alty, T. Andrews, R. Archbould, S. G. Artingstall, C. J. S. Baker, Stud. Inst. C.E., J. B. Baker, A. Z. C. Belin, A. W. D. Bell, Stud. Inst. C.E., G. Bell, C. Bentzen, G. R. Bird, J. W. Blackett, J. H. Briggs, J. Bull, J. S. Butler, Stud. Inst. C.E., H. W. Butt, H. B. Chapman, F. Chauntler, Stud. Inst. C.E., E. J. H. Christie, H. B. Christie, A. R. Colquhoun, L. M. Connor, B.A., C. F. Cooper, Stud. Inst. C.E., H. Croft, Stud. Inst. C.E., G. P. Culverwell, A.B., T.C.D., R. Davison, jun., J. Diggle, E. G. Fraser, Stud. Inst., C.E., J. E. Fulton, H. C. Granville, W. S. Gresley, B. Griffin, G. Hallé, H. H. Harker, R. W. L. Hawkins, C. Q. Henriques, Stud. Inst. C.E., R. N. Hodges, late Stud. Inst. C.E., J. B. Hogan, J. B. Hunter, Stud. Inst. C.E., C. James, E. H. Jeffreys, Stud. Inst. C. E., J. A. McDonald, Stud. Inst. C.E., F. W. Marchant, W. Michell, W. Millhouse, C. A. Moreing, Stud. Inst. C.E., J. H. Nuttall, R. S. Oliver, H. B. Olsen, T. O. Paterson, H. D. A. Reid, E. J. Rumsby, H. B. Smith, Stud. Inst. C.E., H. L. Solly, Stud. Inst. C.E., F. J. E. Spring, J. J. Talman, F. H. Tulloch, Stud. Inst. C.E., J. Wallace, Stud. Inst. C.E., and R. J. Woods, B.E., Stud. Inst. C.E., Associate Members; and T. B. Heathorn, late Capt. R.A., T. McIlwraith, LL.D., and Professor J. F. Main, M.A., D. Sc., Associates.

LETTERS TO THE EDITOR.

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

IMPROVEMENTS IN COMPOUND ENGINES.

Sir,—In you "Patent Journal" of the 25th ult., you take notice of an arrangement of three cylinders working into two cranks, patented by Mr. A. C. Kirk, of Messrs. Robert Napier and Sons, Glasgow. We have since written to Mr. Kirk, pointing out that the engines of the Isa yacht, on the same plan as those now patented, were made by us, and were illustrated at the time. We have his reply, thanking us for drawing his attention to the fact, stating that he had not seen the illustrations of our engines, and that he will disclaim the application in the patent. We never for a moment doubted the good faith of Mr. Kirk in the matter.

We may say that the engines of the Isa, carrying 120 lb. steam, have turned out very successful, both as regards fuel, economy, and ease of maintaining in repair; and that we are at present building for the Claremont—which made an adventurous voyage the other day from the Tyne to this port—considerably larger engines, on the same plan, but to carry 150 lb. pressure.

Dunnikier Foundry, Kirkcaldy, December 13th. — Douglas and Grant.

SIR FREDERICK BRAMWELL ON THE STEAM ENGINE.

Sir,—Referring to the article under the above heading in your issue of 25th November last, I think part thereof might lead to erroneous ideas being entertained by those unacquainted with the theory of the subject regarding the use of the cylinder jacket, a matter of more importance than you seem to acknowledge, and the thorough discussion of which should lead to enlightenment on some most important points not, I think, so generally understood as might be imagined in the advanced state of the laws of thermo-dynamics. The real object of the jacket theoretically is not to prevent condensation of steam in the cylinder, but to restore heat to it again after it has performed work; in fact, to act the part of the boiler partly over again, by imparting heat to the steam to keep it from liquefiing as it performs work in driving the piston. The action could easily be explained popularly more fully, but would, perhaps, take up too much space if added to the foregoing.

Patent-office, 68, West Regent-street, Glasgow. — David Mason.

LONDON, BRIGHTON, AND SOUTH COAST ENGINES.

Sir,—With your permission I would respectfully beg to call the attention of Mr. Stroudley to my queries contained in your issue of October 21st. Judging from the proverbial reputation enjoyed by Mr. Stroudley for his willingness to communicate to the great railway family the results of his many and valuable experiments and investigations as a locomotive engineer, I am sure that it is due to the great pressure upon his time and attention in the important situation which he holds, and not to design, that he has not furnished your readers with the information sought for. I trust that we may soon have the pleasure of reading his reply, and so obtain information, alike valuable to railway officials and employés as well as the great community of railway shareholders.

December 12th. — Foundryman.

THE STRENGTH OF PLATFORMS.

Sir,—There is an easier way of finding the strength of a platform than that given by Mr. Max am Ende. It is fairly approximate. Regard the whole area of the platform as the bottom flange of a girder, strained in two directions at right angles to each other. Find the strength of this girder, first lengthways, then crosswise, then the strength of the platform will be as the area of the flanges remaining is to the area of the whole floor. If, for example, the platform were 20ft. square, and the bottom flanges and portion of the web represented an iron plate of equal size 1in. thick, then we should have a girder with a bottom flange area of 240in. But this flange will also be strained at right angles, and as the second set of strains do not affect the first, the strength of the girder will be doubled.

Probably the net area of the flanges really used would be 30in. Then the true strength of the platform will be as 30 is to 240, the assumed strength.

Of course the result given will not be so accurate as that obtained by the Max am Ende method, but it will give a useful approximation. — T. A.

London, Dec. 6th.

GUN-COTTON SPORTING POWDER.

Sir,—In your interesting article of December 2nd on the Stowmarket Explosive Works you remark, with reference to the new sporting powder, "The absence of recoil is a much more questionable matter, implying that the work done on the piece is more local and sudden, and therefore more dangerous to the piece."

As the inventor of this powder, I should like to add a few words on this important subjeet of recoil. The method usually adopted for measuring the recoil of small-arms is to fix the gun or rifle in a frame, provided with an apparatus for registering the recoil of the whole weapon. This method is, for the reason you have given, defective, and the results necessarily erroneous, as a charge of gun-cotton, dynamite, or other powerful explosive sufficient to burst the barrel might be detonated in it without producing more recoil than ordinary black powder. To obviate this difficulty we now always estimate the recoil by means of a machine in which the pressure at the base of the cartridge itself is registered. Tested in this way I have found that the strain on the base of the cartridge and, consequently, on the breech of the gun is, in the case of the new powder, about one-quarter of that exerted by ordinary black sporting powder, while the penetration at fifty yards is in each case the same. It appears from this that the power required to propel shot at the velocity produced by the usual charge of black powder need not necessarily cause the same strain on the breech of the gun.

It may interest some of your readers to know the method we have adopted to measure the penetration of the shot from ordinary sporting guns. Refined paraffine wax, of a definite melting point, is cast into a block about 2in. thick, and the penetration of the shot into this block is measured. The paraffine is kept at a uniform temperature of 54 deg. Fah. by means of the water from an artesian well. This method has the additional advantage of permitting the recovery of the shot intact; their shape being, to some extent, an indication of the intensity of the explosion. When fired with dynamite or pure gun-cotton, for instance, the shot lose their spherical shape and are converted into polygons, which can be recovered uninjured by melting and pouring off the paraffine.

W. T. REID,
Chief Chemist and Works Manager to the Explosives Company, Limited.

London, Dec. 7th.

STRAINS ON CRANE POSTS.

SIR,—Will you kindly allow me space for some remarks upon a few of the letters on this subject which have lately appeared in your columns?

It is extraordinary that, after reading the letters of Mr. Tozer, Mr. Fyson, and "J. H. H." which appeared in your issue of October 21st, it should have been thought necessary by Mr. Major to write the letter which bears his signature in THE ENGINEER of November 11th. Mr. Tozer shows clearly that the forces acting on a section of the post can be reduced to a couple and a direct compressive force, and that, if the effect of the web is neglected, the tension in the back-plate is equal to $P_2 - \frac{W}{2}$, and that the compression in the breast-plate is equal to $P_2 + \frac{W}{2}$. I wish, however, to remark that Mr. Tozer's demonstration would have been more complete if he had explained that the case he gives is that of a crane post in which the areas of the back and breast flanges are equal, and that this is implied when he applies the forces W_1 and W_2 in the middle of A B. Mr. Tozer concludes his letter by saying: "But it does not follow that the neutral axis coincides with the inner plate." To this I would add that, if we make certain hypotheses which are now generally admitted in problems relating to the strength and deflection of solid bodies, then it is very easy to show, by certain mechanical laws which have long been established, that the neutral axis is the plane passing through the centres of gravity of the cross-sections. These hypotheses are: (1) That if in a rectangular beam we take a plane section A B perpendicular to its axis, then all points which before bending were in the plane A B are, after bending has taken place, still in the same plane A B, and that this plane is now normal to the curve of the beam at the point A. (2) That the bending does not alter the form of the section. (3) That the extension or compression of the material is proportional to the forces exerted. (4) That the modulus of elasticity is the same, both in extension and in compression.

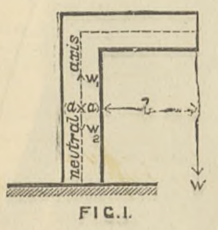


FIG. 1.

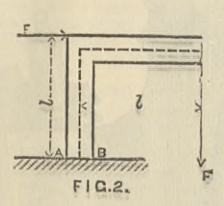


FIG. 2.

To make the above formulæ applicable to an unsymmetrical cross-section, we have only to express that the two forces, W_1 and W_2, are to be considered as applied at a point in the centre of gravity of the section, and we then obtain—

$$\text{Tension in back-plate} = P_2 - \frac{W \times BC}{AB} \quad . \; . \; . \; . \; . \quad (1)$$

$$\text{Compression in breast-plate} = P_2 + \frac{W \times AC}{AB} \quad . \; . \; . \quad (2)$$

Subtracting (1) from (2) we have: Excess strain in breast-plate = W. That is, the compressive force acting on the breast-plate exceeds the tension on the back-plate by an amount W; and this is precisely what Mr. Pendred's calculation leads to.

In a letter which appears in your issue of the 2nd inst., Mr. Fyson after obtaining the same result remarks, "I think Mr. Pendred's safety valve theory now fails." I have, however, shown that it does not fail, and that by taking the neutral axis in its proper position, *i.e.*, in the centre of gravity of the cross section, it makes no difference whether we calculate the stress in the flanges in the same manner as Mr. Pendred, or by the method of a couple and a direct force as shown in Mr. Tozer's diagram. Mr. Pendred is wrong in supposing the neutral axis to run into the breast plate, as shown in the diagram of his first letter; but although he has drawn it wrong, I have shown that it does not interfere with the accuracy of his calculations. Perhaps the following will make this more clear—Let Fig. 1 represent a crane of symmetrical cross section, that is, having the areas of the back and breast flanges equal, and the neutral axis consequently half-way between the two flanges, and further, the effect of the web will be neglected. By Mr. Pendred's method of calculation: Compression in breast plate

$$= \frac{W\,(l + 2\,a)}{2\,a}$$

$$= \left(\frac{W\,l}{2\,a} + W\right) \quad . \; . \; . \; . \; . \; . \quad (3)$$

$$\text{and tension in back plate} = \frac{W\,l}{2\,a} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \quad (4)$$

By the method of a couple and direct compressive force; moment of couple = $W\,(l + a)$, and calling S the tension and compression in the flanges due to the couple alone, we have; moment of resistance of cross section = $2\,S \times a$. Equating these two moments, $S = \frac{W\,(l + a)}{2\,a}$.

The strain on each flange due to the direct compressive force is equal to $\frac{W}{2}$, and must be added to S for the total strain on the breast plate, and subtracted from S for the total strain on the back plate. We then have for the total strains: Compression in breast plate

$$= \frac{W\,(l + a)}{2\,a} + \frac{W}{2}$$

$$= \left(\frac{W\,l}{2\,a} + W\right) \quad . \; . \; . \; . \; . \; . \quad (5)$$

$$\text{Tension in back plate} = \frac{W\,(l + a)}{2\,a} - \frac{W}{2}$$

$$= \frac{W\,l}{2\,a} \quad . \; . \; . \; . \; . \; . \; . \; . \quad (6)$$

It is seen at once that equations (3) and (5), (4) and (6) are identical.

Mr. Pendred's safety valve theory is the most simple method of calculating the stresses when the resistance of the web is neglected, but if this latter is taken into account, it will be found better to calculate the moment of inertia of the cross section about its neutral axis, and then obtain the stresses by means of the well-known formula,

$$S_1 = \frac{M\,x}{I}$$

in which S_1 is the intensity of stress at any point at a distance x from the neutral axis, M the moment of the weight about the centre of gravity of the section, and I the moment of inertia of the section. It must be clearly understood that S_1 is only the stress due to the bending moment, and that we must still add or subtract the intensity of stress due to the direct compressive force. This latter is equal to $\frac{W}{A} = S_2$, where A is the area of the section.

Then, as before, we have:

$$\text{Tension in back flange} = (S_1 - S_2).$$
$$\text{Compression in breast flange} = (S_1 + S_2).$$

Calling T the total stress per unit of area in the metal at any point distant x from the neutral axis, the two above equations can be put in a general form thus:—

$$T = \frac{W}{A} \pm \frac{M\,x}{I} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \quad (7)$$

and substituting for I its equivalent $A\,g^2$, where g is the radius of gyration of the cross-section, and putting M in the form $W\,l$, l being the lever arm of W:—

$$T = \frac{W}{A}\left(1 \pm \frac{l\,x}{g^2}\right) \quad . \; . \; . \; . \; . \; . \; . \quad (8)$$

By using the plus and minus signs this equation gives respectively the compression in the breast and the tension in the back of the post. The results so obtained are precisely the same as obtained by Mr. Fyson in the example given in his first letter.

I have used Mr. Tozer's diagram as a reference, because Mr. Fyson has not shown so clearly in his diagrams how it is that, by applying two equal and opposite forces along the neutral, we are able to express the forces acting on the section by a couple and a direct compressive force. If your correspondents who have opposed the results obtained by Mr. Pendred's or Mr. Fyson's calculations will take the trouble to read some of the recent works on the stresses in elastic arches, they will find that a section of the crane post under discussion is subject to stresses analogous to those which exist in section of that part of an arched rib where the curve of pressure does not coincide with the neutral axis. In his second letter Mr. Major says: "Mr. Fyson's solution is simply delicious. After using his forty tons load to produce strains of compression and tension in his crane post, he still finds forty tons to stick upon the head of the post to produce more compression, and all out of the original forty tons. The cruse of oil was nothing to it." I think I am right when I infer from this last remark that Mr. Major wishes it to be understood that Mr. Fyson is wrong in saying that there exists, besides the strains due to bending, a direct compressive strain acting through the post. If any further proof were required to show Mr. Major his mistake I think the following should suffice: Let Fig. 2 represent a crane post rigidly fastened to the floor at A B; let l = the height of the post as well as the lever arm of a vertical force F about the centre of gravity of A B. Now suppose this vertical force removed and applied horizontally at the top of the post, then the bending moment in A B is equal to F l; but when F is applied vertically at the end of the jib the bending moment is also equal to F l. Therefore, the same force will produce the same bending moment, and consequently the same stresses due to bending, in the section A B, but with this important difference, that when the force is applied horizontally it exerts no pressure on the floor, but when it is applied vertically at the end of the jib, so as to represent a weight, this weight must exert a pressure on the floor. This pressure on the floor must be equal to the weight, and is transmitted from the jib to the floor through the post. If then Mr. Major was correct, the weight which a crane carries does not exert any pressure on the floor.

A curious feature in the discussion is that some of your correspondents should support the method of calculation adopted by Mr. Tozer, Mr. Fyson, and "J. H. H.," at the same time denying the truth of Mr. Pendred's method, although, as I have shown, under the same conditions both methods give the same result. For instance, "H. S." says, "As for Mr. Pendred's safety-valve theory, it is really not worthy of discussion;" whilst in commencing his letter he practically admits Mr. Fyson's solution.

On the other hand Mr. Pendred is supported by some rather curious arguments. In THE ENGINEER of November 25th is a letter signed "Q. E. D." Hailing as it does from the head-quarters of mathematical and physical knowledge, and bearing a signature that would seem to imply that its author had completely elucidated the problem after the manner of Euclid, it is interesting to find that the author of this letter is quite innocent of any attempt to prove or demonstrate his statements. In the second paragraph of his letter he says, "The post is stuck in a hole, and the strains are taken at points shown by the arrows in Fig. 3. Now it is quite clear that these are the equivalent of the toe of the post and the tie A in Fig. 2." Does this mean that the "strains," or the "points," or the "arrows" are the "equivalent," &c.? I venture to say that this is not quite so "clear" as it might be. He then says: "It is also clear that the strain on the toe of the post B, Fig. 2, is greater than the strain on the tie A." Now this is nothing more than the simple statement of a fact that was proved in the columns of your paper a month previously; and in no part of "Q. E. D.'s" letter do I see the slightest attempt made to explain this fact.

"Q. E. D." then takes your correspondents to task for "Supposing that the crane will in practice turn about an imaginary centre line," &c., and says, "In practice it will do nothing of the kind. It will tend to turn about its toe or about the equivalent of that toe, being frequently that part of a collar next the weight." I am forced to admit that I do not know what is meant by "the equivalent of that toe," nor am I at all enlightened by being told that it is "frequently that part of a collar next the weight."

There are other points in "Q. E. D.'s" letter equally remarkable, but I should trespass too far on your space were I to notice them here. It would also be wasting space to discuss at any length such diagrams as Mr. Hoy's and that of Mr. Frederico de Vasconcellos. This latter gentleman comes to the conclusion that by making the post sufficiently high, the tension in the back flange would disappear altogether, and I gather from his letter that he acquired his knowledge of the subject at Cooper's Hill College.

So far as this discussion in your pages has gone, it only shows how even the best arguments may be lost on men who do not understand what are and what are not the generally accepted theories which are to be used in discussing problems of this kind. Mr. Hoy, for instance, proposes to show—by what process of reasoning I know not—what is the position of the neutral axis, without, however, stating whether the flanges are equal or not. Mr. Frederico de Vasconcellos finds that it lies in that edge of a beam in which the tensile forces exist, and Mr. Pendred says it is in the compressed edge. I quote his own words: "The whole system of statical laws of strains on solids like this is that the given mass or body tends to rotate round the moment—he no doubt means 'edge'—of compressive strain." Now this statement is no more or less than the old hypothesis of Galileo and Leibnitz, which was knocked on the head 200 years ago by Mariotte, and at later dates by J. Bernouilli and Dr. Robison.

December 3rd.

W. B. COVENTRY.

SIR,—May I venture to ask you for space for a few lines on this subject, which, to judge from the correspondence now going on in your columns, seems to excite a great deal of interest? May I point out that there are certain peculiarities about the strains in bent crane posts to which your correspondents do not allude at all? I refer to the transverse radial compressive strains in the web or webs of a curved girder, which vanish in the vertical and horizontal components of the jib.

To illustrate my meaning, let us suppose that A, Fig. 1, is the breast of a crane. On A let there be constructed a series of studs, B, B, B, B, each fitted with a pulley on the outer end. Over these let the wire-rope F be run. The strains on this rope from E to the ground will be parallel to the breast; so will the strains from C' to D, a projection on the end of the crane; but on the radial studs thrusts will be exerted which must be dealt with. These thrusts have to be transmitted by B, B, B, B, and supported by something. Concerning this class of strains your correspondents are quite silent. They have no existence in right-angled cranes, nor, indeed, in any crane but the one—namely, that with a curve.

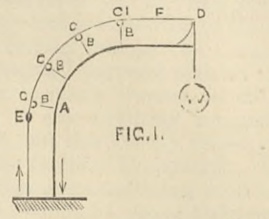


FIG. 1.

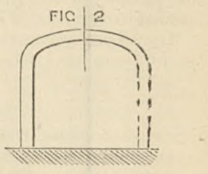


FIG. 2

Now a little examination will show that we have here a very important question raised concerning the stability of arched roof members. For let us suppose that the crane shown in Fig. 1 was faced by another, as in Fig. 2. A load applied at the crown would not produce compression on the web so long as the outer flange of the roof was strong enough to resist compression; but it is easy to see that if one side gave way a little, and the base were virtually anchored—as is the case at St. Pancras terminus—heavy strains might be produced on the web, which might be buckled up. A few words on this subject from some of your correspondents would be of much interest to

A STUDENT.

London, December 5th.

COLD-AIR MACHINES.

SIR,—Being a regular subscriber to your valuable journal I shall feel greatly obliged if you would kindly insert this reply to the letter of Mr. J. W. De V. Galway, of Warrington, on "Machines for Producing Cold Air."

From this gentleman's remarks I should gather he is somewhat interested in the Sturgeon's compressor, and have not much hesitation in saying that he is of opinion, and wishes other parties to think that the above is the compressor for cold-air machines of the future. Myself and others in Liverpool would be pleased to know the opinions of some qualified makers, such as Messrs. Hicks and Hargreaves, Bell and Coleman, or other well-known authorities, who are looked upon as gentlemen of wide experience in this class of appliance; their machines, from what I have seen and heard, speak for themselves. Having examined one of Sturgeon's compressors, allow me to make a remark. I think one point Mr. Galway should take into consideration is the arrangement of the valves in the compressor and expanding cylinders, all of which he must confess are bad to examine; it would take a skilled mechanic a considerable time to get at them.

Mr. Lightfoot has instructed us in the primary expansion, variable expansion, diaphragms, &c., and finally comes to the conclusion that to embody the principle of Messrs. Hicks and Hargreaves and Messrs. Bell and Coleman would be a very great improvement on the Sturgeon's cold-air machine, and probably constitute one of the best machines at present in the market. Mr. Galway comes forward with a machine which will require extensive alterations and improvements before it can be placed under the head of a cold-air appliance, but I shall be pleased to hear of the results obtained by the two machines already erected by Mr. Galway's firm. Having recently returned from the United States, after examining three different machines on the other side of the Atlantic, I may say, in honour to our English engineers, that they are in advance of our American cousins in this class of machine. I saw none in the States that would compare with either Messrs. Hicks and Hargreaves, Bell and Coleman, or Mr. Lightfoot's.

It was whilst on a visit to see one of the Sturgeon's compressors in Liverpool I was informed of another cold-air machine, made by Mr. Hawley, of Liverpool. I with others, through this gentleman's kindness, were invited to see one of his machines tried. He readily showed it to us, and upon questioning him as to the access of valves, &c., he took the two compressor and expansion valves out, and placed them on the floor in ten minutes, and replaced them in five minutes. The machine was then set in motion, and in twenty minutes the air in the returning chamber, or snow box, registered by thermometer 46 deg. below zero. This is no great feat, for I have seen one of Messrs. Hicks and Hargreaves' machines register 55 deg. below zero in fifteen minutes; but with due respect to Mr. Hawley, I certainly think that his is the combined machine of the two well-known makers spoken of by Mr. Lightfoot, it being easy of access to valves, &c., simple in construction and compact.

I shall be greatly indebted if, through your columns, some qualified authority would give some data by which the quantity of air, with a given diameter of cylinder, length of stroke, and speed of piston will give out, as I am wishful to purchase a machine for shipment; but I do not find makers to agree on this point—some say, take the area of the expansion cylinder multiplied by the length and number of stroke will equal the required quantity.

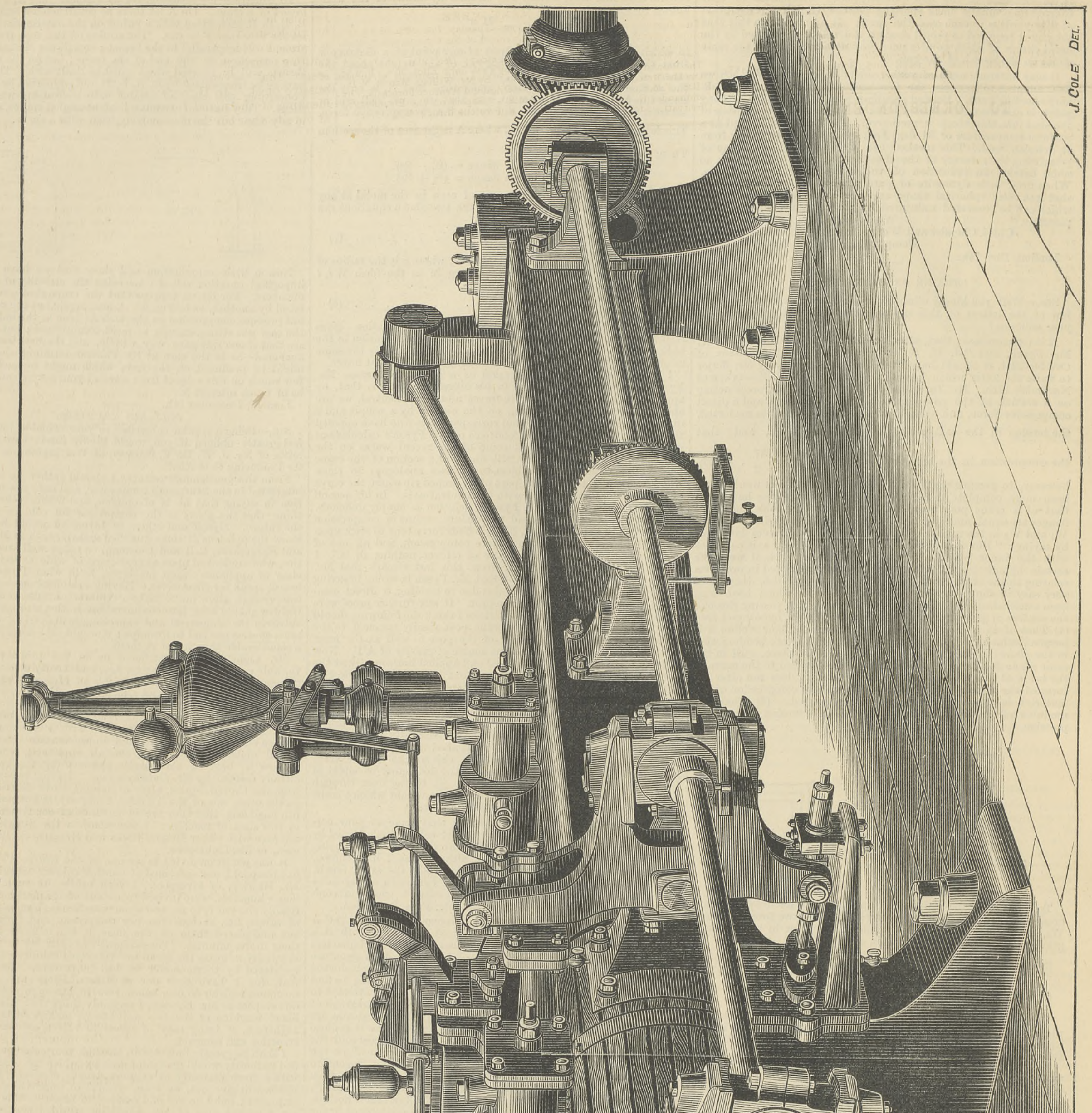
One maker produces a machine with a 10in. expansion cylinder and 14in. stroke, that will discharge 40,000 cubic feet per hour of cold dry air; another says, an expansion cylinder of 16in. diameter will discharge the same amount; whilst Mr. Hawley comes down to the very low figure, with a 10in. expansion cylinder with length of stroke and speed in proportion, discharging only 2000 cubic feet per hour. This shows a wide margin by different makers. There must be a great mistake in the calculations, and some reliable information on this point will greatly assist an intending

PURCHASER.

Liverpool, December 13th.

(*For continuation see page* 444.)

BORING FOR COAL NEAR GOOLE.—Borings are being made near Goole, on the estate of Lord Beaumont, between Carlton and Drax, for the purpose of reaching the well-known Barnsley seam, or finding whether it is there. The diamond rock-boring machine is being employed, under the supervision of Mr. Greaves, mining engineer, Wakefield, who is making a bore-hole 9in. diameter, and considerable progress, it is stated, has already been made, 50ft. having been pierced in six days. Drax is twenty-four miles north-east from Barnsley, and at least eighteen miles from any place where the Barnsley seam is being worked; Denaby Main, one of the nearest, is twenty miles. Northward from Barnsley the seam in a few miles gradually lessens, and the dirt partings increase. At Darton, four miles from Barnsley, the bed is of tolerably good quality; but a dirt parting, which first makes its appearance south of Barnsley, increases in thickness. A mile farther on the coal deteriorates; and at Crigglestone it is split into several small seams by dirt partings, and northward thence becomes valueless. Then there is an area of unexplored ground. At Denaby, the coal was sunk on the margin of the magnesian limestone, and to the east of Pontefract, which is nearest to Goole, there is the permian marls and magnesian limestone. The whole eastern margin of the Midland field is defined by the escarpment of the magnesian limestone, with its subordinate lower permian sandstone, which, commencing near to Nottingham, extends northward beyond the limits of the coalfield itself. The southern boundary of the field is new red sandstone, and the strata rise and crop out westward as far north as Bradford and Leeds, where they bend round to the east, and finally disappear under the magnesian limestone, which rests directly on the millstone grit. It is to be presumed that the boring is intended to pass into the permian strata, under which is, it is admitted, a large area of unworked coal,



100-H.P. ENGINE.—SYSTEM WANNIECK-KOEPPNER.

THE BERLINER MASCHINENBAU-ACTIENGESELLSCHAFT, ENGINEERS.

(*For description see page 444.*)

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TO CORRESPONDENTS.

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

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

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

A. S.—*The rule given in* THE ENGINEER *for Dec. 2nd is correct. The other rule to which you allude is incorrect. If you compare the two you will see at once in what the error consists.*

AMATEUR DRAUGHTSMAN.—*See "Principles of Machine Construction, an Application of Geometrical Drawing for the Representation of Machinery," by E. Tomkins. Published by W. Collins, Son, and Co.*

J. C.—*A bar of wrought iron is longer by* ·0012 *of its length at* 212 *deg. than it was at* 32 *deg. In a rise of* 90 *deg. the shaft would increase in length* ·0006, *which for* 140*ft. would amount to* ·084 *of a foot, or a little over* 1*in. Roughly speaking your shaft will expand and contract about one-tenth of an inch for every* 12 *deg. difference of temperature.*

J. (Belgrave-road).—*In answer to your question, the following is the extract from Molesworth's "Pocket-book":—"Limits of deviation.—In towns,* 10 *yards on each side of the centre line; in the country,* 100 *yards, or* 4½ *chains. Deviation of level.—In towns,* 2*ft.; in the country,* 5*ft. Deviations of gradient.—Gradients flatter than* 1 *in* 100, *deviation* 10*ft. per mile steeper; do. do. steeper,* 3*ft. per mile steeper." There are further restrictions regarding tramways which, we believe, provide for all errors, and it is the business of opposing parties to show from the plans and sections deposited in the Private Bill-office, that the proposed work could not be carried out without violating the limits prescribed by the Railway Clauses Consolidation Act or these Standing Orders. If it could be shown that the sections for a scheme were so much in error as seriously to affect the estimates, the Bill would stand but a bad chance of passing the Examiner if it were opposed.*

COVERING TELEPHONE WIRE WITH GUTTA-PERCHA.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers oblige by naming the makers of modern machinery for covering telephone wire with gutta-percha? H. S.
Manchester, December 14th.

THE DENSITY OF METALS.

(*To the Editor of The Engineer.*)

SIR,—I shall feel obliged to any reader who will tell me what are the temperatures at which copper and iron reach their maximum densities? W. B.
Brierley-hill, December 13th.

PACKING ARROWROOT.

(*To the Editor of The Engineer.*)

SIR,—I shall be glad if any of your readers can tell me the names of the makers of the most economical machine for making and filling ½ lb. or 1 lb. paper or cardboard packets suitable for packing arrowroot.
December 12th. COLONIAL.

COFFEE GRINDING AND ROASTING MACHINERY, AND WINE FILTERS.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents give me the names and addresses of the manufacturers of the undermentioned machinery:—Coffee grinding and roasting machinery; filters for wine. COFFEE.
Lincoln, December 8th.

CORRUGATED IRON.

(*To the Editor of The Engineer.*)

SIR,—We would be much obliged to any one informing us in what way corrugated iron is now usually manufactured, and who could supply the machinery for the purpose, as well as whether any, and if so what, English patents exist for such machinery. P. AND M.
Vienna, Austria, December 6th.

ROUND DRIVING BANDS.

(*To the Editor of The Engineer.*)

SIR,—Could any of your readers inform me where I could obtain a round driving band or belt which will answer the following particulars? It must be endless, practically non-stretchable, not exceeding ⅛in. diameter, and capable of transmitting up to ⅛-horse power, and not affected by weather or temperature. R. A. P.
Westminster, S.W., December 12th.

SIEVES AND VARNISH.

(*To the Editor of The Engineer.*)

SIR,—Will any reader give us the name of a maker of an oscillating sieve? We have heard of one which we could adapt for sieving moulders' sand, but we do not know the name of the maker. Also the name of a maker of transparent varnish which sets so hard upon the face of polished iron that it is as hard as iron itself. G. W. H.
Accrington, December 8th.

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

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Dec. 20th, at 8 p.m.: Annual general meeting, to receive the report of the Council and to elect the Council for the ensuing year.

THE METEOROLOGICAL SOCIETY.—Wednesday, Dec. 21st, at 7 p.m.: "The Rainfall of Cherrapunji, Assam," by Prof. John Eliot, M.A., F.M.S. "On the Meteorology of Cannes, France," by Mr. William Marcet, M.D., F.R.S., F.M.S. "The Principle of New Zealand Weather Forecasts," by Commander R. A. Edwin, R.N., F.M.S. "Report on the Phenological Observations for 1881," by the Rev. T. A. Preston, M.A., F.M.S.

THE ENGINEER.

DECEMBER 16, 1881.

THE CANONBURY ACCIDENT.

ON the morning of Saturday, the 10th inst., a very singular accident occurred in a tunnel, 750 yards long, through which passes a branch line of a mile and a-half connecting the Great Northern Railway at Finsbury Park with the North London Railway at Canonbury. The facts are very simple, and easily stated. A Great Northern train from Higher Barnet was passed over the line from Finsbury Park station a few minutes before 9 a.m.; it was not permitted to enter Canonbury Junction, as the line was not clear, and stood with the engine just out of the south end of the tunnel. While there it was run into behind by a second train from Finsbury Park, which had started four minutes after the first train, which we shall call No. 1. Train No. 1 was not injured, the collision being extremely slight, and it went on its way as soon as the signals were lowered for it—that is, almost immediately after it had been run into. Train No. 2 now occupied nearly the place previously taken by train No. 1, and while standing it was run into very severely by train No. 3—one from Enfield, which had also come through Finsbury Park. Great confusion resulted, and both lines in the tunnel were blocked. While matters were in this condition, a train No. 4, which had left Finsbury Park at 9.8, ran into the *débris*, with shocking results. In all, up to this moment, five lives have been lost, and some forty persons have been more or less injured. Two heavy collisions, smashing up three trains, occurred between 8.50 a.m. and 9.12 a.m., or thereabouts. We have repeatedly pointed out that the block system is very far from perfect, and that it possesses none of the almost magical virtues with which some railway managers would endow it. The Canonbury accident is, however, perhaps the most complete illustration of the weak points of the system yet supplied.

There are three block-signal stations between Finsbury Park and the junction of the branch line with Canonbury. The first in order of these allows the train to pass from the Great Northern main line at Finsbury Park on to the Canonbury branch; the second is situate about midway between Finsbury Park and Canonbury, and close to the northern entrance of the Highbury Tunnel. This box is in direct telegraphic communication with the third block signal, which is outside the southern end of the tunnel, and is supposed to control the junction, which is closely adjacent to the signalling-box. The first and second signal-boxes are controlled by Great Northern officials; the third, being upon the proper North London line, is manned by a North London official. It is with the signalmen in charge of No. 2 and No. 3 Boxes respectively—W. W. Hovey in the case of the Great Northern line, and Henry Hills as a North London man—that we have here to do. Two inquiries are pending—one by the Board of Trade, conducted by Colonel Yolland; the other is a coroner's inquest. The facts elicited already by Colonel Yolland leave very little doubt as to how the accident, or accidents, took place. Our readers must bear in mind that the first signalman from Finsbury has had nothing whatever to do with the matter. The story told by Hills, the North London signalman at Canonbury, is very simple, when it is divested of extraneous matter about other trains than the four with which we are now concerned. He came on duty at 7 a.m. for a shift until 3 p.m. All went right until 8.55, when he blocked the Great Northern line by sending six beats to Hovey, the Great Northern signalman; but in spite of this blocking train No. 2 was sent on by Hovey, and ran, as we have seen, with slight force into train No. 1. Then Hovey sent Hills word that he was sending on another train, No. 3; and Hills, apparently in desperation, sent him seven bells. About this signal we shall say more in a moment. Notwithstanding, No. 3 was sent on, and almost while the second collision was taking place Hovey again telegraphed that he was sending on a train. Hills replied by seven bells, and train No. 4 came on, and ran into train No. 3. It is not quite clear how Hovey was at last prevented from sending on trains. We suppose someone went to his box, and told him that he was wrecking trains as fast as he could, and so terminated his proceedings. Thus, it will be seen, the case lies in a nutshell. According to Hills he blocked the section of the line between himself and Hovey, and never took the block off all the time. It must be understood that there is a miniature semaphore arm in the telegraph instrument, and when the block signal, six bells, is sent, this arm flies up to danger, and remains there until line clear is given from the next station. Thus not only hearing but sight is brought into play in a signal-box. Hovey with the signal before his eyes at danger, and six bells ringing in his ears, nevertheless sends on train after train. Now, Hovey is an experienced signalman, and it must not for a moment be supposed that he did what he did without a reason, and the reason he gives is that Hills sent him *seven* bells on his first applying for the road for what we have called No. 2. train. He never had received such a signal before, did not know what it implied, and referred to his signal-book to find out what the North London signalman meant. The rule is long, and he did not read it with care, and assumed that it meant "send on a train with great caution," accordingly he hung out a green flag and let the trains go as we have said, with what result we know. Why did Hills send seven bells? Here is his own explanation: "I gave the Great Northern signalman seven beats because he would not answer me with six, to see whether he understood that. Six beats is a block, and seven is also a block. If I got seven beats I should let nothing through." But on the Great Northern it seems that seven bells is what is known as permissive block. In Hovey's own words: "Not knowing the meaning of the signal I received of seven bells, I turned at once to the code card and found that it was explained as 'Obstruction of the line and permissive block.' I then worked my trains according to the rules of the 'permissive block' as carried out on the Great Northern line. That was the course I pursued with all the trains in question."

As the coroner's inquest is still pending, it would be improper to say anything concerning the action of the signalmen, but there is no reason for being reticent concerning the faults of the system. We have here a North London man communicating with a Great Northern man; and these two read a signal differently. The North London man sees in the seventh bell after six only an emphasis attached to the warning not to send on trains; the Great Northern man finds the seventh bell practically reversing the order given by the six preceding strokes, and so sends on train after train to destruction. Is it possible that there are any other discrepancies between the signal practices of various companies? If so, they ought to be found out and cleared away at once. It is essential that there should be but one code for the United Kingdom. It is worth notice that in this case the difference between safety and destruction was apparently one beat of a bell. Now, nothing is easier than for both the sender and receiver to make a mistake in counting the number of strokes. As a matter of fact, such mistakes are constantly made, but they are fortunately of small importance; that is to say, a train will not be suffered to enter a blocked section so long as the needle is pegged over to danger. But none the less is it certain that the bell system is imperfect. In the case under consideration, Hills, although he knew that Hovey was doing what was wrong, could explain nothing to him. Had speaking instruments been provided, Hovey and Hill could have used them; a mutual explanation could have taken place, and there would have been no accident. It may be objected that speaking instruments are expensive, and that signalmen who can use them are rare. We may grant this, but there is a simple way out of the difficulty. Why are not all the signal stations on metropolitan lines put into telephonic communication? If Hill and Hovey had each a telephone, Hill could have told Hovey to send on no trains. So obvious, indeed, are the advantages to be derived from the establishment of telephonic communication between signal boxes, that we venture to hope the introduction of the telephone on all lines with stations close together will not be long delayed. Furthermore, so long as the present signalling system is used, so long will there be a chance for a signalman to deny having received a certain message. Many years ago we suggested, when a dispute of the kind arose in connection with a railway accident, that all messages should be automatically recorded. Our suggestion has not been carried out. We now make it again. A strip of paper, marked with cross lines showing hours and minutes, is rolled by a clock off one reel, and wound up by another. Over the ribbon of paper is fixed a pricker. This pricker is in connection with the plunger by which the bell signals are sent. Every time the plunger is pushed in a hole is made in the paper; the time when it was made will be given by the place of the hole on the ribbon. Thus an unerring record will be provided of the message sent. A similar device may be used at the other end to record the message received. If our readers will turn to THE ENGINEER for November 11th, they will find on page 347 an engraving of an instrument which embodies our suggestion very completely. For the moment it is for the reasons we have stated impossible to draw all the lessons from the Canonbury accident which it is capable of teaching; but nothing can, we think, be clearer than that if Hills could have spoken to Hovey the accident would never have occurred. If Hills could have gone straight to Hovey's cabin after the first collision between Nos. 1 and 2 had taken place, and told him about it, and to send on no more trains until he was ready for them, it is obvious that the trains would not have been sent. A telephone would practically have taken Hill into Hovey's box. The general adoption of the telephone will, we feel certain, prove of very great advantage on the railways of London or other great cities, such as Liverpool or Manchester.

MADRAS HARBOUR WORKS.

A SAD catastrophe has befallen the works at the Madras Harbour, the progress of which has from time to time been reported in our columns. On the morning of November 12th, a gale sprang up from the north-west, which increased in intensity until the wind had attained about half the maximum velocity recorded in the case of the cyclone of 1872. The weather being calm along the coast to the north and south of Madras, it is believed that that place was on the border of a cyclone, the vortex of which was in the bay. This storm, then, the serious results of which we have now to record, was but of half the strength of that which visited the same shores in 1872; and that the works should have succumbed under such circumstances proves that there was very insufficient provision made against the known and ascertained force of the sea. That this fact had been apparent to those acquainted with the coast has long been made known to us by direful prophecies appearing in the Madras papers; and it was but recently that the Governor of that Presidency, the Duke of Buckingham, when speaking at a public gathering, stated that grave and well-grounded fears existed that the breakwater, as constructed, would not stand against the force of a cyclone such as had been previously experienced. These foreboding have been only too fully verified by the total failure of the breakwater. The sea carried away the béton blocks of 27 tons—to quote the words of the *Ceylon Observer*—"like so many cockle-shells." The titans and cranes, which had been left *in situ* in spite of warnings of the approaching storm, were also engulphed. These casualties were the result of the outbreak, as it may be called, of the storm, and were observed during daylight of the 12th by the crowds which thronged the shore. The gale increased in strength towards nightfall, and during the night its ravages were extended until about 700ft. of each pier were wholly destroyed, and the topmost tier of blocks throughout their entire length carried away, so that the sea, surmounting the rest of the structure, flowed easily into the harbour and caused the steam hopper barges, Hobart and Salisbury, which were at moorings within the breakwater, to founder, nineteen of their crews going down with them.

According to the latest received accounts, the piers, with the exception of the topmost run of blocks, are still intact from the shore to the point at which they curved to form the closing of the harbour, and it may be presumed, therefore, that from that portion of their length they were not exposed to the full force of the sea; but as they have so far yielded under the stress of a cyclone of what may be termed only half-cyclone power, it must be naturally fancied that they would altogether disappear were they exposed to a storm of the violence of that which occurred in 1872. It may, therefore, be truly said that the whole work will have to be re-commenced *de novo*, and it is extremely questionable, we should say, whether anything but the rubble mounds yet remaining can be utilised towards the re-construction; for it is evident that the béton blocks of 27 tons in weight, which may still remain *in situ*, are utterly inadequate to resist the violence of a cyclonic storm. Of course there will be strict inquiry as to the character of the design which has so signally failed, and caused so heavy a loss both of money and life. The assertions made by many engineers and others long in advance of this catastrophe are sufficient evidence that the experimental dimensions given by the designing engineer were foreseen to be utterly insufficient. The *Ceylon Observer*, commenting upon the occurrence, has thus written :—"Mr. Parkes' experiment in cheap work on a new principle of his own invention, hitherto unknown to marine engineers, has proved a failure. Mr. Kyle, the resident engineer of the Colombo works, long ago told us that if the Madras breakwater proved a success, it would practically revolutionise the system of breakwater construction, and we know that local critics have again and again censured the useless expense to which Sir John Coode was putting the colony by his slow, expensive, old-fashioned system of constructing our — Colombo—harbour wall. Such criticism will now be silenced for ever. Mr. Parke's work has ignominiously collapsed, while Sir John Coode's gives every promise of permanency."

It will be of interest, when considering the cause of failure, to inquire into the difference of construction adopted by Mr. Parke and Sir John Coode. At Colombo there are four courses of three blocks in each to the required depth. Each block is set or bonded nearly one-half its length over that of its neighbour, either over or under, turn about. In addition to this vertical band, there are five joggle holes running from top to bottom of the wall. As the work extended into deep water the wall on the rubble mound consisted of a uniform thickness of 34ft., consisting entirely of béton blocks. We are unaware of the exact dimensions of the corresponding work at Madras, which has so signally failed. We believe, however, it did not consist of more than two-thirds the thickness of the Colombo work. The courses had no transverse bond whatever, and the upper and lower ones were connected only by simple joggles. In fact, to quote *Ferguson's Ceylon Hand-book*, Mr. Parkes was of opinion that the bonding adopted at Colombo was "not at all necessary, and therefore constructs it without either vertical or lateral bonds, excepting in the case of the over and underlying blocks, where, we believe, they introduce a box-joggle in the centre of each bed of each block, top and bottom. But the inner and outer sections of the wall have no bond to keep them together, and enable them to cope with prolonged heavy weather."

A single failure, it is said, teaches us far more than do a thousand successes, and the unfortunate instance of the Madras breakwater will teach us a lesson not easily forgotten. It would be hard, indeed, if engineers were never to try and economise in work by departure from long-established customs. We should never progress did such a rule hold good in all cases; but probably in the case of marine work, where natural forces are so difficult to estimate with exactitude, it is better—as has been proved in the case of the Madras breakwater—to abide by rules established by known successes. The uplifting force of suddenly arrested sea waves, appears to have been altogether ignored in the design of the bonding described. The blocks at Colombo are, we believe, 50 tons in weight, while those which a comparatively trifling cyclone has scattered at Madras, weigh but 27 tons. But weight alone does not ensure stability against this force; the horizontal must be small compared with the vertical surfaces, or in relation to the weight, and Mr. Parke's blocks do stand on edge.

THE DITTON PUMPING ENGINES.

It is not improbable that many of our readers have passed with a glance the report by Mr. Cowper on the Ditton pumping engines, which appeared in our last impression on page 420. When they learn that the performance of those engines is, so far as we know, the best of which a trustworthy record exists, they will see that the report in question deserves more than a superficial examination. It is full of interest, and claims careful analysis. The engines are two in number, compound, with beams and fly-wheels. They are, in short, of the well-known rotative pumping type. The great peculiarity about them is that they are fitted with what was christened long since in the Navy, Cowper's "Hot-pot." In other words, the steam in the intermediate receiver is kept warm by fresh steam from the boiler. Each pair of engines consists of one high-pressure cylinder, 21in. in diameter and 5ft. 6in. stroke; and one low-pressure cylinder, 36in. diameter and 5ft. 6in. stroke. These cylinders stand each one under its own beam, and between them is placed the intermediate receiver or hot-pot, a cylinder about as large as the low-pressure cylinder. The engines work cranks at right angles at the ends of the fly-wheel shafts, and the plunger pumps are worked direct from the beams with a stroke of 4ft. The exhaust steam from the high-pressure cylinder has to pass through a thin annular space with full-pressure steam from the boiler on both sides of it in the hot-pot, and by this means the steam condensed in the high-pressure cylinder is re-evaporated, and dry steam only is delivered to the low-pressure cylinder. We have on more than one occasion dwelt on the importance of using dry steam in the large cylinders of compound engines. Mr. Cowper's figures confirm the accuracy of our conclusion; they also support our often-reiterated assertion that high pressures are not essential to economy, the boiler pressure at Ditton being only about 75 lb. absolute. The conditions of the trial were such that it is very difficult to see how any error could have crept in; yet the engines used but 13·39 lb. of feed-water per indicated horse-power per hour. To this must be added the steam condensed in the jackets and hot-pot. This was not measured, but amounted, according to Messrs. Simpson, to a little over 2 lb. per horse per hour, thus bringing the total consumption up to, say, 15·5 lb. The best results we can compare these figures with are those got from a Saltaire engine mentioned by Mr. Clark, which required 17·4lb. of steam. It has also been stated that some pumping engines in the United States, constructed by Mr. Leavitt, get on with 16 lb., but of this we have no trustworthy proof. Mr. Clark gives the best result for compound engines as about 18lb. There are compound engines which have perhaps slightly beaten the Saltaire engine, but we think we shall not be wide of the mark if we say that no quite trustworthy record has ever before been published of a performance in which the engine used less than 17lb. of water per indicated horse-power per hour. When it is borne in mind how difficult it is to save a pound of feed-water when an engine is already very economical, it will be seen that the performance of the Ditton engines is really phenomenal.

It appears from the diagrams that steam was cut off in the small cylinder at about one-eighth of the stroke. The clearance is, we know, very small. The high-pressure piston has an area of 346·36in.; the stroke is 66in., and one-eighth of this is 8·25 in.; allowing half an inch, as equivalent to clearance in ports, passages, and cylinder, we have 346·36 × 8·75 = 3030·66 cubic inches of 75 lb. steam per stroke, or per minute, 133,349in. = 77·17 cubic feet per minute, and per hour 4630 cubic feet, weighing 814·4 lb. Assuming a fifteen-fold expansion, 75 lb. initial pressure and 1·5 lb. back pressure, the calculated power of each engine, on the assumption that the curve of expansion was hyperbolic, would be 127 indicated horses, proving that the curves were very nearly hyperbolic. It was actually 120-horse power in round numbers. The consumption of steam by the indicator, which takes no account of condensation, was but 6·616 lb. per indicated horse-power. Such a result is absolutely unprecedented. It will be seen that our figures are based on the point of cut-off, as shown by the indicator. In other words, on the cubic space filled at the beginning of each stroke with steam, and not on the nominal cut-off. We have before us a table of some of the finest results ever got from steam engines; picking out the best of these, we find a Corliss engine using 10·63 lb. per horse per hour by the indicator; a 72in. engine at the East London Waterworks requires 13·58 lb.; the low-pressure cylinder of a pair of compounds by Messrs. Day, Summers, and Co., used 11·99 lb.; the high-pressure cylinder of a compound engine by Messrs. Donkin requires 10·09 lb. If we compare even this last figure with the performance of the Ditton engines, it will be seen that the difference is enormous—not less than nearly 3·5 lb. of steam per horse per hour. The ratio which the steam, as measured by the indicator, bears to that actually used, was in the case of the Donkin engine 100 to 203; that is to say, 103 per cent. more steam was used than the indicator accounted for. In the Ditton engines the steam actually used was a little more than 134 per cent. in excess of that accounted for by the indicator. We may say again that this result is unparalleled by the performance of any good engine with which we are acquainted; and it proves that, in spite of the use of every expedient known to science, the condensation of steam in an engine must be very great. It may be urged that the 8·884 lb. of steam condensed per horse per hour in the cylinders, jackets, and hot-pot was condensed in the performance of work; but this cannot be the case, as assuming the initial cylinder pressure to have been 75 lb. absolute—and this is not far from the truth—and the terminal temperature of the steam 107 deg., the condensation of about 2·3 lb. of steam would have sufficed to liberate heat, the equivalent of 1-horse power for an hour. Accordingly, we have a condensation of 6·584 lb. per horse per hour to be explained. This was due, of course, to the usual causes, namely, the inability of the jackets to prevent condensation from taking place in a cylinder exposed to considerable alterations in temperature. Putting on one side the question of relative performance, it is a curious fact that this is absolutely a very much larger condensation than takes place in engines in which no re-heating device is employed. For instance, the Saltaire engine to which we have already referred only uses 20 per cent. more steam than is accounted for by the indicator. Its actual consumption is 17·4 lb. of steam per horse per hour, and 20 per cent. of this is 3·48 lb., as the quantity condensed per horse per hour. Other instances might be cited if it were necessary. In order, however, to draw a proper comparison of this kind it is essential that the steam be worked under the same conditions of expansion and pressure in the cases compared. The advantage of the hot-pot lies not in reducing the positive loss of steam by condensation in the cylinder, but in reducing the loss, as compared with the grade of expansion. For example, it has hitherto been found impossible to expand steam anything like fifteen-fold without bringing about an enormous condensation. Thus, in an engine which we tested some years ago steam of 80 lb. absolute pressure was expanded fifteen times. The quantity used was 22 lb. per horse per hour. Assuming that it was as efficient in this engine as in the Ditton engines, then the indicator would have accounted for 6·616 lb. only, and the difference, 15·384 lb., would have been condensed.

The greater the range of expansion the less will be the quantity of steam accounted for by the indicator, and the greater the quantity, other things being equal, condensed in the cylinders. For some reason not fully understood, a very small quantity of water in a cylinder enormously augments the condensation. The hot-pot seems to play the part of a drier very effectually. It can do nothing whatever to help the high-pressure cylinder, but it no doubt augments the power given off by the low-pressure cylinder, by keeping up the expansion curve in that cylinder; and this seems to be entirely a result of drying the steam, and not of heating it. Indeed, the temperature of the steam as it enters the low-pressure cylinder at Ditton is, we are informed, not more than 5 deg. or 6 deg. higher than that of the same steam before it passed through the hot-pot. If our readers will turn to the account of the performance of a compound engine by Messrs. Richard Garrett and Son, which appeared in our impression for 26th November, 1880—the only compound portable engine which we have as yet had an opportunity of personally testing—it will be seen that a very high duty was got from it. All through the engine is non-condensing; it required but 22·8 lb. of steam per horse per hour, and the high efficiency of the steam was, we believe, mainly due to the circumstance that the pressure in the intermediate receiver was raised high enough to re-evaporate nearly all the water condensed in the high-pressure cylinder; consequently the large cylinder was supplied with dry, or nearly dry, steam. The drawback to this method is, that the power developed in the two cylinders is very different, the greatest power being got from the low-pressure cylinder. But this is not an insurmountable objection, and the system is very simple, and easily applied in practice.

It will perhaps not have escaped notice that the boilers at Ditton were abnormally economical, and this although, as Mr. Cowper tells us, the furnaces were not quite what he would have liked them to be. It will be seen that these boilers had to evaporate 15·5 lb. of water from an average temperature of probably 92 deg. with 1·6 lb. of coal. This is within a small fraction of 9·7 lb. of water per lb. of coal, equivalent to an evaporation of 10·86 lb. at 212 deg. We have no hesitation in saying that this again is an unparalleled result. Nothing at all approaching it has ever before been recorded of a plain Cornish boiler. We have found 9·5 lb. of water per pound of coal the highest duty that could be got from two large Lancashire boilers, 30ft. long, with Bwlfa coal, which is as good as Nixon's navigation. The grates were specially adapted for burning this coal, and the bridges had been altered to get the best possible result; in addition the feed-water was heated to 120 deg. Our readers will, we think, join with us in saying that it is desirable that Mr. Cowper should express his views concerning the performance of the Ditton engines and boilers more fully than he has done in his meagre report. We have, as we have said, an almost, if not altogether, unparalleled performance of steam machinery to deal with, and engineers will expect some explanation from the man who has secured so wonderful a result.

TELEPHONE WIRES OVER THOROUGHFARES.

Mr. John Walsh, telegraphic engineer, Stretford, near Manchester, has presented a report to the corporation detailing the results of his examination of the several lines of over-house telegraph and telephone wires in the borough. With the Postmaster-General, he does not apprehend the corporation will have any difficulty, but with all over-house wires one or two conditions should be insisted on. Chief among these are—(1) All over-house wires crossing streets or parallel to streets where there are approaches to works, &c., should not be less at the lowest point than 35ft. from the ground, so as to allow a sufficient headway for the fire-escape; (2) over wires should cross streets at right angles, and be "shackled off" at both sides of the street; (3) over-house wires should be placed upon poles where possible and not on buildings. Mr. Walsh specially compliments Messrs. Tasker, Sons, and Co.'s construction of their telephone and private telegraph wires, and mentions that no better test of their strength could be obtained than the fact that they stood the severe storms of October and November without injury. Their manager, Mr. Johnson, was an efficient telegraph engineer, and would no doubt continue to keep Messrs. Tasker's telephone wires in a good state of repair and condition. What Mr. Walsh, indeed, practically recommends, is that the principles and regulations laid down with respect to Messrs. Tasker's wires should be strictly enforced with all other owners of private telegraph or telephone wires in Sheffield, and no new lines of wires should be allowed to be erected without the sanction and approval of the corporation being first sought for and obtained.

PROPOSED TUNNEL UNDER THE THAMES.

Some of the local authorities in the east end of London are much exercised at a rumour that the Metropolitan Board of Works have a project under consideration for a tunnel from the Whitechapel-road to the south side of the Thames, this being, in their opinion, the best method of satisfying the great need of communication. It would probably be more correct to say that the tunnel is proposed in order to avoid the opposition of the City authorities, who, apparently, will consent to nothing—however much for the good of the metropolis—which may touch the vested interests of Billingsgate and Thames-street. At any rate in the East of London, beyond the City, the need is for the bridge, and not for a tunnel, and this view is to find expression at the next meeting of the Whitechapel District Board of Works on Monday, the 19th inst., when Mr. William Smither, the well-known carrier and local representative, is to move :—"That in the opinion of this board the proposed means of communication between the north and south side of the Thames below London Bridge should be a low-level bridge." If London had a representative government like every other town and city in the empire, a resolution such as this would have had effect long ago.

THE DESTROYER.

Further information has reached this country concerning Ericsson's torpedo boat, the Destroyer. It appears that he has abandoned the use of steam for ejecting his torpedo from the boat, and uses gunpowder instead. Thus the boat really carries a submarine breech-loading gun. The target referred to in The Engineer, for November 18th, was made of manila rope and wooden slats. A dummy projectile, or one of wood only, was discharged from the gun. The muzzle of the gun was 6½ft. below the surface of the water. The charge was 12lb. of giant powder. The projectile was 25½ft. long. The gun is aimed and discharged by electricity, operated by the steersman. The projectile traversed the target at a depth of 5ft. beneath the surface of the water, appeared on the surface about 100ft. beyond, and continued its course with considerable velocity for 200ft. more. A submarine distance of 400ft. was made in three seconds, although the gun charge was, as we have said, but 12 lb.

AMERICAN LOCOMOTIVES IN ENGLAND.

ENGLISH engineers will be somewhat surprised to learn that the order has been obtained in this country for a considerable number of American locomotives for railways in America. They are now being built from the designs and instructions of Mr. James Cleminson, M.I.C.E., Westminster, by a leading North of England firm, and are on the true American type, as represented in Baldwin's "America," "Mogul," and "Consolidation" classes, though some slight modifications are made in the arrangement of the compensating beams. The system of compensation is carried out completely so that the wheels must bear with full weight on any road, just as the speculum of a large telescope is supported on Lord Rosse's or Grubb's system of connected levers. It is expected that the engines will show what can really be done by locomotives on the American type built on the best English methods and workmanship, and we shall probably learn how much truth there is in the oft-repeated statement that American locomotives will haul a greater load, weight for weight and cylinder for cylinder, than those of the English type.

LITERATURE.

Elementary Treatise on Natural Philosophy. By A. PRIVAT DESCHANEL. Translated and edited by J. D. EVERETT, M.A., F.R.S. London: Blackie and Son. 1882. Sixth edition.

WHEN a book has reached its sixth edition, it is almost of necessity so well known, that of a new edition it is only necessary to speak of the additions and modifications made in it. It is difficult to understand why the date 1882 should be put on the title page, unless it is because the remarkably rapid strides being made in the applications of electricity have made several additions necessary to the part dealing with electricity, which was published earlier this year; while to hold back the volume now before us would have made it somewhat behind the time on this subject. The book is published either in one volume or in four parts, and while referring to the electrical part, we may at once mention as an illustration of the rapidity with which books on current electricity become behind the time, that, though a description of the Planté secondary battery is given in the new edition, the Faure battery is not described, nor is the Planté illustrated, nor the Varley battery mentioned, subjects which are engaging as much as any in the electrical world just now. In other respects, however, great additions are made to the electrical chapters, and the descriptions of the methods of testing by Wheatstone's bridge or Christie's, as perhaps it should be called, are amongst the useful new matter. One of the new forms of dynamo-electric machines is described, but as a student's book, a diagram illustration of these machines as used by Professor Adams in his Cantor lectures would have been a most useful addition, as showing how the magnets are wound and placed in connection with the armature, commutator, and shunt, and also how Wheatstone's observation that the effects are increased by diverting a great portion of the current from the magnets by means of a shunt; and subsequently how the work, as a lamp, was placed in the shunt are carried out. There seems to be some error in the description of the device by which Planté was enabled to alter the connections of a large number of his batteries instantaneously, so as to be in series as soon as the charging is completed, as this is called a rheostatic machine. As the device is not illustrated this is rather confounding.

Turning back to the commencement, we find considerable alterations and additions in the chapters dealing with heat and thermo-dynamics. The Centigrade scale is used throughout the book, and this is to be commended; but most English readers will be glad to find that though the centimetre-gramme-second or C.G.S. system is described, we are spared at present the infliction of a book using that system throughout; and for this we ought to be thankful, when we remember the temptation that Professor Everett, who is the author of the book on "Units and Physical Constants," in which this system is developed, must have experienced in revising this edition, unless in his book he had enough of it.

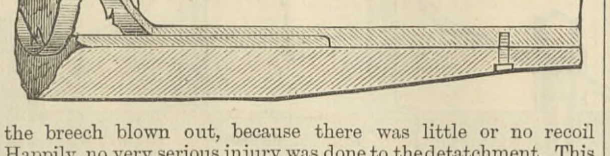
In the chapter on steam and other heat engines we find little change, and here change and addition might have been very necessarily made. Stirling's air engine is described and illustrated, but we have nothing more modern, though the Rider engine is very largely in use, and Stirling engines are obsolete. The illustrations and diagrams of steam engines are old when they might as well show modern practice, and give students modern ideas at once, instead of making it necessary for them to unlearn ideas that they will gather from these old pipey, long-ported, and many parted engines. Of the locomotive a much more modern and accurate section might just as well have been given, and of the modern gas engine something more than perspective views should have been considered necessary by the author to supply the information which students require. Of the compound engine, too, something more than a pair of contiguous cylinders connected by a pair of cross pipes could have been just as easily illustrated, and would have enabled students to obtain a practical idea of a compound engine at once, instead of a perhaps half-formed conception of a mixture of two cylinders by plumber's aid. The steam engine may "be on its last legs," but we imagine that its last legs will probably last as long as its first, and therefore the steam engine might be illustrated as made now rather than as made when Professor Everett was very much younger.

We have thus found fault with the book where necessary, but nobody needs to be told that Professor Everett's "Deschanel's Natural Philosophy" is amongst the best and most clearly written books dealing with most of its many and interesting subjects.

BURSTING OF A SPANISH CONVERTED GUN.

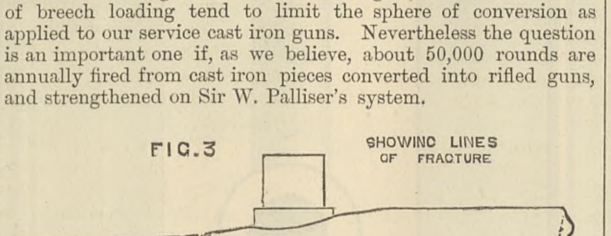
THE *Revista General de Marina* for October gives a short account of the bursting of a Spanish cast iron gun lined with wrought iron coils while firing with shell. The piece was originally a smooth bore of 20 centimetres, lined and rifled, being then brought to 16 centimetres (6·3in.) calibre. The firing charge was the service one of 6 kilogrammes (13·2 lb.). The gun appears to have yielded by blowing out the breech end, which flew to the rear. Figs. 2 and 3 show that it yielded in a line from the bottom of the bore to the curve or exterior angle of the metal, on rear of the vent and vent field. The piece also split longitudinally in a vertical line as cast iron pieces generally do,

FIG. 1.



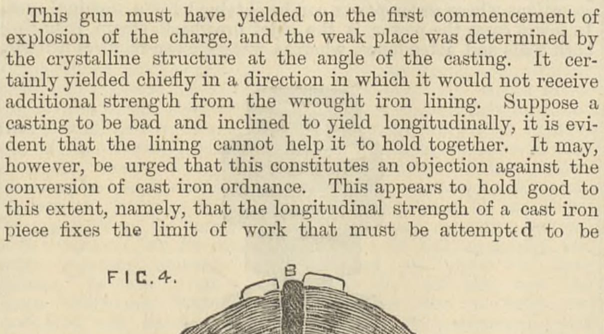
see BB and CC Fig. 3 and Fig. 4. The cup which formed the bottom of the bore was, of course, blown out to the rear with the breech, the coils into which it was screwed being unwound, as shown in Fig. 2 and Fig. 4. The coils do not appear to have been rent, they seem to have held well together, *vide* Fig. 4. The writer of the Spanish report considered that the longitudinal work was equally divided between the projectile and portion of

FIG. 2.



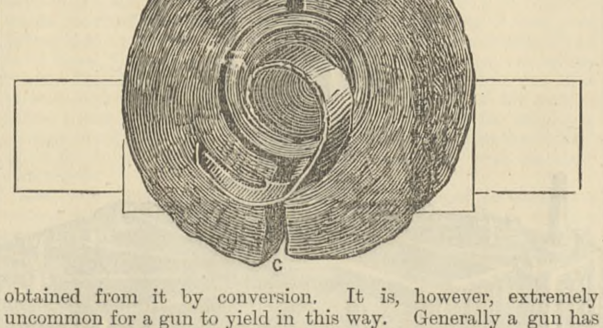
the breech blown out, because there was little or no recoil Happily, no very serious injury was done to the detatchment. This result doubtless interests Spain very directly, if this gun is a representative of a large class; the question is, how far does it concern us in England? Increase in length and the introduction of breech loading tend to limit the sphere of conversion as applied to our service cast iron guns. Nevertheless the question is an important one if, as we believe, about 50,000 rounds are annually fired from cast iron pieces converted into rifled guns, and strengthened on Sir W. Palliser's system.

FIG. 3



This gun must have yielded on the first commencement of explosion of the charge, and the weak place was determined by the crystalline structure at the angle of the casting. It certainly yielded chiefly in a direction in which it would not receive additional strength from the wrought iron lining. Suppose a casting to be bad and inclined to yield longitudinally, it is evident that the lining cannot help it to hold together. It may, however, be urged that this constitutes an objection against the conversion of cast iron ordnance. This appears to hold good to this extent, namely, that the longitudinal strength of a cast iron piece fixes the limit of work that must be attempted to be

FIG. 4.



obtained from it by conversion. It is, however, extremely uncommon for a gun to yield in this way. Generally a gun has a sufficient margin of longitudinal strength to admit of a considerable gain to be obtained by conversion. The coils appear to have behaved very well. It is difficult to say what strain was thrown upon the piece. The charge 13·2 lb. is rather large; 12 lb. R.L.G. is the largest charge we fire from our 64-pounder 6·3in. wrought iron gun. The nature of the Spanish powder, however, is not stated. In this case the weight and velocity of the projectile would tell us more than anything else. We should be inclined to think that the cause of rupture was simply a fault in the cast iron. One thing appears certain, that the wrought iron prevented the whole gun from flying into fragments, and thus, perhaps, it saved the lives of the detachment. We hold that the Palliser system of conversion is good, and we would point out that in this country, as far as we know, no accident of any kind has occurred with it.

PUMPING ENGINES, CANTERBURY SEWAGE WORKS.

WE illustrate at page 437 pumping machinery recently constructed by Messrs. Gwynne and Co., of Essex-street, London, for the Canterbury Sewage Works. The price paid for the land at Sturry was £3500, and the cost of building the work, three cottages, draining and preparing land, boilers, engines, pipes, and all complete was £4800, making a total sum of £8300. The sewage farm covers 22½ acres of land, lying to the east of Sturry-road. At the present time eleven acres are devoted to the cultivation of mangold wurtzel, which are estimated to return forty tons per acre.

The Broad Oak Sewage Works will be utilised as heretofore in conjunction with the new works. The whole of the sewage matter from the city will be conveyed to the old works in the first instance; the solid matter will be separated from the liquid, which after filtration will run to the new works for irrigation purposes as described below. It is confidently believed that these will be the most perfect works in England carrying out the process of sewage irrigation. In all other instances the raw sewage is placed upon the land for natural filtration, here the solid matter is retained at the Broad Oak Works, the effluent water alone being spread over the land.

In the engine house there are two pumping engines of 15-horse power, each capable of discharging 1400 gallons per minute to a height of 35ft., but the engines can if necessary be worked up to 25 or 30-horse power, when they would each discharge 2600 gallons per minute. The boilers are each 5ft. 8in. in diameter, by 18ft. long, with one internal flue 3ft. in diameter and six Galloway tubes. They were tested up to 125 lb. to the square inch, the pressure remaining for half an hour. There are two donkey pumps for the supply of water to the boilers, and one air pump for charging the centrifugal pumps. The engines work very satisfactorily, being so powerful that the sewage water can be carried to within a short distance of the height of the table land at Scotland Hills. They can be worked together if necessary without any difficulty, and either will discharge 1400 gallons per minute. An admirable supply of water is obtained from a surface well at the depth of 10ft. at a short distance from the engine-house. The water proceeds from a bed of gravel, and answers the purpose for which it is required perfectly. At the pumping station there are two cottages and sheds. As the sewage water enters the well from the old works, it is pumped up and delivered through five lengths of 18in., 15in., and 12in. covered stoneware carrier pipes, extending the length of land. The sewage in its passage along the carriers is stopped by sluices in the distributing wells, which are placed at distances of about 200ft. apart. The water rises in these until it reaches the surface of the land, when it passes through sluices which are made to regulate the flow of water, so that either a small or large quantity can be put on any particular piece of land. The buildings have been erected by Mr. John Bingham, of Headcorn, from the designs and under the personal supervision of the surveyor, Mr. J. G. Hall, Assoc. M. Inst. C.E.

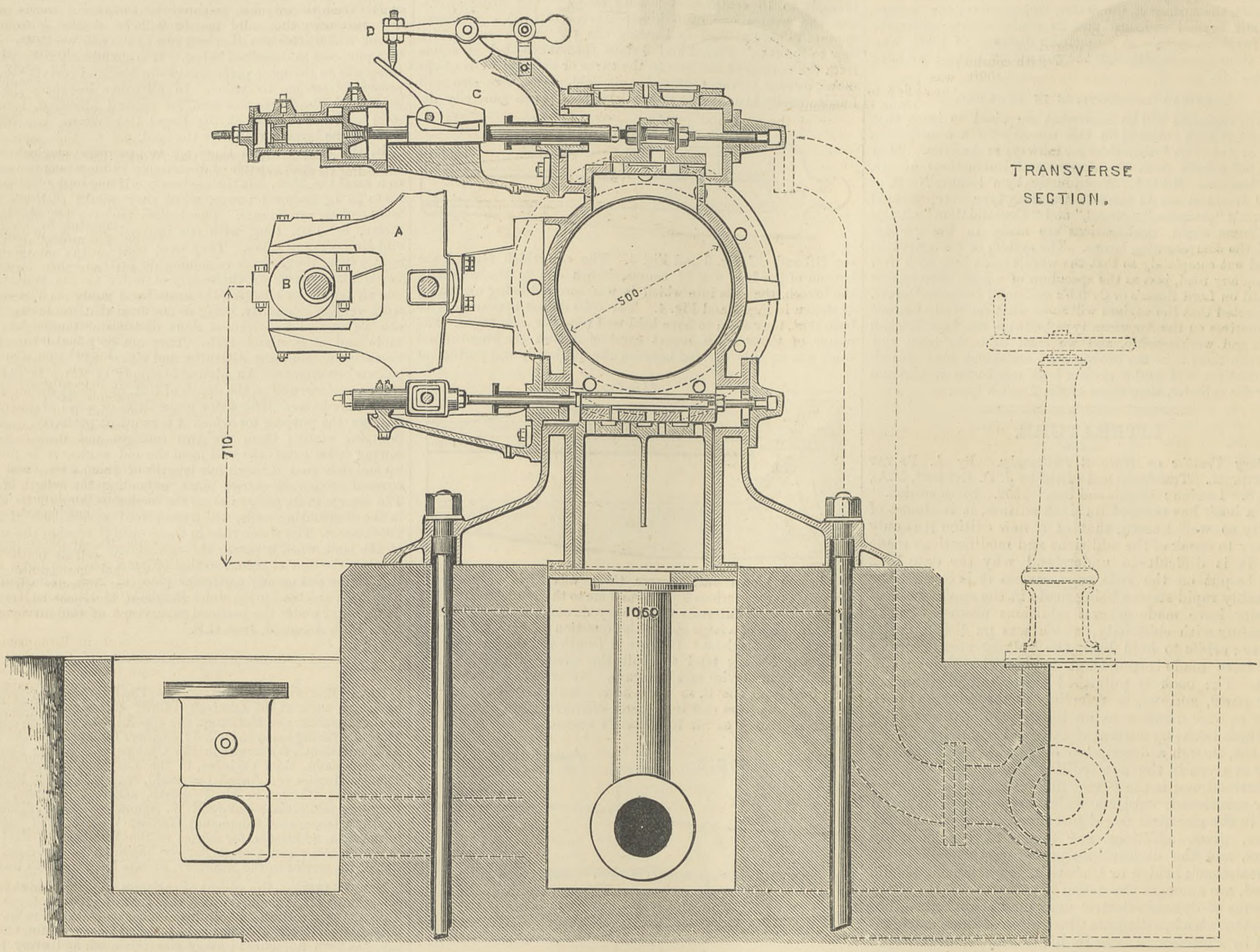
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty: Chief engineer James McGough to the Monarch, *vice* Holloway, the appointment of chief engineer Thos. J. Gissing being cancelled; engineer George H. Cooke to the Asia, additional, for service in the Cyclops, *vice* Laird; Frederick H. Herrmann, chief engineer, to the Euryalus, recommissioned; Thomas Hughes and Joseph Langmaid, engineers, to the Euryalus, additional; Charles F. H. Tilbrooke, assistant engineer, to the Euryalus, additional; and John W. Agnew, assistant engineer, to the Assistance, *vice* Langmaid; Herbert Wooley, chief engineer, to the Asia, additional, for service in the Minotaur, to date from the 24th inst.; and George Brewer, engineer, to the Asia, additional. for service in the Minotaur, to date from the 24th inst.

NEW DIARIES.—The advent of packages of diaries, always welcome in itself, reminds us of the near departure of the year. Messrs. Letts' collection, both for number and variety, is specially noticeable. Every need has been supplied; every whim, one may say, has been humoured; every size produced, and every pocket considered. The general information contained in the larger diaries is immense. There are also Housekeeping Expense books, already well known, and Family Registers, both of which will be in request. Our contemporary, the *Chemist and Druggist*, has also issued a diary, and a very copious one it is. As far as one outside the pale can judge of information of so technical a character, we should say that it is of great value to the class for whom it is specially produced. The advertisements, enough of them to make one's journalistic mouth water, are in their way scarcely less interesting than the matter. The "City Diary," published at the office of the *City Press*, is a useful six days in a page and cheap diary, as is also for some purposes Blackwood's shilling interleaved scribbling diary, foolscap size. A diary calling for special notice in our columns is the Railway Diary and Officials' Guide. As the title indicates, this diary contains a great deal of information on the railways of the kingdom, and their officers. It gives the miles open, and in most cases the date of opening, and might usefully give the gauge of the lines. It is a cheap and useful diary. With this diary is also a sheet railway almanack.

ANNUAL DINNER OF THE SOCIETY OF ENGINEERS.—On Wednesday evening the annual dinner of this Society was held at the Guildhall Tavern, Gresham-street, and was attended by nearly 100 members and friends. The chair was occupied by Mr. Charles Horsley, C.E., F.G.S. In proposing the toast of the evening, "Success to the Society," the chairman said that the Society was nearly twenty-eight years old, that it was doing a great deal of good work, and that it would do much more if members availed themselves more of the opportunities of inspection which were afforded by the visits which the members were privileged to make, and if they would state more freely at the ordinary meetings the reflections which had been suggested to them by what they saw and heard on the occasions of those visits. They had been permitted to visit, among other places, the Mint, the Royal Dockyard at Sheerness, the fortifications there, and the works of the Great Eastern Railway, and all concerned did everything in their power to make the visits as profitable to the members as possible. The subjects that had been discussed at the Society's meetings had embraced gas engines, dock gates, the prevention of smoke, iron roofs, and the machinery of breweries. An addition of 31 members had brought the total up to 400. They were always well received wherever they went, and the advantages of the Society's work were highly appreciated by the members, but not so much by those who relied upon their transactions as by those who availed themselves personally of the privileges of members. The prospects of the profession were improving; they did not do much last year, but there was every prospect now that they were going to have a first-rate time of it. Mr. A. Williams, hon. secretary and treasurer, and one of the founders of the Society, said that the excursions and visits were the most useful part of the Society's work, for it was one thing to be able to make a drawing and another to be able to give those further instructions which could not be given without the knowledge and experience that could be derived only from observation. Mr. Jabez Church, president-elect, said there were a good many Bills to come before Parliament next session, which was a good sign for the profession. There was a vast amount of work for engineers to do in this country; so far from being "played out," as some said, he believed they had more to do than they had ever done before. Science was making advances, and engineers had to adapt themselves to the changes which must follow. The toasts included the Vice-Presidents, the Council, and the Secretary (Mr. B. Reed), who was complimented on his arrangements for the excursions, and a good selection of vocal music was given under the direction of Mr. Montem Smith, by Mr. H. Aston, Mr. G. T. Carter, and Mr. Chaplin Henry. Mr. A. Williams, Mr. Jabez Church, Mr. Isaacs, Mr. R. P. Spice, Mr. T. Porter, Mr. R. Berridge, Mr. S. Cutler, and Mr. C. Gandon responded to other toasts.

100-H.P. ENGINE.—SYSTEM WANNIECK-KOEPPNER.

THE BERLINER MASCHINENBAU-ACTIENGESELLSCHAFT, ENGINEERS.



WE illustrate above and at page 440 a horizontal engine by the Berliner Maschinenbau-Actiengesellschaft, which attracted a good deal of attention at the Berlin Exhibition. The action of the valve gear will be readily understood from our engravings. The valves are plan slides of the gridiron type, and they are actuated by a pair of lever arms one of which is shown above at A. Each of these levers is caused to rock by an excentric B, and the arm gives a positive motion to the exhaust slide beneath the cylinder. The upper arm of A is fitted with a trip gear, the tripping of which is determined almost precisely as in the Wheelock engine by the position of the tripper or trigger puller D, which again depends on the position of the inclined planes shown at page 440. The rest of the details, dash-pot, &c., are too clearly shown to need description. The cylinder is $19\frac{3}{4}$in. diameter nearly, and the stroke is $21\frac{1}{16}$in. The construction of the air pump and condenser is worth examination. The air pump is $4\frac{1}{2}$in. in diameter.

THE CORNISH STEAM PUMP.

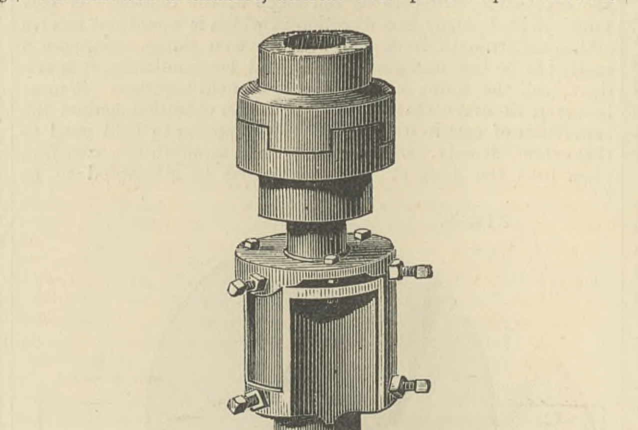
THE engraving on the next page illustrates a new type of steam pump, manufactured by Messrs. Joseph Evans and Sons, of Wolverhampton, and Queen Victoria-street, London. Its action will be readily understood from the drawings. As the piston approaches the end of its stroke, say from right to left, the steam from the cylinder is admitted by the ports K and M to the left of the small plunger G, moving it to the right, by which means the right end of the large plunger D is placed in communication with the exhaust through the ports N, and the left end with the interior of the steam chest B, from which steam is admitted through the ports R and Q, causing the plunger D, together with the common slide valve E, to be carried over to the opposite end of the steam chest, thereby reversing the motion of the main piston; a similar motion takes place at the opposite end. The cushioning of the plunger valves is most effectively performed by means of small ports, through which steam direct from the steam chest flows upon the end of the plunger towards the completion of its stroke, and this prevents its striking up the covers and caps; the exhaust steam from the plunger G passes through the small port S, and thence into the main exhaust through N. The steam chest being placed on the side of the cylinder, and the bottom of the steam port on the same level as the bottom of the cylinder, the whole of the condensed water is carried out at every stroke of the piston, whereby the necessity for drain cocks is avoided. This appears to be a simple and efficient pump, well adapted for doing a great deal of work under trying conditions. There are few parts to get out of order, and the whole machine will obviously stand knocking about without injury.

LETTERS TO THE EDITOR.

[*Continued from page 438.*]

THE LEFFEL TURBINE.

SIR,—The object of this letter is to bring the Leffel's turbine water wheel under the notice of those who are engaged in introducing the electric light. The generating of the light requires power to drive the electrical machinery, and there are many situations where water-power can be obtained for a nominal sum. In many cases the power is the chief drawback, steam requiring both coals and attendance, whereas water-power requires neither.



THE LEFFEL TURBINE.

When the machinery with turbine is erected, there is little or no further expense connected with it. With even a low fall, a high speed is obtained, which is a very great advantage, and combined with the high speed is a very steady motion. It can be stopped and started in a few seconds, is always ready to work, requires no oiling or packing, &c. The James Leffel's double turbine water wheel has now been before the public for many years, not only in America, where it is made, but almost in every part of the world. 10,000 wheels are successfully working on falls varying from 18in. up to 300ft., and the demand for the wheels is greater to-day than at any previous time. The construction of the wheel is truly scientific, having strength combined with lightness. The wheel has a division in the centre of the buckets, which divides the flow of water into two distinct streams, the upper stream passing horizontally into the centre of the wheel, the lower stream passing downwards, each stream having a set of buckets which receive the full force of the water. The wheel is turned in the lathe, and the gate framing or wheel case bored out, leaving just sufficient play between the two, so that the wheel can turn without touching the sides of the gates or case. The gates are easily adjusted by a segment and arm, which is connected with the gates by connecting-rods. Motion is given to the segment by a small spur pinion. By this means the gates can be adjusted to the smallest space. This is a very great advantage where the stream of water which supplies the wheel is variable. The percentage of useful duty is, by this means, retained with a large or small quantity of water, as the wheel will give nearly the same useful effect with one-tenth of the water as it will with the full quantity which the wheel can consume, the power being in proportion to the quantity of water used. It will be readily understood by this that the water enters the wheel round the circumference. By this arrangement the wheel has no tendency to press more on one side than the other, the pressure being equal all round. The foot-step is of hard wood, very large, and being directly in the flow of the discharged water, the heat is carried off as fast as it is generated, so that there is no wear on the step, and they run for years night and day without giving any trouble. The wheels for low falls are generally placed in an open penstock, which is made of wood, stone, or iron. This is a very good and cheap arrangement for low falls, thereby doing away with the wrought iron or cast iron piping; for high falls the wheels are fitted in a cast iron globe case or wrought iron case. The water is conveyed to it by wrought iron or cast iron pipes. We have, and are still erecting, a number of turbine wheels in England and elsewhere, and all with the same satisfactory results.

THOMAS MCKENZIE AND SONS.

Holborn Viaduct, London, E.C., Nov. 11th.

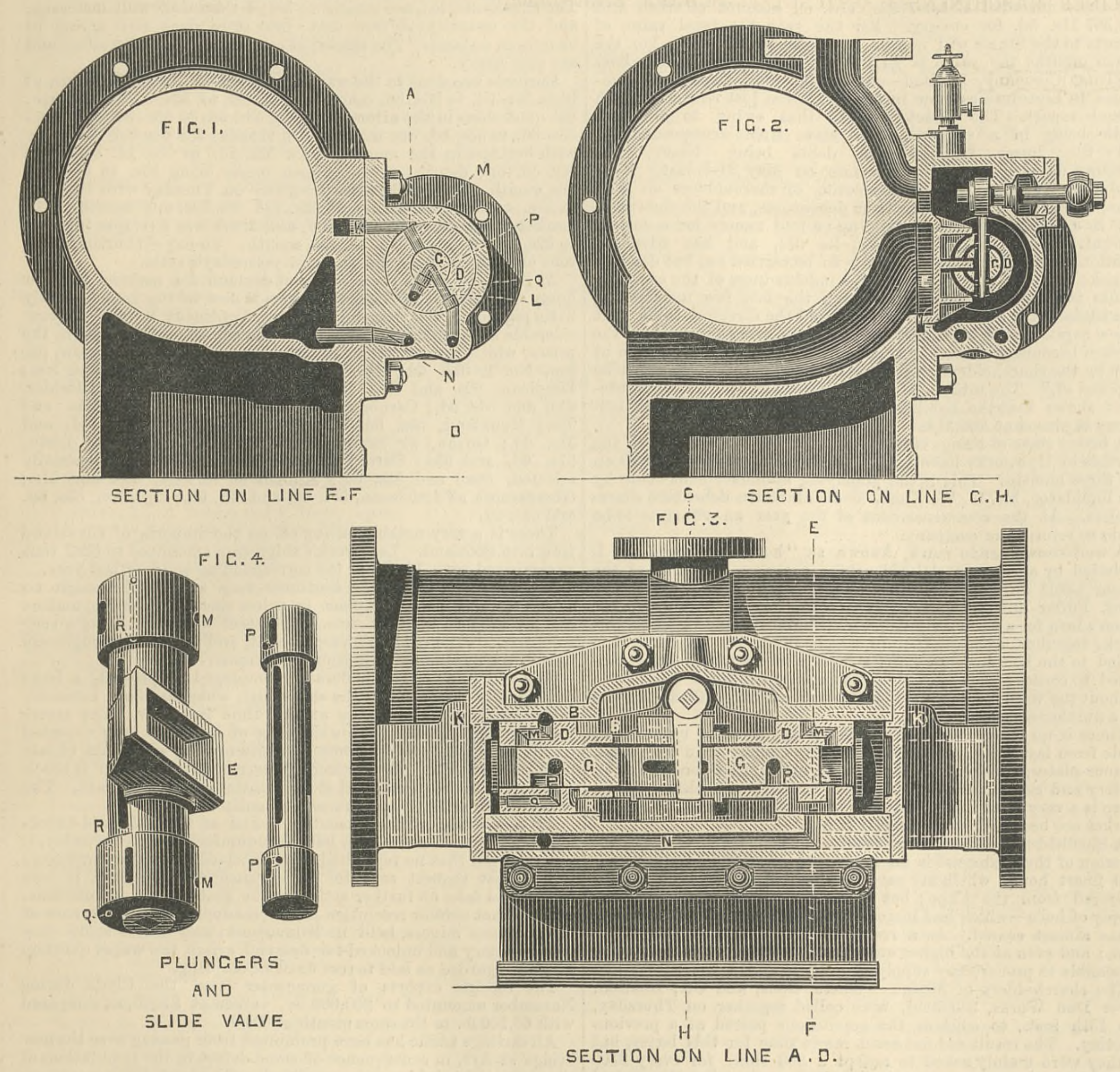
THE EFFICIENCY OF ELECTRIC LAMPS.

SIR,—The recent publication in your journal of Professors Ayrton and Perry's paper "The Efficiency of Electric Lamps," and the comparisons they make of some of the electric light lamps exhibited at the Paris Exhibition, comparisons which appear to me to be misleading and erroneous, and to call for some comment. It is obviously a mistake to compare electric arc lamps or semi-incandescent lamps with incandescent lamps in vacuo, and to test them all in the same horizontal position, inasmuch as the incandescent lamps practically give the same light in any position, whilst only the minimum light is given by 'arc' lamps—such as those tested—and semi-incandescent lamps in the horizontal position.

I was present on two occasions whilst the professors were testing my lamps, and the results varied as much as 100 per cent. They gave me at the time red glass 100 candles, green 140, and again red 140 and green 180 and 200-candle power, and all with exactly the same light, which they now give as only 70-candle power. Different observers gave altogether different powers of one and the same light. The extraordinary difference of candle-power between the Pilsen arc lamp and the Brush arc lamp, whilst the electrical conditions appear identical, calls for some explanation, and I hope the professors will favour us with further tests, and these explanations, and make them equally as public as their recent report.

CORNISH STEAM PUMP.

MESSRS. JOSEPH EVANS AND SONS, WOLVERHAMPTON, ENGINEERS.



Tests which are so scanty and incomplete—except in the case of the Maxim lamp—and which do not give the number of lamps in circuit, the maximum and minimum candle-power at all angles, the volume of light in some unit of illuminated area, as well as the intensity and the colour of the light, and which do not give direct tests of the engine power—are, I consider, totally unreliable.

Considerable credit is due to you for taking the initiative in such a matter. Messrs. Ayrton and Perry's tests serve to point out the great difficulties there are in the way of aiming at a satisfactory comparison of different lights.

HENRY F. JOEL, A.M.I.C.E.

Queen's-buildings, 52, Queen Victoria-street,
London, E.C., December 13th.

THE TRANSIT OF VENUS.

SIR,—You at the time inserted some letters of mine on the subject of a great puzzle and difficulty connected with the transit of Venus. Another transit will occur in 1882; so that all the difficulties have even yet to be got over as before, when all things equally failed. I then, at the time of the last transit, in your journal tried to point out why they failed. How difficult the work still is you will judge from the following *re* the transit, but just published by authority:—"It is a point of primary importance that all the observers shall, as far as possible, observe the same kind of contact, and it is therefore desirable that the time recorded for contact should refer to some marked discontinuity in the illumination of the sun's limb, about which there cannot be a doubt." A quite extraordinary statement; for to make all the observers see the same kind of contact is, and must be, a simple impossibility—unless the eyes of all the observers could be made exactly alike. It is strange, indeed, that this could be said by anyone after cognisance of the fact that all depends on the action of the eye in each individual observer, and that, consequently, each one of them sees the meeting bodies—*e.g.*, the sun—differently, according, indeed, to the special make of that organ in each case which takes cognisance of it.

I ventured, Sir, at the time you published my letters, to draw the attention of the Council of the Royal Society and Professor Stokes to these attempted explanations of the difficulty always to be met with in transit observations, and I asked, at the same time, the Council to grant me a small sum out of their annual Government grant, given to aid in scientific research. I cannot but think that a new eye-piece, specially fitted for this work, might be contrived and constructed, that shall nearly, if not quite, eliminate the shading on the edges or outlines of the two meeting bodies, the coming together and meeting of which causes or produces the "black-drop," as it is somewhat indefinitely now termed. And if this be so, all the difficulty special to transit work would be done away with. I cannot but think that this is a scientific problem and difficulty, which to do away with and to explain, is worthy of some small help out of this fund thus confided to the Royal Society.

111, Cheyne-walk, Chelsea, C. BRUCE ALLEN.
December 5th.

DRAUGHTSMEN IN THE UNITED STATES.

SIR,—There is, I believe, at the present time an increased interest taken in the affairs of the United States, and as there are at all times many people who are infatuated with the idea that America is the country to which all aspiring young men should go to find appreciation for their talents, and bearing in mind that these enthusiasts number among them men in high positions, some of whom have even visited the country in question, I desire to offer one or two cases of the treatment which young men from England have received there, for the consideration of intending emigrants.

A draughtsman who had obtained a permanent position near Philadelphia, was induced to leave it by the promise of better work and good pay by an employer of high standing in New England. He served with eminent satisfaction for many months, but his employer then secured some raw Swedes who could not speak a word of English, and as soon as they had learnt enough of the language, and had got the benefit of his experience and example, he was summarily discharged at half-an-hour's notice by the chief draughtsman of the establishment, in the employer's absence. The employer on his return being appealed to, stated that he must uphold his chief "right or wrong," and further admitted his false position by paying the discharged draughtsman the amount he claimed in lieu of notice.

The second case I have to mention is of even greater hardship, though in this case the sufferer had not a wife and family to share the consequences. The employer being pressed for assistance, requested one of his men to write to a friend in London, then occupying a permanent position, and to offer him wages, if he would come out, that were fairly good remuneration in America. The draughtsman was tempted by the prospect and wrote, accepting the offer, and followed his letter in a few weeks. His friend introduced him to the chief draughtsman, who immediately informed him that all new comers at that establishment were paid 2½ dols. per day to commence with, and that he would have to do with that or go elsewhere. He replied that he had come on a definite understanding for nearly double that amount, and was told it was merely the custom, but that he would soon be raised, when he had shown his capabilities. He thought it best to acquiesce, expecting honourable treatment, but for three weeks was kept tracing details, and after repeated requests to be allowed to "show his capabilities," he was given a drawing to do. All this was the more ridiculous, inasmuch as the man was a fully experienced old hand, and held the highest testimonials; but what followed was even more preposterous. After finishing the drawing, the employer ordered his pay to be raised to 3 dols. a day—still short of the promised amount, notice. But a week afterwards the chief draughtsman pointed out in checking it over, two figures that he said should be there, and which were afterwards found to be there, though he had not seen them, and reduced our unfortunate Englishman's pay to 2½ dols. again. The result was that he was kept tracing for the remaining six months of his service there, never being permitted to justify himself, as the employer refused to do anything, "having perfect confidence in the chief," while the chief "was not responsible for the wages"—to use their own words.

Lastly, a young engineer in Boston, who engaged to work at a certain salary, was told that he would have to substitute for it a small percentage on the sales, which being most irregular and uncertain, have resulted hitherto in giving him no remuneration at all.

To sum up, the intending emigrant, if a draughtsman, will spend from £20 upwards on his journey; he must not reckon on getting more than £3 a week to begin with, and he will have to work nine hours a day all the week through and all the year round for that, and he will find to his cost that hour for hour he is earning less than he did in England.

Finally, I would caution draughtsmen against New England, where the cases I have related are by no means strange, and beg of them to pay small attention to the glowing accounts of enthusiastic sightseers or interested journalists; but if they must emigrate, choose some colony where they will not receive such treatment as has disgusted A RETURNED DRAUGHTSMAN.

Nottingham, December 5th.

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

(*From our own Correspondent.*)

THE nearer the end of the year approaches the more satisfactory seems to become the state of the iron and coal trades of the district. This was made fully apparent by the tone of the weekly iron and coalmasters' meeting in Wolverhampton yesterday and in Birmingham this afternoon. Proprietors of mills and forges reported that they were still full of work, and that operations would in the majority of cases continue to be actively carried on right up to Christmas Eve; and it is very gratifying that there would seem to be no probability of much falling off in this activity certainly during the early part of the new year, for fresh inquiries continue to be received relating to important contracts which buyers are wishful to place for next quarter's delivery, but which at present makers refuse to book except at prices which buyers decline to give. Buyers would, however, do well not to remain out of the market too long. There is little room to doubt that the terms which they will be able to make during the new year will be even less favourable than those which vendors are now prepared to concede. Already prices are again advancing. In the front rank of the departments in which this feature is observable are common bars. This afternoon certain makers of a good quality firmly refused orders offered them at £6 10s. per ton—a figure which lately they were only too glad to secure. They declared that they should not now accept less than £6 15s. Similarly the hoop makers were less numerous than a fortnight ago who would accept anything below £7 per ton, and the majority asked £7 5s. and £7 10s. according to quality. There is still an excellent demand for this commodity, not only to supply the wants of export customers who need it for baling purposes, but also for consumption by the wrought iron tube makers at home, who take it in the less valuable form of strip.

Sheets of galvanising descriptions were quoted in some cases 2s. 6d. to 5s. per ton dearer than a fortnight or three weeks ago; and makers' quotations were less open to negotiation by purchasers than they were at the earlier date; £8 10s. was insisted upon with greater firmness than for some time past as the minimum for singles of good quality by firms who already have their books well filled.

The deep stamping sheet makers who lately have been well occupied, and whose prices since the revival in trade have been officially advanced £1 per ton, were decidedly stronger this week than last; and it would seem to be not unlikely that before long a further official advance may be declared. Indeed one prominent house has issued a circular setting forth that their former quotations are withdrawn. New orders will have to be subject to special prices regulated by negotiations. This example has not yet been followed by other makers in the same line; but it is having considerable influence with them in their dealings with customers. Makers' prices to merchants varied this afternoon from £11 to £18 per ton.

The plate makers did not give very encouraging reports as to the business doing either in boiler, or tank, or girder sorts. Nor can it be reported that prices are strengthening in this branch proportionately with the greater firmness noted in other departments of the finished iron industry.

Tin-plates are moving off a little better, though there is plenty of room for improvement in the demand as well as in the prices realised; but it is under this latter head that there is most reason for complaint. Makers speak of the great difficulty which they find in securing advances from the great Liverpool buyers which are not out of all proportion to the recent upward movement in the prices of the raw materials.

Pig iron quotations were very strong, both in Birmingham and Wolverhampton. The makers of second and third-class native brands regretted that they had not more furnaces in blast to meet the current demand, and they reported that they are taking steps to augment the output. All-mine hot blast pigs were strong at from 65s. to 70s.; part-mine were 45s. to 47s. 6d.; Derbyshire were 50s. to 55s.; for Tredegar hematites, 72s. 6d. was refused, and nothing under 75s. would be accepted.

Alike yesterday and to-day the market was strengthened by the necessity which exists in the coal trade for doing something to meet the views of the colliers, who are agitating for higher wages. Coal was influenced by the same cause. No orders could be placed for delivery into the new year at other than an advance of from 3d. to 1s. per ton, according to quality, upon the prices which a fortnight since have been mostly accepted.

The Coalmasters' Committee have resolved upon a revised basis of the subsisting wages sliding scale. They propose that from the 1st January, "when thick coal is 9s. per ton, the wages of thick-coal miners shall be 3s. per day, and thin-coal men 2s. 6d.; and that when thick coal is 10s. wages shall be, thick-coal men 3s. 4d. and thin-coal men 2s. 8d. per day." Instead, therefore, of a rise of 3d. and 1½d. respectively upon coal advancing 1s. per ton, the rise after the price has touched 9s. shall be 4d. and 2d. respectively, but when the price descends below 9s. the drop is to be only 3d. and 1½d. per day per 1s. per ton of coal. This revised scale was submittted to a deputation of colliers' agents, who on Wednesday waited upon Mr. E. Fisher-Smith, the chairman of the association at Dudley; and the deputation were understood to promise that they would recommend the revised scale to the adoption of their constituents.

The Commissioners and Arbitrators under the South Staffordshire Mines Drainage Act held a joint sitting in Wolverhampton on Tuesday, to make final the draft award for the Old Hill district proposed on the 7th November, when graduations were allowed to about nine firms. The full rate required was 3d. on fireclay and limestone, and 6d. on ironstone, coal, and slack. There were only two appellants. Mr. W. Bassano, a member of the Old Hill committee, began an appeal against the graduations allowed to seven out of the nine firms, but was ultimately induced to withdraw till next year, the Court ruling that the matter was one for the consideration of the arbitrators alone at the first appeal court on a new rate. Messrs. Skedmore, Webster, and Co.—the Eagle Colliery Company—appealed that their graduation to 4½d. should be further reduced to 3d., but were unsuccessful. The awards will probably be issued on the 16th inst.

The War-office have deposited at the Wolverhampton Chamber of Commerce samples of certain hardwares of which they are just now needing supplies.

Application for the loan of £50,000 wanted for gas undertakings in Smethwick has been made to the Local Government Board, and the reply received is that the department would cause an inquiry to be held with reference to the application, and that the details of the estimated expenditure would then be required. At a meeting of the authorities last Monday it was accordingly resolved to instruct Sir F. Bramwell to prepare the necessary information.

The Smethwick Corporation have decided to oppose the carrying out of the scheme of the London and North-Western Railway Company as to the suppression of certain level crossings at the rail way stations of Smethwick, and to prepare an alternative scheme, which, in the opinion of the local authorities, would meet the need more effectually.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Although the visit of royalty to Manchester during the past week tended for the time being to interfere somewhat with the ordinary course of business, the iron trade of this district has continued to develope an amount of activity, which gives increasing hopefulness to the prospect for next year. The improvement, both in the demand and in the upward movement in prices, is being so well maintained throughout as to leave little or no doubt that a good trade is being established on a thoroughly sound and healthy basis. During the week there has been a considerable business done, both in pig and manufactured iron, and prices have advanced all round.

Lancashire makers of pig iron have advanced their list rates 2s. per ton, and for delivery into the Manchester district their quotations are now 51s. per ton, less 2½ per cent., for both forge and foundry qualities. So far from this having checked business, large sales are reported at the advanced rates for delivery over the first three months of next year, and in forge iron local makers are now so fully sold that they have practically none to offer in the market. The tendency of prices is still upwards, and with a continuance of the present demand, a further advance at an early date is more than probable, whilst an increase of the output is also in contemplation, as not only is the whole of the make now going away, but heavy stocks which were previously held are being rapidly cleared off.

In Lincolnshire iron also considerable transactions are reported at prices averaging about 50s. to 50s. 6d. per ton less $2\frac{1}{2}$ delivered equal to Manchester, and makers are now asking an advance upon these figures of 1s. 6d. to 2s. per ton. The advanced rates have, however, not yet been actually realised upon any sales of importance, but makers are so well sold that they are indifferent about further orders at present, and for delivery into this district they are firm at 51s. 6d. to 52s. 6d. less $2\frac{1}{2}$ for forge and foundry qualities. Derbyshire makers who have recently been selling pretty heavily in Staffordshire have also gone up in their prices and in some cases are asking as much as 4s. to 5s. per ton above late rates; in fact there is very little Derbyshire at all now being offered in this market. The advance in the Lancashire and the more local brands is enabling Middlesbrough iron to come into this market more freely than of late, and in forge and foundry qualities business has been done at prices ranging from 50s. up to 52s. 4d. per ton net cash for delivery equal to Manchester.

The local finished iron makers all continue very busy, and in most cases are well sold for the next three or four months. Prices for all descriptions of manufactured iron are stiffer, and for delivery into the Manchester district the minimum quotations are now £7 per ton for bars, £7 10s. for hoops, £8 15s. for sheets, £8 to £8 10s. for common, and £9 10s. to £10 for best boiler plates. Merchants have also advanced their quotations during the week, and for bars the warehouse price is now £7 10s. per ton.

As the recent increased activity in the engineering trade has in no branch been more marked than amongst tool makers, a short description of the class of work at present in hand at some of the large establishments of this district will be of interest. During the past week I paid a visit to the well-known works of Messrs. Wm. Muir and Co., of Manchester, and there I had an opportunity of inspectlng a large number of both special and ordinary tools upon which the firm are at present engaged. Noticeable amongst the work in progress was an exceptionally massive lathe, specially designed for marine engine steel cranks and shafting. This machine, which was upon the point of completion and is the second of the kind made by Messrs. Muir, has a 54in. centre, a face plate of 9ft. diameter, with 48ft. length of bed, and a total weight of upwards of 70 tons. The lathe has quadruple gearing, four carriages, which act independently in any direction, and on the headstock are thirty changes so arranged that any change of gearing can be effected almost instantly. A considerable number of rivetting machines on McCall's patent are also being turned out by the firm, and one of these of more than ordinary massive construction contained one or two special features which I may just notice. These consisted of an arrangement for enabling the attendant to see from the gauge the amount of pressure given to each rivet, and in the machine being so laid out as to be easily adaptable for either light tank work or for heavy marine boilers. Another special tool in hand was a shaft lathe, which, although having only an 11in. centre, was of particularly heavy construction. In this machine the headstock is treble geared with a traverse to the carriage of three per inch, and it is designed to slide and finish a shaft at one cut. For boiler work a special tool was also being constructed for cutting out the oval man-holes, and also the circular holes in the front of the boiler for the furnace flues. Of milling machines, specially designed to supersede the slotting machines for circular and hollow work, there were a considerable number in hand. In these the chief feature was the patent cutter invented by Mr. Muir, by which the body of metal operated upon is reduced $\frac{3}{4}$in. in width, and 4in. in depth by one cut. This cutter differs from the ordinary tool for working on a 4in. surface, in that the teeth instead of being continuous are divided by a peculiar spiral groove, which gives a clearance to the teeth on both sides, and the cutting taken out instead of being in one length, is cut away in small $\frac{1}{4}$in. pieces. I may also add that this class of cutter is suitable for reamers, and as an evidence that amongst engineers the special arrangement of the teeth is regarded as based upon a correct principle, I may mention that a firm of marine engineers in the North of England who have one of the machines at work, now wish a machine to be designed on the same principle which is to work 18in. in depth. American milling machines are made of twice the weight of any as yet being constructed here, some of them going up to nine tons, but Messrs. Muir claim for their machines that, although so much smaller, they are, by the special arrangement of the cutter, enabled to get through very much more work; and certainly what I was able to see of the performance of the machines was in every way most satisfactory. Many other tools, presenting here and there some feature of novelty, were also to be found in going through the works; but with regard to these I need only at present notice an excellent feed motion arrangement, which I saw applied to several of the machines. In this a pawl and ratchet wheel, with a disc, is employed instead of the ordinary slotted lever and connecting rods; and the change of feed is effected instantly by the mere turn of a small handle, one or more teeth being taken off or on, as desired, by the action of the movable disc.

The colder weather of the last few days has imparted a little more activity to the house-fire coal trade, and there is not quite so much weakness in prices. Heavy stocks are, however, still held, whilst many of the pits continue on short time, and for prompt sales in quantity sellers are willing to take low figures. Common round coals for iron-making and steam purposes and engine classes of fuel are in fairly good demand. Prices at the pit mouth are about as under:—Best coal, 9s. 6d. to 10s.; seconds, 7s. 6d. to 8s.; common coal, 5s. 6d. to 6s. 6d.; burgy, 4s. 9d. to 5s. 3d.; good slack, 4s. to 4s. 3d.; and common, 3s. to 3s. 6d. per ton.

Shipping continues very quiet, and Lancashire steam coal is being offered, delivered alongside at Liverpool, at 8s. 3d. to 8s. 6d., and at the high level or the Garston Docks at 7s. 6d. to 7s. 9d. per ton.

For coke there is a good demand at late rates.

Barrow.—The demand for all classes of hematite pig iron remains strong, but business is slow, owing to the fact that on the one hand makers are disinclined to do business at present prices for forward delivery, as it is anticipated better prices will be secured next year. The arrangements already entered into for spring deliveries are very extensive, and it is more than probable that the foreign demand next year will swallow up more than half the output of the works in the district. Prices are quoted this week at the same rates as last week, No. 1 Bessemer being worth 62s. 6d. per ton at works, and No. 3 forge 60s. per ton.

In the steel trade no change can be noted in the demand, which is very full all round, nor in the general activity of the steel mills; but there are unmistakeable evidences that the business in the steel trade of the district next year will be very much increased, and makers are preparing for this in the new machinery which they are putting down at their works.

Shipbuilders are busy, and the new orders recently booked will be followed, it is expected, by others of some size and importance.

The construction of the new high-level bridge at Barrow, which is to connect the centre of the town with Old Barrow Island, is proceeding satisfactorily. The Corporation of the town have agreed to continue the bridge after it has crossed the railway into Duke-street. This will make a very important feature in the town when it is completed. It is proposed to pull down a large amount of old property in the neighbourhood of the bridge with the view of laying it out for shops, &c. The Corporation of Barrow have also determined to proceed with the erection of new municipal buildings at a cost of £50,000, Mr. W. H. Lynn, of Belfast, being the architect.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE returns of Sheffield trading with the States, when the year is concluded, will exceed the calculation I formed at the outset. The values for November again show an important increase, but it is noticeable that although the gross increase is £33,550, cutlery is actually less by £2681 than for the corresponding week of 1880. Steel exports are higher by £3649; but the great increase is really in steel rails and similar heavy goods, of which details are not supplied. The total exports for November were £98,849 13s. 3d., and these included £34,067 19s. 11d. on account of steel, and £20,387 11s. 5d. for cutlery. For the year the total value of exports to the States will not be less than £1,250,000. For the eleven months the value is £1,157,080. The Lincolnshire Iron Smelting Company, Limited—one of the most important companies in Lincolnshire now in the field—has just issued its ninth annual report. The directors state that owing to the iron trade being in a very depressed state from over-production, and the losses through bad debts being heavy, the directors damped down the furnaces on May 31st last. By a resolution passed at a general meeting of shareholders on 30th June, 1876, it was decided to issue debentures, and the chairman, Mr. S. J. Claye, agreed to take up or find money for a certain amount. This, the directors say, he did, and has advanced additional sums to enable the works to be carried on, but declines to make any further advances, as the indebtedness of the company to him is already very large. During the last few months the iron trade has considerably improved, and the directors think that if new capital could be introduced, there is every prospect of the concern becoming ultimately a success. "Unless this is done at once by the shareholders," the directors say, "the works must be disposed of." The total loss for the year is £10,586. The balance-sheet shows that the liabilities are £148,832, and the total deficiency is placed at £66,314.

A better state of things is reported from Rotherham, where the Northfield Ironworks have been worked to a profit of £1000 on the three months. This is the gratifying announcement made by the liquidator, Mr. G. W. Knox, Sheffield, to the debenture shareholders. At the commencement of the year an effort is to be made to reform the company.

A well-known trade mark, known as "hoop L"—the letter L encircled by a ring—is claimed as the exclusive property of the Baron Louis de Geer, manufacturer of Swedish iron. Messrs. Thos. Fuller and Sons, Norfolk Works, having purchased the baron's iron for a term of years, are enforcing their right to this mark, together with another in which the word "Leüfsta" is added to the L. A number of Sheffield manufacturers have combined to contest the case. As a matter of fact, the "hoop L"—without the word "Leüfsta"—has been struck off by Sheffield firms for a number of years.

There is no change to report in the heavy or light branches of trade from last week. The mills are fully employed on steel rails, armour-plates, boiler-plates, ship-plates, and similar goods; and in cutlery and general hardware, as well as silver and plated goods, there is a very brisk business doing. The orders for the Australian market are becoming exceptionally heavy.

A Sheffield manufacturer informs me that one result of the retrogression of the Transvaal is an increasing scarcity in Cape horns. The finest horns, which are used for hafting cutlery, are always procured from the Cape; but according to my informant, the supply of horn—which had increased during the brief British reign—has almost ceased. As a result the price has advanced 15 per cent.; and even at the higher quotations now current it is next to impossible to procure any supply.

The shareholders of Messrs. Vickers, Sons, and Co., Limited, River Don Works, Sheffield, were called together on Thursday, the 15th inst., to confirm the resolutions passed at a previous meeting. The result did not reach me in time for this letter, but as they were mainly asked to accept a £50 share for every £100 they held in the company—thus practically increasing the capital from £500,000 to £750,000—and all out of accumulated profits, and revaluations of works, there is no doubt they would willingly confirm such agreeable resolutions.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A STRONG and steady tone characterised the iron market held at Middlesbrough on Tuesday. Not very much business, however, was actually done, principally on account of a disinclination on the part of sellers to enter into contracts. Whatever iron was sold was for prompt delivery. Some smelters would sell for three months ahead at an advance of 3d. per ton on present prices, and others would commit themselves for the second quarter at an advance of 6d. per ton. Consumers were generally anxious to buy ahead as far as they could. Under these circumstances prices may be said to be easier for prompt delivery, but exceedingly stiff for forward delivery. Most of the business which was done was done by merchants.

The general price for No. 3 g.m.b. was 43s. 3d. f.o.b.; forge iron was about 9d. per ton less than No. 3.

It is not thought that stocks will be reduced much if at all at the end of the present month, as during the last week there will be a good deal of time lost owing to holidays, stock-taking, and so forth.

The foundry trade is decidedly slack, and in this respect quite out of harmony with the manufactured iron trade. This accounts for the gradually lessening difference between foundry and forge qualities of pig iron.

The price of manufactured iron advanced 2s. 6d. per ton. Plates are now sold at £7 per ton free on trucks Middlesbrough; angles are £6 10s., and bars about the same.

There is a considerable desire on the part of merchants to make contracts for manufactured iron for postponed delivery; makers are, however, very averse to enter into any such contracts, knowing by past experience that they tell against their interests in any case. For instance, if prices go up it is evident they might have done better by not selling; if they go down it is almost impossible to get specifications out of the merchants, who, at the same time, compete with them, and so run the prices down further. The trade in manufactured iron has therefore recently been mainly done direct between consumer and producer, that is, for consumption in this country; and for several weeks the quantities contracted for have been in excess of the quantities run off.

The coal trade is active, and the recent advance in price is maintained. A strong attempt has been made by certain speculative merchants to create an artificial scarcity in purple ore. They seem to act on the American principle of endeavouring to "corner" consumers. The price has in this way been run up from 8s. per ton f.o.t. Widnes, to 12s. There does not, however, appear to be any increase in consumption, or decrease of production, or increase of exportation, or in fact, any substantial reason for such a rise, and it is confidently expected that when the holders have to take delivery, a smart reaction in prices will set in. The present dearness of this material is causing consumers to look about for a substitute. The sellers of other ores, notably the better classes of hematite ore and pottery mine, see their advantage, and are introducing their commodities in various quarters, from whence they have long been excluded. At almost all the manufactured ironworks on the north-east coast red ore has now again come into use, after having been absent for many years.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

UP till the close of last week the Glasgow iron market continued very strong, and a large business was done at steadily advancing prices. The transactions effected were to a great extent of a speculative nature, but, nevertheless, the condition of the market was regarded as satisfactory. There has been a general belief that prices would continue upward for a considerable time, and iron has consequently been firmly held. At the beginning of the present week, however, a number of holders manifested a disposition to sell, and this had the effect of easing the market, and arresting the upward movement in prices. There is still, however a good business doing, and a steady demand for makers' iron on home account. The shipments, too, are somewhat better than they were last week, and the quantity of iron sent into store does not appear to have been so large. The stocks, of course, are still increasing, and are very heavy.

Business was done in the warrant market on Friday forenoon at from 53s. 6d. to 53s. 3d. cash, and 53s. 8d. to 53s. 6d. one month, the quotations in the afternoon being 53s. 5d. to 53s. 3d. cash, and 53s. 8d. to 53s. 6d. one month. On Monday the market was weak with business in the morning from 53s. 2d. to 58s. 1d. cash, and 53s. 3d. one month; the afternoon prices being 53s. to 52s. 6d. one month. The market was irregular on Tuesday with business at 53s. to 52s. $9\frac{1}{2}$d. cash, and 52s. $1\frac{1}{2}$d. to 53s. one month. The market was weak on Wednesday, and there was a relapse in prices to 52s. $1\frac{1}{2}$d. cash and 52s. 2d. one month. To-day—Thursday—the tone of business was quiet at about yesterday's rates.

As indicated above there is a good demand for makers' iron for home consumption, although America is now taking comparatively little pig iron. The demand from the Continent is fair. A considerable advance has taken place in the course of the week in the prices, which are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1. 61s. 6d.; No. 3, 53s.; Coltness, 62s. 6d. and 55s.; Langloan, 62s. and 53s.; Summerlee, 61s. 6d. and 54s.; Calder, 61s. and 54s. 6d.; Carnbroe, 56s. and 53s. 6d.; Clyde, 54s. and 52s.; Monkland, 55s. 6d. and 51s. 6d.; Quarter, 55s. 6d. and 51s. 6d.; Govan, at Bromielaw, ditto ditto; Shotts at Leith, 61s. 6d. and 55s.; Carron at Grangemouth, 53s. 6d. (specially selected, 56s.) and 52s. 6d.; Kinneil at Bo'ness, 53s. and 51s.; Glengarnock at Ardrossan, 55s. 6d. and 52s. 6d.; Eglinton, 53s. 6d. and 51s. 6d.

There is a very notable falling off on the imports of Cleveland iron into Scotland. Last week's shipments amounted to 6387 tons as compared with 13,253 in the corresponding week of last year.

The malleable iron trade continues very busy, and though no actual advance has taken place in prices since last report, makers are reported to be very firm. The steel works are doing a very good trade principally on home account, and locomotive engineers have recently obtained additional contracts.

The coal trade is but moderately employed at present, a large falling off is observable in the shipments, which are now, however, rather better than they were at this time last year. The severe weather which set in towards the close of last week was expected to give an impetus to the domestic consumption, which has of late been rather slack. The producing power of the collieries is much greater than is required, and stocks continue to accumulate. The prices of all sorts of coal are consequently easier.

At a meeting of the executive board of the Fife and Clackmannan Miners' Association, held in Dunmfermline on Saturday, it was reported that no reply had been received from the employers to the last request sent for an advance of wages, and it was resolved to take no further action in the matter in the meantime. A somewhat similar resolution has been adopted at a conference of the Ayrshire miners, held in Kilmarnock, and unless some very extraordinary and unlooked-for demand arises, the wages question may be regarded as laid to rest until next spring.

The foreign exports of gunpowder from the Clyde during November amounted to 200,000 lb., valued at £3865, as compared with 68,200 lb. in the same month of 1880.

All carriage traffic has been prohibited from passing over the new bridge at Ayr, in consequence of some defect in the foundations of the piers. This bridge was completed only about three years ago at a cost of £15,000.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

A MEETING in support of the Rhondda Valley and Swansea Bay line was held at Treherbert, a few days ago, when the engineer attended and gave a lucid explanation of the projected course. At the close it was decided to favour this line in preference to others and a subscription was started in aid.

The Taff Vale, Great Western, and Rhymney are the three competing lines for running into Merthyr and opening out connections with Cyfarthfa; but if the Rhymney get running powers on either, that will be all that will be required. It is scarcely likely that the shareholders of the line will sanction going in for separate powers.

The newly invented tram of Kirkhouse and Lewis, Treherbert, for sprinkling floors and sides of coal pits, and thus lessening explosions, meets with a great deal of attention, and a large number of visitors from distant collieries go to Treherbert Foundry to examine it.

The iron trade is in a healthy state. Prices are firm, and the production is large. In one case, that of Rhymney, this is specially noticeable. During last week over 3000 tons of steel ingots were made there. The mills, too, worked in thorough harmony with this, and in eleven shifts converted the whole of this into finished steel.

Rhymney not long ago bought its spiegel and its ganister. It is now thoroughly independent of all home or foreign, and this is shown by the fact that the reversing engines, 25in., were made at the works, others getting them from Belgium. The electric light is now brought into use at the mill, with capital effect.

Tredegar and Dowlais, Blaenavon and Ebbw Vale, are also busily employed, and the general activity noticeable in all branches has extended to the tin-plate trade, which begins at length to look much more encouraging. Latest market quotations:—I.C. ordinary coke plates, 17s. 6d. to 18s.; charcoals, 19s. to 21s., according to quality. This improvement has come too late to save the Gadlys Company. I see the whole of the plant, even to the office furniture, is to be sold next Monday and Tuesday.

I am glad to hear that Mr. Menelaus is recovering his health. All improvements of late are in abeyance on account of his illness, and it is much to be hoped that now he will soon be able to take active duty. Extension of coke ovens, addition of washing machines, &c., are amongst the suggested additions.

Extreme hardness of price is now characteristic of the steel market, and an advance in price seems so imminent that buyers are coming forward freely, and makers books are filling. In the Swansea district this is especially noticeable, and in the coal trade a steady improvement is setting in. During last week the shipments amounted to 17,430 tons against 9000 of the preceding week. The cause of the advance in quantity is the shipments to Ireland, which are steadily on the increase.

Cardiff and Newport coal shipments, foreign, have not been up to usual average, still a total of 135,000 tons of coal is recorded from all Wales, out of which Cardiff shipped 101,140 tons. Prices are very firm at Cardiff and Newport, and the falling off in shipping and lessened activity at the pits are due, not to a decline in the number of orders booked, but simply to the showery weather. This has told more seriously on the colliers than the public generally are aware of. At an important colliery last week the men only worked three days, solely in consequence of the storms delaying wagons. Another source of delay to coal shipments has been in the non-arrival of Bilbao vessels with iron ore, and this has told on the stocks at the several ironworks. This, however, is fast altering, and within the last few days important cargoes of ore have come to hand.

At the Birmingham conference of miners this week, Wales was represented, and it was stated there that adherents to the Union were increasing, and that dissatisfaction was felt with the sliding scale. I think this was not a fair expression of the opinion held in the district concerning the scale. So far it has been of considerable benefit to the colliers.

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.

6th December, 1881.

5320. Making Hats, R. Wallwork, Manchester.
5321. Printing Machinery, J. Salmon, M. Smith, and J. Hamilton, Manchester.
5322. Electric Accumulators, J. Imray.—(*J. Carpentier and Dr. O. de Fezer, Paris.*)
5323. Cutting Machines, W. Lorenz, Baden.
5324. Implement, &c., W. Saunders, Stepney.
5325. Steam Boilers, H. Sharp, Bolton.
5326. Washing Machine, A. Mill, Glasgow.
5327. Rivet Peg, J. Hewitt, Leicester.
5328. Pounding Rice, S. Pitt.—(*F. Brotherhood, U.S.*)
5329. Machine Embroidery, C. A. Barlow.—(*Messrs. Wetter Brothers, St. Gall, Switzerland.*)
5330. Combing Machines, B. Dobson and J. Macqueen, Bolton.
5331. Openers, &c., B. Dobson and T. Wood, Bolton.
5332. Feeding to Machines, J. J. Allen, Halifax.
5333. Locking Devices, A. J. Boult.—(*A. Ichl, France.*)
5334. Securing Ropes, H. McIntosh, Great Grimsby.
5335. Pillow-lace, W. R. Lake.—(*C. Jannig, Vienna.*)
5336. Protecting Respiration in Cold Atmospheres, E. Saunders, London.
5337. Holder, R. Burgess, Shepherd's Bush.
5338. Secondary Batteries, D. G. FitzGerald, Brixton, and G. H. Biggs and W. W. Beaumont, Strand.
5339. Checking Money, A. J. T. Wild, Peckham.
5340. Looms, J. Baird, Glasgow.

7th December, 1881.

5341. Lace Edging, R. J. S. Joyce, London.
5342. Temples for Looms, J. Hardacre, Leeds.
5343. Kilting, &c., Machines, G. Browning, Glasgow.
5344. Lubricant, &c., J. Accles & J. Scott, S. Shields.
5345. Cutting Cloth, &c., J. Gracey, Belfast.
5346. Target-trap, H. J. Haddan.—(*J. Reis, U.S.*)
5347. Scales, J. Post, Hamburg.
5348. Glycerine, W. Clark.—(*F. Armandy, France.*)
5349. Shearing Wool, T. R. Hutton, Manchester.
5350. Engines, C. W. Siemens, Westminster.
5351. Warming, &c., T. Rowan, London.
5352. Melting Composition, R. Corsham, London.
5353. Divining Rods, C. F. Varley, Bexley Heath.
5354. Indicating Speed of Shafts, P. Cardew, Chatham.
5355. Belt Fasteners, W. H. Steil, Battersea.
5356. Teaching Harmony, F. Clifton, Brixton, and J. N. Maskelyne, London.
5357. Grinding Corn, W. L. Wise.—(*A. and A. Mariotte and E. Boffy, Paris.*)
5358. Wheels, &c., W. Lake.—(*J. Friedlander, Berlin.*)
5359. Boots and Shoes, F. Richardson, Providence, U.S.
5360. Telephone Transmitters, E. Johnson, London.
5361. Nail Machines, J. Imray.—(*J. Coyne, U.S.*)
5362. Drying Agricultural Produce, E. Outram, Greetland, York.

8th December, 1881.

5363. Exhausting Apparatus, E. Dunn and J. F. Sleat, London.
5364. Organs, W. Sweetland, Bath.
5365. Self-closing Cocks, J. Barr, Kilmarnock, N.B.
5366. Extracting Nickel, W. Galbraith, Sheffield.
5367. Covering Conductors with Lead, W. R. Lake.—(*H. S. Maxim, Brooklyn, U.S.*)
5368. Photometer, J. Mucklow & J. Spurge, London.
5369. Car Trucks, J. N. Smith, New York, U.S.
5370. Packing Embroidery, F. W. Parker, London.
5371. Furnaces, J. Bisset, Glasgow.
5372. Paper Bags, F. D. Bumsted, Hednesford.
5373. Rabbit Trap, J. C. B. Fox, Brislington.
5374. Disengaging Boats, &c., W. Lowrie, Newcastle-on-Tyne, and J. A. Rowe, North Shields.
5375. Roundabouts, F. Savage, King's Lynn.
5376. Frames for Music, J. F. Walters, Bayswater, and J. H. Roseman, Soho.
5377. Water-closets, D. G. Cameron, London.

9th December, 1881.

5378. Looms, W. H., E., & J. Smith.—(*W. Talbot, U.S.*)
5379. Ventilating, J. C. Baker, Liverpool.
5380. Detaching Boats, E. Hill and J. Clark, London.
5381. Water-closets, D. Gill, Weston-super-Mare.
5382. Lighting, &c., Gas, F. Wirth.—(*C. Westphal, Germany.*)
5383. Rivetting Machine, T. Wallace, Dalmuir.
5384. Weaving, J. O'Neil, Lancashire.
5385. Telephones, G. W. Foster, London.
5386. Roller Mills, W. Thompson.—(*W. Gray, U.S.*)
5387. Steam Engines, H. B. Young, London.
5388. Cutting Sugar, J. M. Day, W. R. Green, and H. C. Walker, Falmouth-road, London.
5389. Metallic Alloys, G. A. Dick, London.
5390. Purifying Sewage, F. Petri, Berlin.
5391. Cesspools, W. R. Lake.—(*L. Mouras, France.*)
5392. Musical Sounds, J. O. Spong, London.
5393. Projectiles, R. H. Brandon.—(*B. B. Hotchkiss, France.*)
5394. Driving Velocipedes, R. H. Berens, Sidcup.
5395. Fire-arms, W. Tranter, Birmingham.
5396. Electric Lighting, C. F. Varley, Bexley Heath, Kent, and F. Varley, London.
5397. Heating Air, W. Whitwell, Stockton-on-Tees.
5398. Syringes, T. and W. J. Nicholls, London.
5399. Gas, J. Laycock and T. Clapham, Keighley.
5400. Electric Light Lamps, T. Rowan, London.
5401. Cutting Out Garments, W. P. Thompson.—(*M. A. Bornet, Dijon, France.*)

10th December, 1881.

5402. Tobacco, O. W. T. Barnsdale, Nottingham.
5403. Artificial Flowers, P. K. Klein.—(*G. Bittner. Munich.*)
5404. Covering Boilers, S. Schuman, Glasgow.
5405. Soft Metal Pipes, W. Cooke and D. Mylchreest, Liverpool.
5406. Decomposing Salt, J. G. Willans, London.
5407. Compounds for Electrical Insulators, W. Abbott and F. Field, London.
5408. Gas, J. F. G. Kromschröder, London.
5409. Indicators, C. I. and F. Edmonson, Manchester.
5410. Winding, &c., Cotton, W. Sumner, Preston.
5411. Spanners, B. Godfred and F. Brittain, Sheffield.
5412. Spinning Machinery, J. W. Smith, Bradford.
5413. Blow-pipes, F. Fletcher, Warrington.
5414. Scutching Machinery, E. Schenson, London.
5415. Sickle, C. H. Eden, Manchester.
5416. Absorbing Sulphurous Gases, F. Lyte, Putney.
5417. Ships, W. H. Marks, London.
5418. Electrical Apparatus for Trains, J. E. Liardet, Brockley, and T. Donnithorne, London.
5419. Locks, G. H. Chubb, London, and H. W. Chubb, Chislehurst.

12th December, 1881.

5420. Fire-arms, W. H. Beck.—(*F. C. Tassel, Paris.*)
5421. Truss-bars, S. Alley, Glasgow.
5422. Cardboard, H. J. Haddan.—(*D. Pequegnot et Roux, Lyons, France.*)
5423. Looms, G. Geissler, Kirkburton.
5424. Gas-stoves, E. A. Rippingille, Warwick.
5425. Curing Meat, &c., H. Lake.—(*A. Fowler, U.S.*)
5426. Cabs, A. Forder, Wolverhampton.
5427. Colouring Matters, J. A. Dixon.—(*Dr. C. Koenig, Germany.*)
5428. Burners, R. Brandon.—(*L. Sepulchre, Belgium.*)
5429. Gelatine, J. H. Johnson.—(*A. J. Huet. Paris.*)
5430. Telephones, A. W. Rose, London.
5431. Telephones, A. W. Rose, London.
5432. Telephones, A. W. Rose, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

5328. Pounding, &c., Rice, S. Pitt, Sutton, Surrey.—A communication from F. Brotherhood, Charlestown, U.S.—*6th December*, 1881.
5344. Lubricant, &c., J. G. Accles and J. D. Scott, South Shields.—*7th December*, 1881.
5346. Target Trap, H. J. Haddan, Kensington, London.—A communication from J. Reis, Cincinnati, U.S.—*7th December*, 1881.
5358. Wheels, &c., W. R. Lake, Southampton-buildings, London.—A communication from I. Friedlander, Berlin.—*7th December*, 1881.
5369. Car Trucks, &c., J. N. Smith, New York, U.S. *8th December*, 1881.
5393. Hollow Projectiles, R. H. Brandon, Paris.—A communication from B. B. Hotchkiss, Paris.—*9th December*, 1881.

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

4970. Sewing Machines, H. J. Haddan, Strand, London.—*5th December*, 1878.
4986. Shaking, &c., Yarn, S. Knowles, Tottington, near Bury.—*5th December*, 1878.
5058. Vacuum Brakes, J. Imray, London.—*10th December*, 1878.
5201. Working Brakes, G. Westinghouse, jun., London.—*18th December*, 1878.
5005. Filling, &c., Bottles, P. Lafeitte and J. Pia, Paris.—*6th December*, 1878.
5015. Working Iron and Steel, B. Hunt, Serle-street, London.—*7th December*, 1878.
5052. Closing, &c., Casks, F. H. Mort, Widnes.—*10th December*, 1878.
5060. Electric Light Regulators, A. V. Newton, London.—*10th December*, 1878.
5070. Fastening Wearing Apparel, E. H. Smith, London.—*11th December*, 1878.
5088. Preventing the Fouling of Ships' Bottoms, J. B. Hannay, Glasgow.—*12th December*, 1878.
5028. Alloys of Copper and Tin, C. D. Abel, London.—*9th December*, 1878.
5031. Fire-arms, M. Kaufman, London, and J. Warnent, Belgium.—*9th December*, 1878.
5048. Wood-working Machinery, M. Benson, London.—*10th December*, 1878.
5082. Screw Bolts, W. R. Lake, London.—*11th December*, 1878.
5126. Preventing the Formation of Blow-holes in Metal Objects, F. C. Glaser, Berlin.—*14th December*, 1878.
5127. Plating Metals, F. C. Glaser, Berlin.—*14th December*, 1878.
5167. Screw-cutting Machinery, W. R. Lake, London.—*10th December*, 1878.
5311. Charging and Discharging Gas Retorts, A. Q. Ross, Cincinnati.—*30th December*, 1878.
5036. Transferring Photographic Pictures, T. Pixis, Munich.—*9th December*, 1878.
5090. Destroying Insects, J. Wilson, Penrith.—*12th December*, 1878.
5111. Plaiting and Kilting Fabrics, J. Holroyd, Manchester.—*13th December*, 1878.
5137. Saving Life from Drowning, K. J. A. M. King, Victoria Park, London.—*14th December*, 1878.
5143. Concentrating Syrups, S. Pitt, Sutton.—*14th December*, 1878.
5145. Road Locomotive Engines, W. L. Holt, London.—*14th December*, 1878.
5193. Sewing Machines, S. Pitt, Sutton.—*18th December*, 1878.
5260. Roasting Copper, P. Spence, Manchester.—*24th December*, 1878.
5264. Mounting, &c., Guns, G. W. Rendel, Newcastle-on-Tyne.—*24th December*, 1878.
111. Screws, &c., C. W. Parker, Leeds.—*10th January*, 1879.
5076. Electro-magnetic, &c., Machines, J. H. Johnson, London.—*11th December*, 1878.
5110. Regulators for Electric Light, J. H. Johnson, London.—*13th December*, 1878.

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

4237. Discharging Air, J. J. Royle, Pendleton.—*9th December*, 1874.
4400. Centrifugal Pumps, W. Anderson, London.—*31st December*, 1874.
4227. Gas-burners, W. T. Sugg, Westminster.—*9th December*, 1874.
4236. Ageing Printed Fabrics, J. Thom, Chorley.—*9th December*, 1874.
4274. Compressing Oil Seeds, H. H. Ayre, A. S. Ayre, W. Chambers, and W. A. Ayre, Kingston-upon-Hull.—*19th December*, 1874.
4241. Sewing Machines, H. Bland, Luton.—*9th December*, 1874.
4261. Circular Braiding Machines, G. F. James, Salford.—*10th December*, 1874.
4281. Anchors, W. W. Smith, Newcastle-on-Tyne.—*12th December*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 30th December, 1881.

3365. Capping Tins, B. J. B. Mills, London.—Com. from H. K. and F. B. Thurber and Co.—*3rd August*, 1881.
3372. Ships' Berths, W. R. Lake, London.—A communication from J. H. Laskey.—*3rd August*, 1881.
3375. Traps for Sinks, C. Parker, Amberley.—*4th August*, 1881.
3389. Wire Hair Brushes, W. R. Lake, London.—Com. from J. A. Horton.—*4th August*, 1881.
3398. Roving Frames, G. P. Leigh, Manchester.—*5th August*, 1881.
3403. Treating Sugar, J. Duncan, Mincing-lane, London.—*5th August*, 1881.
3408. Bicycles, G. Strickland, Strada San Paolo, Malta.—*6th August*, 1881.
3412. Galvanic Batteries, T. Coad, South-street, Finsbury, London.—*6th August*, 1881.
3416. Cutting Stone, J. C. Vanlohe, Providence, U.S. Com. from P. Gay.—*6th August*, 1881.
3419. Feeding Bottles, H. G. Wells, Liverpool.—*8th August*, 1881.
3423. Actuating Musical Boxes, &c., J. G. Dudley, Carmarthen.—*8th August*, 1881.
3426. Locks, F. C. Glaser, Berlin.—A communication from F. Hasdenteufel.—*8th August*, 1881.
3430. Pumping Apparatus, A. Steirlin, Manchester.—A communication from Schläpfer and Sonderegger.—*8th August*, 1881.
3442. Liquid Rouge, C. D. Abel, London.—A communication from M. A. A. L. Lade.—*9th August*, 1881.
3460. Guns, J. Evans and R. Low, Dundee.—*10th August*, 1881.
3475. Umbrellas, &c., E. Posselt, Bradford.—A communication from F. Leitner.—*11th August*, 1881.
3476. Cutting Wood, C. F. Parsons, Hamilton-road, London.—*11th August*, 1881.
3490. Tell-tale Apparatus, L. V. Bunnen, Brussels.—*12th August*, 1881.
3502. Valve Gear, H. W. Pendred, Manchester.—*12th August*, 1881.
3514. Furnaces, W. R. Lake, London.—Com. from H. T. Litchfield and D. Renshaw.—*12th August*, 1881.
3563. Utilising the Power of Waves for Driving Machinery, W. Clark, London.—A communication from I. L. Roberts.—*16th August*, 1881.
3569. Registering Fares, A. J. T. Wild, Nunhead.—*17th August*, 1881.
3578. Boat Disengaging Gear, M. H. Robinson.—*17th August*, 1881.
3624. Controlling the Incursions of Locusts and other Insects, W. Clark, London.—A communication from A. Durand and C. Hauvel.—*19th August*, 1881.
3718. Sizing, &c., Materials, J. Wolff, Chapel-street, Manchester.—*25th August*, 1881.
3744. Bicycles, E. C. F. Otto, Peckham.—*27th August*, 1881.
3762. Autographic Transfers, A. M. Clark, London. Com. from J. J. Magne.—*29th August*, 1881.
3796. Lenses, A. M. Clark, London.—Com. from P. Collamore and N. Boyle.—*31st August*, 1881.
3828. Raising, &c., Gaseliers, M. Merichenski, Stainsby-road, London.—*2nd September*, 1881.
4287. Automatic Check Valve, M. Merichenski, Poplar.—*3rd October*, 1881.
4329. Projectiles, H. Simon, Manchester.—A communication from F. Vetterli.—*5th October*, 1881.
4427. Pipe Joints, E. G. Mawbey, Market Harborough.—*11th October*, 1881.
4624. Screw Presses, C. S. Mair, Glasgow.—*22nd October*, 1881.
4625. Furnaces, G. W. Clarke, San Francisco, U.S.—*22nd October*, 1881.
4666. Mincing Meat, &c., C. M. Sombart, Germany.—A communication from C. Hammer, sen., and H. Perschmann.—*25th October*, 1881.
4777. Electric Lamps, E. R. Prentice, Stowmarket.—*1st November*, 1881.
4808. Breech-loading Fire-arms, H. Simon, Manchester.—Com. from F. Vetterli.—*3rd November*, 1881.
4857. Dyeing, &c., Materials, W. R. Lake, London.—Com. from P. St. A. Basquin.—*5th November*, 1881.
4861. Permanent Way of Railways, J. Whiteford, Greenock.—*7th November*, 1881.
4868. Ships, J. Dickie, King William-street, London.—*7th November*, 1881.
4908. Weaving Carpets, J. S. and S. Smith, Glasgow.—*9th November*, 1881.
4909. Drawing-off Liquids from Vats, &c., J. Webster, Solihull.—*9th November*, 1881.
4979. Compositors' Rules, &c., J. C. Mewburn, London.—Com. from L. Johnson.—*14th November*, 1881.
5005. Velocipedes, E. J. Castle, Temple, London.—*15th November*, 1881.
5027. Firegrates, E. R. Hollands, Newington-green, London.—*16th November*, 1881.
5035. Bottling Aerated Waters, J. T. Hayes, Shernhall-street, Walthamstow.—*17th November*, 1881.
5051. Forming Grooves, C. H. Halcomb, Sheffield.—*18th November*, 1881.

Last day for filing opposition, 3rd January, 1882.

3335. Cranes, A. Barclay, Kilmarnock, N.B.—*2nd August*, 1881.
3418. Indicating Depth of Water, J. Dillon, Dublin.—*8th August*, 1881.
3427. Permanent Way, F. C. Glaser, Berlin.—A com. from A. Haarmann.—*8th August*, 1881.
3443. Absorbing Acid, C. D. Abel, London.—A communication from H. Precht.—*9th August*, 1881.
3451. Regulating Supply of Water, E. Lee, Torquay, and C. Moore, Deptford.—*9th August*, 1881.
3457. Permanent Way, C. Dunscombe, Liverpool.—*10th August*, 1881.
3464. Electric Brake, S. von Sawiczeski, Paris.—*10th August*, 1881.
3465. Graters, J. G. Thresher, London.—A communication from M. V. Bligh.—*10th August*, 1881.
3481. Rotary Pumps, C. Comstock, Wolverhampton.—*11th August*, 1881.
3503. Spinning Cotton, J. Seed, Preston.—Partly com. from T. Seed.—*12th August*, 1881.
3510. Horizontal Presses, C. Humfrey, Chester.—*12th August*, 1881.
3511. Treating Paraffin Scale, L. Hislop, Chester.—*12th August*, 1881.
3535. Cement, I. C. Johnson, Gravesend.—*15th August*, 1881.
3579. Protecting Ships, &c., B. L. Thomson, London.—*17th August*, 1881.
3589. Mounting Shafts, J. Tangye, Birmingham.—*17th August*, 1881.
3592. Barrels, W. Smedley, Burton-upon-Trent.—*18th August*, 1881.
3604. Brushes, S. Abraham, Manchester.—*19th August*, 1881.
3721. Rope Stopper, T. Edmond, Plymouth.—*25th August*, 1881.
3842. Shuttles, S. Tweedale, Accrington.—*3rd September*, 1881.
3862. Regenerative Kilns, J. Dunnachie, Lanark.—*6th September*, 1881.
3880. Revolving Armatures, W. R. Lake, London.—A com. from C. Dion.—*7th September*, 1881.
4037. Secondary Batteries, W. Clark, London.—A com. from N. de Kabath.—*19th September*, 1881.
4060. Discharge of Batteries, A. M. Clark, London. A com. from N. de Kabath.—*20th September*, 1881.
4274. Stowing Ships' Boats, I. A. Timmis, London.—*3rd October*, 1881.
4336. Treating Raw Hides, D. R. S. Galbraith, Edinburgh.—*5th October*, 1881.
4448. Electro-Magnets, J. Imray, London.—A communication from M. Stearns, jun.—*12th October*, 1881.
4450. Effecting Telephonic Communications, J. Imray, London.—A communication from J. M. Stearns.—*12th October*, 1881.
4638. Ventilating Enclosed Lamps, F. H. Smith, London.—*22nd October*, 1881.
4703. Axle-boxes, R. McIntosh, Dundee, and J. Wright, Kingston-upon-Hull.—*27th October*, 1881.
4849. Reducing Friction of Wheels, W. J. Brewer, London.—*5th November*, 1881.
4885. Insulating Electric Wires, W. C. Johnson and S. E. Phillips, Charlton.—*8th November*, 1881.
4897. Ageing Padded Materials, W. R. Lake, London.—Com. from P. St. A. Basquin.—*8th November*, 1881.
4906. Mules, &c., J. Chisholm and J. Clegg, Oldham.—*9th November*, 1881.
4927. Artificial Stone, E. de Pass, London.—A communication from R. H. Stone.—*10th November*, 1881.
4959. Conveying Grain, J. Higginbottom and O. Stuart, Liverpool.—*12th November*, 1881.
4966. Signalling, W. R. Lake, London.—A communication from J. B. Johnson.—*12th November*, 1881.
4990. India-rubber, I. Livermore, London.—*15th November*, 1881.
5015. Cooling Apparatus, J. F. Littleton, Battersea.—*16th November*, 1881.
5024. Bicarbonate of Soda, E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.—*16th November*, 1881.
5037. Grading Grain, W. Korth, Belfast.—*17th November*, 1881.
5058. Pneumatic Brake, G. Westinghouse, jun., London.—*18th November*, 1881.
5079. Cleaning Wire Ropes. M. W. Parrington and C. Almond, Sunderland.—*21st November*, 1881.
5080. Conducting Electric Currents, R. E. B. Crompton, London.—*21st November*, 1881.
5096. Electrical Commutators, W. R. Lake, London.—A com. from F. Blake.—*22nd November*, 1881.
5100. Rotary Engines, J. Patten, San Francisco, U.S.—*22nd November*, 1881.
5102. Lead, &c., Holders, J. H. Johnson, London.—A com. from J. Reckendorfer.—*22nd November*, 1881.
5159. Galvanic Batteries, R. E. B. Crompton, and D. G. Fitz-Gerald, Brixton.—*25th November*, 1881.
5221. Stopping Trains, &c., W. R. Lake, London.—A com. from W. C. Shaffer.—*29th November*, 1881.
5222. Ladies' Cloaks, &c., I. Lojda, New York, U.S.—*29th November*, 1881.
5265. Screws, W. R. Lake, London.—A communication from The American Screw Company (Incorporated)—*1st December*, 1881.
5328. Pounding Rice, S. Pitt, Sutton.—A communication from F. Brotherhood.—*6th December*, 1881.
5346. Target-trap, H. J. Haddan, Kensington.—A communication from J. Reis.—*7th December*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 9th December*, 1881.)

2527. Printing Surfaces, W. B. Woodbury, South ampton-buildings, London.—*10th June*, 1881.
2530. Drilling Rock, &c., G. F. Wynne, Minera, near Wrexham.—*10th June*, 1881.
2538. Electric, &c., Brakes, M. R. Ward, Heddon-street, London.—*10th June*, 1881.
2541. Spade Rifle, J. F. Fuller, Brunswick-chambers, Dublin.—*11th June*, 1881.
2542. Electrical Insulated Wires, &c., S. J. Mackie Peckham.—*11th June*, 1881.
2551. Straps and Bands, H. Studdy, Waddeton Court—*11th June*, 1881.
2556. Combing Machines, J. Carroll, Bradford.—*13th June*, 1881.
2563. Electric Lamps, G. G. André, Dorking, London. *13th June*, 1881.
2564. Locomotive Engines, J. R. Wigham, Capel-street, Dublin.—*13th June*, 1881.
2604. Cooking Eggs, W. H. Beck, Cannon-street, London.—*15th June*, 1881.
2616. Chimney-pieces, &c., G. Hodson, Loughborough.—*16th June*, 1881.
2657. Glass-holders of Lamps, &c., J. Gordon, Birmingham.—*17th June*, 1881.
2738. Treating Bessemer Metal, P. Jensen, Chancery-lane, London.—*22nd June*, 1881.
2745. Fibrous Animal Matter, E. Davies, Liverpool, and E. Massey, Dewsbury.—*23rd June*, 1881.
2752. Packing for Stuffing-boxes, F. des Vœux, London.—*23rd June*, 1881.
2754. Reservoir Pens, W. R. Lake, London.—*23rd June*, 1881.
2764. Stalls for Cattle, W. S. Hunter, Belville.—*24th June*, 1881.
2778. Steam Generators, W. Cooke and D. Mylchreest, Liverpool.—*25th June*, 1881.
2782. Secondary Batteries, H. E. Newton, London. *25th June*, 1881.
2788. Obtaining Light by Electricity, B. J. B. Mills, London.—*25th June*, 1881.
2806. Sheep-shears, W. E. Gedge, Strand, London.—*25th June*, 1881.
2859. Treating Gas, J. E. Dowson, Westminster.—*30th June*, 1881.
2915. Breech-loading Fire-arms, C. D. Abel, London.—*4th July*, 1881.
2929. Elastic Bulb Syringes, J. A. Grant, Ottawa.—*5th July*, 1881.
3190. Fittings for Electric Lamps, R. H. Hughes, London.—*21st July*, 1881.
3276. Adjusting Swing Looking-glasses, C. E. Bulling, London.—*26th July*, 1881.
3424. Gearing, &c., G. M. Cruickshank, Glasgow.—*8th August*, 1881.
3438. Self-levelling Berths, B. J. B. Mills, London.—*8th August*, 1881.
3448. Axle, &c., Boxes, J. Hooley, Macclesfield.—*9th August*, 1881.
3717. Cotton Cloths, J. Winter and T. Ivers, Farnworth.—*25th August*, 1881.
3740. Tanning Hides, G. L. Loversidge, Rochdale.—*27th August*, 1881.
3760. Sewing Machines, H. Bland, Luton.—*29th August*, 1881.
3776. Horse-shoe Nail Blank Forging Machines, S. Pitt, Sutton.—*30th August*, 1881.
3845. Moulding Bottles, A. M. Clark, London.—*3rd September*, 1881.
4133. Purifying Gas, L. T. Wright, Beckton.—*26th September*, 1881.
4147. Roasting Coffee, &c., W. R. Lake, London.—*26th September*, 1881.
4420. Telephonic Apparatus, S. Pitt, Sutton, Surrey.—*11th October*, 1881.
4445. Screws, &c., W. R. Lake, London.—*12th October*, 1881.

(*List of Letters Patent which passed the Great Seal on the 13th December*, 1881.)

2571. Looms, J. Pickering, Batley, York.—*14th June*, 1881.
2601. Leggings, &c., I. Frankenburg, Salford.—*15th June*, 1881.
2602. Copying Presses, J. Mitchell, Sheffield.—*15th June*, 1881.
2610. Securing Metal Boxes, W. Downie and W. F Lotz, London.—*15th June*, 1881.
2613. Velocipedes, A. L. Bricknell, Brixton.—*16th June*, 1881.
2633. Window Blinds, S. Hodgkinson, Manchester.—*16th June*, 1881.
2637. Cigarettes, &c., H. Black, London.—*16th June*, 1881.
2643. Garden Syringes, &c., F. Cooper, Handsworth.—*17th June*, 1881.
2650. Sewing Books, G. Brown, Glasgow.—*17th June* 1881.
2654. Book-cases, W. T. Rogers, West Dulwich.—*17th June*, 1881.
9674. Type Composition, I. Delcambre, Brussels.—*18th June*, 1881.
2681. Lamps, F. R. Baker, Birmingham.—*18th June*, 1881.
2700. Roller Mills, M. Benson, London.—*20th June*, 1881.
2797. Treating Fuel, S. Lloyd, Birmingham.—*25th June*, 1881.
2817. Lamps, &c., W. R. Lake, London—*27th June* 1881.
2972. Looms, W. Atherton, Preston.—*7th July*, 1881.
2990. Gas Engines, C. and C. T. Linford, Leicester.—*7th July*, 1881.
3043. Bicycles, &c., G. J. T. Barrett, London.—*12th July*, 1881.
3292. Fastening Doors, A. Sclanders, London.—*27th July*, 1881.
3304. Protecting Iron, &c., F. S. Barff, Kilburn, and G. and A. S. Bower, St. Neots.—*28th July*, 1881.
3674. Locomotives, &c., C. D. Abel, London.—*23rd August*, 1881.
3792. Steel, C. W. Siemens, Westminster.—*31st August*, 1881.
3884. Boots and Shoes, T. Laycock, Northampton.—*7th September*, 1881.
3970. Perambulators, &c., G. Asher, Birmingham.—*14th September*, 1881.
3996. Twisting Cotton, A. Yates, Derby.—*16th September*, 1881.
4022. Torpedo Boats, &c., A. Yarrow, Poplar.—*19th September*, 1881.
4330. Knitting Machine Needles, W. R. Lake, London.—*5th October*, 1881.
4660. Belt-pulleys, G. Pitt, Sutton.—*25th October* 1881.

List of Specifications published during the week ending December 10th, 1881.

3978*, 4d.; 4973, 2d.; 1857, 2d.; 1864, 6d.; 1896, 2d.; 1915, 2d.; 1924, 6d.; 1932, 2d.; 1936, 2d.; 1941, 6d.; 1946, 2d.; 1954, 4d.; 1957, 4d.; 1959, 6d.; 1969, 2d.; 1975, 2d.; 1977, 6d.; 1978, 6d.; 1980, 2d.; 1981, 4d.; 1982, 6d.; 1983, 2d.; 1985, 2d.; 1986, 2d.; 1987, 2d.; 1990, 2d.; 1991, 6d.; 1992, 2d.; 1993, 2d.; 1996, 4d.; 1997, 2d.; 1998, 4d.; 1999, 2d.; 2000, 6d.; 2002, 4d.; 2003, 8d.; 2005, 4d.; 2006, 6d.; 2007, 2d.; 2008, 4d.; 2012, 2d.; 2013, 2d.; 2014, 6d.; 2015, 2d.; 2019, 2d.; 2020, 6d.; 2021, 2d.; 2022, 2d.; 2024, 6d.; 2025, 6d.; 2026, 6d.; 2027, 6d.; 2028, 6d.; 2029, 2d.; 2031, 2d.; 2032, 2d.; 2033, 6d.; 2034, 2d.; 2035, 4d.; 2036, 6d.; 2037, 2d.; 2038, 6d.; 2039, 6d.; 2040, 4d.; 2041, 8d.; 2042, 2d.; 2043, 6d.; 2044, 2d.; 2047, 2d.; 2048, 4d.; 2050, 4d.; 2051, 6d.; 2053, 2d.; 2054, 6d.; 2055, 6d.; 2056, 6d.; 2057, 2d.; 2058, 2d.; 2059, 2d.; 2060, 6d.; 2061, 6d.; 2062, 6d.; 2063, 6d.; 2064, 2d.; 2066, 6d.; 2067, 2d.; 2068, 6d.; 2069, 6d.; 2070, 6d.; 2071, 2d.; 2072, 6d.; 2073, 2d.; 2074, 2d.; 2076, 2d.; 2077, 4d.; 2079, 2d.; 2084, 6d.; 2085, 4d.; 2086, 6d.; 2087, 6d.

2088, 6d.; 2089, 2d.; 2090, 2d.; 2091, 6d.; 2092, 2d.; 2093, 6d.; 2094, 2d.; 2095, 4d.; 2096, 8d.; 2098, 2d.; 2100, 2d.; 2101, 6d.; 2103, 4d.; 2104, 2d.; 2105, 2d.; 2106, 10d.; 2111, 6d.; 2112, 2d.; 2114, 6d.; 2118, 6d.; 2129, 6d.; 2145, 6d.; 2183, 6d.; 2190, 6d.; 2239, 6d.; 2255, 6d.; 2253, 6d.; 2730, 2d.; 3007, 8d.; 3041, 6d.; 3885, 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.*

1857. DRYING AND CURING FISH, &c., *H. Susmann.—29th April*, 1881.—(*Not proceeded with.*) 2d.
This consists of an apparatus in which the fish or other substance is dried by means of the fumes from coal or coke, which do not come in contact with the fish, the colouring and finishing being afterwards effected by means of the fumes of sawdust and wood acting directly on the fish.

1864. VELOCIPEDE OR MONOCYCLE, *J. E. Hatch.—29th April*, 1881. 6d.
The wheel is of sufficiently large diameter to permit the rider to sit within it, the seat being below the axle. The driver works treadles on an axle carrying a chain wheel, from which motion is transmitted to the wheel axle.

1896. SEPARATING THE LIME AND MAGNESIA IN DOLOMITE, *S. Cliff.—2nd May*, 1881.—(*Void.*) 2d.
This consists in the separation of the lime and magnesia contained in dolomite, by employing the differences in the specific gravities of the different salts or combinations of lime (calcium) and magnesium respectively. The dolomite is mixed with sulphuric acid or any natural sulphate or sulphide, so as to form sulphate or sulphide of calcium. The magnesia being heavier than the sulphate or sulphide, falls down first, and the sulphate or sulphide afterwards. The latter is then removed by suitable means.

1915. WHITE ZINC PIGMENTS, *W. R. Lake.—3rd May*, 1881.—(*A communication from J. Crawley.*)—(*Void.*) 2d.
This relates to the manufacture of white zinc pigment for use as paint and for other purposes, and consists essentially in an admixture of precipitated sulphide of zinc, or precipitated sulphide of zinc and precipitated sulphate of barium or calcium, or both, with oxide of magnesium prior to ignition or calcination of the mass.

1924. PREPARATION AND DRYING OF MATRICES USED FOR CASTING STEREOTYPE PLATES, *J. E. Taylor, P. Allen, W. Evans, and D. Braithwaite.—4th May*, 1881. 6d.
The material on which the type has been impressed is, while still in its damp state, removed and dried by means of a strong air current or blast, either alone or in combination with a heated plate.

1932. WEAVING BROCADED AND OTHER FANCY ARTICLES, *T. Stevens.—4th May*, 1881.—(*Void.*) 2d.
This relates to the production by weaving of brocaded, embroidered, or figured articles to be used as substitutes for printed Christmas and other cards, or as screens and bannerets.

1936. CUTTING OR DIVIDING CHEESE, BREAD, &c., *J. Richardson.—4th May*, 1881.—(*Void.*) 2d.
This relates to an instrument consisting of a blade with handles, sliding in vertical guides connected to a table or tray, on which the material to be cut is placed.

1941. FASTENING OF TIRES TO RAILWAY WHEELS, *A. Longsdon.—4th May*, 1881.—(*A communication from A. Krupp.*) 6d.
The rim of the wheel is on the inner or flange side provided with a hook-formed rim which hooks into or over, or abuts against a dovetailed or otherwise suitably formed part of the tire, and on the other side of the rim there is a lip flange which is rivetted over, and there is in addition thereto or for further assisting this rivetted part a number of slanting screws.

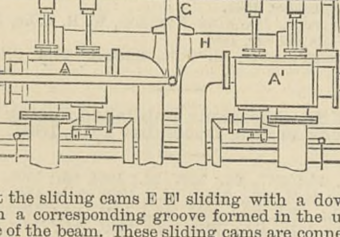
1946. REGISTERING, CHECKING, AND MEASURING THE FARES ON PUBLIC VEHICLES, *T. Wilson.—4th May*, 1881.—(*Void.*) 2d.
A series of dials corresponding in number to the places in the vehicle are capable of being set in motion by the travelling wheels, so as to indicate the distance travelled by each passenger, suitable mechanism being provided to add together the whole of the fares taken.

1954. SLIDING WINDOWS OF RAILWAY CARRIAGES, TRAMCARS, &c., *P. Attock.—5th May*, 1881. 4d.
In order to prevent the windows jarring, and also to exclude draughts, a bar is applied to the upper framework, and is shaped and arranged so that its upper edge constantly presses against the fixed frame whilst its lower edge presses against the upper sash of the window when closed, such bar being forced towards the sash by means of springs.

1957. SULPHURIC ACID, *W. Weldon.—5th May*, 1881. —(*A communication from F. Benker and H. Lasne.*) 4d.
This relates to means of reducing the loss of nitrous compounds, which occurs in the manufacture of sulphuric acid, and it consists in transforming the nitric peroxide contained in the chamber gases into compounds absorbable by strong sulphuric acid by the chemical reaction upon the nitric peroxide of sulphurous acid gas aided by vapour of water and free oxygen.

1959. VALVE GEAR FOR STEAM ENGINES, *R. H. Robinson.—5th May*, 1881. 6d.
The valve boxes A A¹ carry a beam B on which are side guides C, in which work loops D¹ D² D³ D⁴ on the valve rods; within these loops are rollers that bear

1959



against the sliding cams E E¹ sliding with a dovetail base in a corresponding groove formed in the upper surface of the beam. These sliding cams are connected by links F to one and the same lever G, receiving reciprocating motion from any convenient part of the engine in such manner as to cause the cams E E¹ by their motion to correctly operate the admission and exhaust valves at each end of the steam cylinder H, that is to say, by the motion in one direction the cam E by means of its surface *e* lifts the admission valve at D¹, while the cam E¹ by its surface *e*³ lifts the exhaust valve at D⁴, and by the motion in the other direction the cam E¹ by means of its surface *e*² lifts the admission valve at D³, while the cam E by means of its surface *e*¹ lifts the exhaust valve at D².

1969. DARK LANTERNS AND SIGNAL LAMPS, *A. N. Hopkins.—6th May*, 1881.—(*Not proceeded with.*) 2d.
This consists of an inner shield capable of being revolved, so as to conceal the light; its removal being effected by means of a spring when released by pressing on a button above the handle.

1975. METALLIC CASES OR BOXES FOR NEEDLES, &c., *G. W. Hinchley.—6th May*, 1881.—(*Not proceeded with.*) 2d.
The box consists of an outer and an inner case, the latter open at one side to receive and withdraw the needle. Within the outer case is a combined spring strap fastening and releaser or pusher.

1977. TILLAGE OF LAND BY STEAM, *F. H. P. P. Oram.—6th May*, 1881. 6d.
A machine similar to a traction engine is mounted on four wheels, the fore carriage being pivotted for turning, and at the hind part is suspended a horizontal disc with plates or blades at its periphery, which when the disc is caused to revolve rapidly operate upon the soil.

1978. SWEETMEATS, *S. P. Wilding.—6th May*, 1881.—(*A communication from Thiele and Holzhause.*) 6d.
This relates to the manufacture of sweetmeats of an elongated spherical form, so that they will have a perfectly smooth and polished surface without seam or ridge, and it consists principally in the use of three rollers, two having grooves of the required outline, and between each of which grooves is a circular disc knife serving to cut off the sweetmeats in lengths, and the third roller, situated between and below the other two, is also grooved in corresponding positions to the knife edges. These three rollers compress and roll the pieces cut off into elongated spheroids.

1980. PORTABLE BED, *E. Edwards.—6th May*, 1881.—(*A communication from H. Strauss.*)—(*Not proceeded with.*) 2d.
The bed is divided by transverse seams so as to fold up, and one side of it is covered with india-rubber, and the other with woollen cloth. To its edges blankets are sewn, which, when crossed over, are secured by buttons and button-holes. The bed is supported by a rest or trestle capable of folding up.

1981. CORNICE POLES *G. Giles.—7th May*, 1881. 4d.
The pole is tubular, and has a slot along its underside. Within it is a second pole with a right-handed screw on one half and a left-handed screw on the other. Upon the inner pole are runners, the two leaders only having a tooth fitting into the screw, while all of them have an eye projecting through the slot in the outer pole and receiving the curtain hooks. The inner pole is caused to revolve in either direction by means of a cord passing over a pulley.

1982. SMOOTHING IRONS, *T. McCracken.—7th May*, 1881. 6d.
This relates to irons heated by gas or vapour mixed with air, and consists of an outer shell and an inner chamber forming a receptacle for the gas, and also a lower chamber for its combustion.

1983. STOVES AND FIRE RANGES, *B. J. Pollard.—7th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to the application of protected air passages to ensure a proper distribution of air to the fuel in the stove.

1985. LAUNDRY BOILERS, &c., *L. J. Groves.—7th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to means for causing a rapid circulation of the liquid in the boiler, and consists of a small conoidal metallic nozzle secured by a flange to the bottom of the boiler. A small steam pipe with cock is attached to the underside in direct communication with the nozzle, so that a jet of steam is blown through it, and has the effect of heating and generating a rapid and strong upward current in the water.

1986. TOILETTE VINEGAR, *H. J. Allison.—7th May*, 1881.—(*A communicaton from E. Redarès and L. Bouviez.*)—(*Not proceeded with.*) 2d.
Vinegar is poured on to a number of different roots, leaves, flowers, &c., previously crushed, the whole being thoroughly mixed and exposed to the heat of the sun for ten or fifteen days.

1987. SPINNING AND DOUBLING COTTON, &c., *F. Coulthard.—7th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to ring spinning and doubling frames, and consists, First, in means for facilitating the operation of starting a fresh set of empty bobbins after the full bobbins have been doffed; and Secondly, to the application of a guard or cup to the bolster of the spindles, so as to receive the oil thrown off by the bobbin.

1990. FIRE ALARM, *E. de Pass.—7th May*, 1881.—(*A communicatiion from La Société Lebacq and Kretz.*)—(*Not proceeded with.*) 2d.
A quick match, when ignited by fire, causes the explosion of a fuse, which by suitable mechanism drives a fly-wheel, to which the striker of a gong is attached.

1991. UMBRELLAS, *H. A. Davis.—7th May*, 1881. 6d.
This relates chiefly to means for securing the ribs to the stick, and it consists of a tubular rib-holder having in it a series of recesses to receive heads formed on the ends of the ribs. A second tube secures the heads of the ribs within the recesses.

1992. BOLTING REELS FOR DRESSING MEAL, *T. Sheldon.—7th May*, 1881.—(*Not proceeded with.*) 2d.
A series of sets of arms, each consisting of three equidistant radial arms connected to a boss, are mounted on a slightly inclined shaft, and all connected by bars of wood, over which the silk or wire cloth is stretched, thus forming a triangular reel. Weights are arranged to slide on rods, so as to give a succession of blows upon the silk or wire.

1993. FASTENINGS FOR LIDS OF MILK CANS, &c., *E. G. C. Bomford.—7th May*, 1881.—(*Not proceeded with.*) 2d.
The lid is hinged, and on its upper side a plate is pivotted, and to it a second plate is hinged and has a glazed opening over a slot in the under plate. A short lever is jointed to the side of the can, and its top end is turned over so as to project over the pivotted plate, while the lower end is turned inwards, and presses against the side of the can.

1996. HOLDING HATS, COATS, UMBRELLAS, &c., *M. Conrath.—7th May*, 1881. 4d.
The stand is of ordinary form, but in place of pegs to receive the hats, two or more cross-bars are so arranged that when the back part of the rim is placed under one rail the hat rests on the top of the next rail.

1997. CIGARETTES, *F. Hipgrave.—7th May*, 1881.—(*Not proceeded with.*) 2d.
The tobacco is placed in a hopper terminating in a tube, from which, as the tobacco issues in a continuous length, wheels convey it to a forming chamber, where it is cut into lengths and enveloped with paper.

1998. SPECULUM TUBES, *J. H. Aveling and J. J. Hicks.—7th May*, 1881. 4d.
This relates to speculum tubes of glass, silvered on the outside, and protected by a coating of elastic gum, and it consists in carrying the protecting coating to within a short distance of the entrance end of the tube, leaving the glass tube uncovered for such short distance, and the end of the tube is smoothed by polishing or fusing it.

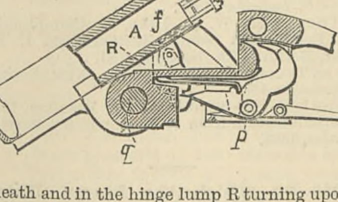
1999. WATERPROOF BOOTS AND SHOES, *W. R. Lake.—7th May*, 1881.—(*A communication from G. Spencer.*)—(*Not proceeded with.*) 2d.
This relates to a boot or shoe having a leather sole and in sole, and a middle sole of waterproof canvas or duck, and an upper of duck, combined with a wool skin interior, the waterproof duck serving to keep the feet both warm and dry.

2000. WROUGHT IRON WINDOW FRAMES, *E. Edwards.—9th May*, 1881.—(*A communication from E. A. Schütz.*) 6d.
This relates to the formation of window sashes from wrought iron bars rolled to such sectional shape that they can very simply and readily be put together and fixed in place.

2002. PENCILS AND PENHOLDERS, *E. Wolff.—9th May*, 1881.—(*Not proceeded with.*) 4d.
This relates to the application of a swivel to one end of the pencil or penholder, by means of which it may be secured to the person by a cord or chain so as to prevent it being mislaid.

2003. BREECH-LOADING FIRE-ARMS, *W. W. Greener.—9th May*, 1881. 8d.
This relates partly to the method of throwing out or ejecting the fired cartridge case from single or double drop-down guns, &c., and is an improvement on Needham's patent No. 1205, dated 7th April, 1874. The exact position of the ejectors is indicated by dotted lines *f*, the barrels A having one or two lumps R

2003



underneath and in the hinge lump R turning upon the centre pin *q* the ejectors are pivotted, then by making use of a shorter breech action the centres *q c p* are so arranged that the barrels A drop of their own weight, and without any assistance from the breech action, lever, or bolts in connection therewith. Other improvements are shown and described.

2005. PAPER, CLOTH, &c., FOR TRACING PURPOSES, *W. T. Harvey.—9th May*, 1881. 4d.
This consists essentially in thoroughly permeating the paper or other material with boiled linseed oil or other drying oil, benzine being used to move all traces of unchanged or non-drying oil from the paper.

2006. CORKING BOTTLES, *J. P. Jackson.—9th May*, 1881.—(*A communication from C. Duché.*) 6d.
The machine is constructed so that the cork to be inserted is pressed from several sides, and the operator sits in front. In the vertically reciprocating trunk is a slot in which is a roller held in a stirrup working through a guide hole in the frame. A double cam on each side of the trunk also holds a roller fixed to the end of a lever fulcrumed in the middle. These levers carry a flat or curved block at the end. The stirrup carries a block with a groove at the end corresponding to a groove in the blocks, such grooves forming a round hole, a continuation of the hole through which the cork is forced.

2007. ILLUMINATING GAS, *J. L. Walker and J. W. Jowett.—9th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to means for allowing the gas as carbonised, or made in the retorts, to have a free and uninterrupted passage to the hydraulic "foul mains," the sealing of the dip of the pipes being only used to prevent escape and waste of gas during the time the lid of the mouthpiece of the retort is removed. The ordinary dip of the dip pipe in the tar and liquor in the hydraulic main is dispensed with, and in two or more of the dip pipes a trough containing tar and liquor is mounted in slings or by guide rods, a lever and chain being so connected with such rods and trough that when the lid of the mouthpiece of the retort is removed the trough is raised so as to seal the lower ends of the dip pipes.

2008. PREPARATION OF BEVERAGES FROM EXTRACT OF LIQUORICE, *B. Hunt.—9th May*, 1881.—(*A communication from Y. F. Marchier.*) 4d.
Liquorice root is crushed and placed in vats of water and macerated for about twelve hours, when the water is withdrawn and boiled, then filtered and treated with dilute sulphuric acid. The precipitate from this operation is washed in boiling water to remove excess of acid and other foreign matters, and is afterwards used to produce beverages, by mixing with carbonate of soda and adding suitable flavourings.

2012. HOISTING AND LOWERING APPARATUS, *H. Haddan.—9th May*, 1881.—(*A communication from A. Guérolt and A. Blondel.*—(*Not proceeded with.*) 2d.
This relates more particularly to apparatus to be used as a fire-escape, and consists of telescopic supports carrying a cradle capable of being moved up and down chains, and suitable winding gear.

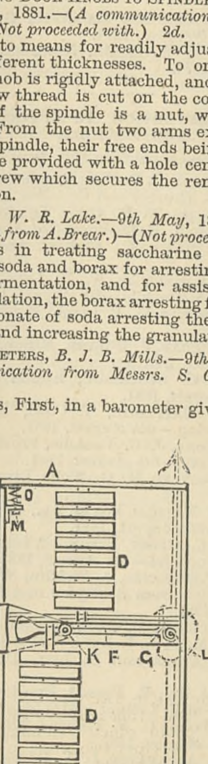
2014. SCALES FOR WEIGHING, *Dr. O. Gerike.—9th May*, 1881. 6d.
The scales can be used for domestic and business purposes. The scoop is carried by a frame working vertically between friction rollers which work in centres between brackets on the inside of the case. A descending tongue from the frame rests with its rounded bottom part on a block fastened in the loop of a flexible metal band passing over a curved part of a crook-shaped lever on each side, and united by pins and eyes. The levers under the curved part are supported on knife edges, and carry, on their descending inward, bent ends, each a weight. The scoop frame has a rack gearing with a pinion, the axle of which carries a pointer moving over a suitably graduated dial.

2015 SECURING DOOR KNOBS TO SPINDLES, *W. R. Lake.—9th May*, 1881.—(*A communication from W. H. Gonne.*)—(*Not proceeded with.*) 2d.
This relates to means for readily adjusting handles to doors of different thicknesses. To one end of the spindle one knob is rigidly attached, and at the opposite end a screw thread is cut on the corners, and on an extension of the spindle is a nut, which engages such screw. From the nut two arms extend, one on each side the spindle, their free ends being connected by a cross-piece provided with a hole centrally tapped to receive a screw which secures the removable knob to the extension.

2019. SUGAR, *W. R. Lake.—9th May*, 1881.—(*A communication from A. Brear.*)—(*Not proceeded with.*) 2d.
This consists in treating saccharine liquids with bicarbonate of soda and borax for arresting the acidification and fermentation, and for assisting and increasing granulation, the borax arresting fermentation, and the bicarbonate of soda arresting the acidification and assisting and increasing the granulation.

2020. BAROMETERS, *B. J. B. Mills.—9th May*, 1881.—(*A communication from Messrs. S. Guichard and Co.*) 6d.
This consists, First, in a barometer giving large in-

2020



dications, of the combination of two groups of barometric chambers D independent of each other, and acting on each side of the pivot K of a lever F; Secondly, in the combination of two or several groups of barometric chambers, and of the lever upon which they act, with a toothed segment G and a pinion L or their equivalent, transmitting to the indicating hand or pointer the oscillations of the lever; Thirdly, in the combination with the acting parts of a movable side A of the box or other movable piece with a spring O and a screw M or their equivalent.

2021. SLIDING WINDOW SASHES, *E. V. Harris.—9th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to means for enabling sliding windows to be cleaned from the inside, and consists in making the sash reversible by dividing the stiles, so that the side portions which usually slide in the grooves of the window frame are separate from the sash, which is pivotted or hinged thereto, so that it may be swung over or reversed for cleaning.

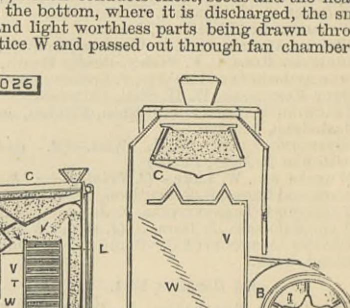
2022. CHAIRS, *T. Harrison and C. W. Garthwaite.—9th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to chairs in which the seat is hinged, so as to be capable of being turned upwards, and it consists in forming an opening or "sneck" in the seat, into which the back enters when the seat is turned up, and thus holds it in its raised position. A bar is placed under the chair to receive a hat.

2024. BOOTS, *M. Nicolson.—9th May*, 1881. 6d.
This relates to a cavalry boot capable of being easily taken off when the foot is damp or warm, and yet fits properly when on, and it consists in forming a slit or cut on the inner side of the boot, starting from the middle line in front of the ankle. The arc or flap so formed is turned back over the opposite side of the boot, and a strap or pad is placed over the vacant space and also over the arc, and is sewn round the edges of the hole in the boot. A kind of bellows-like valve is thus formed, which as the foot is introduced or withdrawn yields to the pressure of the instep. The end of the strap is brought round to the other side of the boot and fastened by a buckle, while the other end terminates in a slip to receive the inner spur stud.

2025. ELLIPTIC SPRINGS FOR CARS, &c., *A. M. Clark.—9th May*, 1881.—(*A communication from B. S. Clark, E. K. Righter, and E. Cliff.*) 6d.
This consists in an elliptical spring which, when bent into the required form, has at all times the greatest amount of steel in the centre, both lengthwise and sidewise, and the sides or edges of which are of the same thickness from end to end of the centre bar; also in "pounding" out from the end of the bar the "eye," so that the eye and bar are of one and the same piece.

2026. SEPARATOR AND SMUTTER MACHINE, *H. E. Kratz.—10th May*, 1881.—(*Partly a communication from M. Deal.* 6d.
This consists, First, in the arrangement of receptacle V in combination with the wide air chambers L and T, and horizontal scouring cylinder B, into which all the offal is precipitated, and containing a slotted shute V, which conducts cheat, seeds and the heavier part to the bottom, where it is discharged, the smut dust, and light worthless parts being drawn through the lattice W and passed out through fan chamber U

2026



Secondly, the scouring cylinder case is formed with overlapping slots so as to provide an effective scouring surface and afford instant escape of dust to receptacle V. The blades of beaters I are perforated, and they act upon the grain and convey it from end to end of cylinder, the grain passing by centrifugal action into a scattering box K, with numerous offsets which distribute it in the second air chamber L, where it is again acted upon by suction. The passage between separating chamber and fan can be regulated by a sliding valve. The riddle C is driven by belt in combination with an excentric so as to give it a smooth, even motion

2027. APPARATUS OR RINK FOR SLIDING UPON AND FACILITATING THE MOVING OF HEAVY ARTICLES, *H. Langsford.—10th May*, 1881. 6d.
This relates to a surface made up of series of rollers mounted so as to revolve freely on spindles, and placed at a sufficient distance apart to enable the rollers of the next row to enter the spaces between them. Upon this surface people may skate or slide along in a similar manner to sliding upon ice.

2028. WATERPROOF CANVAS, SAIL CLOTH, &c., *G. and W. H. Good.—10th May*, 1881. 6d.
The thread from which the canvas is to be made is dressed, previous to being woven, in the following manner:—The threads are first boiled in an alkaline solution, and then passed through a solution consisting of 60 lb. beeswax, one gallon linseed oil, 2 lb. india-rubber solution, 6 lb. gutta-percha solution, 10 lb. resin, 24 lb. palm oil, 30 lb. prepared tar, and one gallon pure crude oil.

2029. CHEQUES, &c., *R. Murray.—10th May*, 1881.—(*Not proceeded with.*) 2d.
This consists in the application of sensitive marking paper over the cheque, and which has only to be removed by the payee of the cheque.

2031. PRESSING HORN AND HOOP FOR THE MANUFACTURE OF COMBS, &c., *D. Stewart.—10th May*, 1881. 2d.
This consists in the application of a combination of steam and cold water pipes for heating and cooling alternately plates of a very fine smooth metal, between which the sheets of horn are placed, the plates being first heated by steam, and then hydraulic pressure applied, after which they are cooled by water.

2032. TREATMENT OF CALF SKINS, *L. A. Groth.—10th May*, 1881.—(*A communication from P. Bernard.*)—(*Not proceeded with.*) 2d.
The skins are intended to be used for making military collricks and spencers, instead of making them of seal or Astrachan skins. The calf skins are lightly tanned by placing them for two days in a bath composed of 100 litres water, 6 kilogrammes salt, 6 kilogrammes alum, and 1 hectogramme oil of vitriol. After this they are placed in a mordant bath for four hours, and finally through a black die bath.

2033. SOLE PLATES AND HEEL TIPS FOR BOOTS, *M. and R. Rlack.—10th May*, 1881. 6d.
The sole plates are made up of from four to six sections placed transversely on the sole, and consisting of malleable cast iron plates of an open or skeleton form, each secured by screws, the heads of which enter countersunk recesses in the plate. The heel tips consist of a malleable cast iron open or skeleton framework, secured in the same manner.

2034. AUTOMATIC FOG SIGNAL APPARATUS, *H. Whitehead and T. Dodd.—10th May*, 1881.—(*Not proceeded with.*) 2d.
This relates to fog signal apparatus for use on railways, and consists of a bar to be acted upon by the first wheel of an engine, so as to lower it and cause a cross shaft to partially revolve and elevate a weight in a bell crank, and thus cause the slackening a chain,

whereby a balance weight on a T-lever comes into action, and through connecting rods and bell cranks causes two detonators to be placed on the rail, and the wheel passing over them will explode the same.

2035. TREATING IRIDIUM, &c., *W. P. Thompson.—10th May, 1881.—(A communication from J. Holland.)* 4d.

The object is to fuse, mould, and prepare iridium in order that it may be used in the mechanical arts wherever a hard, non-wearing, non-corrosive substance is needed; and it consists in fusing and moulding iridium by raising the metal to a high temperature, then adding phosphorus, and after the metal is cast releasing the phosphorus by subjecting the metal to heat in a bath of lime, chalk, or other absorbent. To adapt it for pen points and other small objects, the phosphuret of iridium is poured out on to metal plates heated and formed with fine ribs, so as to form a network on grooves in the metal, which can then be broken into pieces of the required shape and size.

2036. TICKET DELIVERY APPARATUS FOR PASSENGERS, &c., *J. J. Mielecki.—10th May, 1881.* 6d.

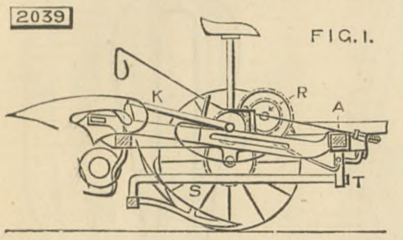
This consists of a series of piles of tickets of different values, the bottom one of each pile being pushed forward by a pusher when required, a bell at the same time being sounded.

2037. DRYING, ROASTING, &c., *H. J. Haddan.—10th May, 1881.—(A communication from B. H. Potter.)—(Not proceeded with.)* 2d.

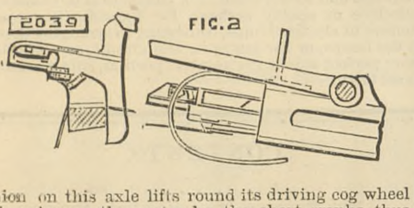
This consists of an oven in which a suitable screw can revolve, and which is surrounded by flues from a fireplace.

2039. MACHINERY FOR GATHERING AND BINDING CUT CROPS, *G. A. Walker.—10th May, 1881.* 6d.

The invention has for its object the gathering and binding of sheaves after an ordinary reaper, or the binder may be otherwise applied, that is to say, it may be attached to a reaper. The machine has two wheels carrying an oblong frame A, to the front beam of which is hung, supported at one end, a trailing rake S, reaching to the backward part of the machine. The



teeth of this rake run underneath the sheaf to be bound, and the rake meets all irregularities of the ground by working or lifting on the forward centres T. An intermittent revolving axle passing across or near the centre lengthwise of the frame A carries projecting arms K of suitable length, which lift the corn to be bound up the trailing rake S about to a level with the top of the frame A. This intermittent revolving axle may be carried at each end by short cranks. A



pinion on this axle lifts round its driving cog wheel R, hanging on the centre by the short cranks, thus allowing the intermittent revolving axle to rise in case the arms K should strike the ground while revolving. Fig. 1 is a side elevation of the apparatus, and Fig. 2 an elevation partly in section showing the binding mechanism.

2040. ARTIFICIAL STONES OR COMPOSITIONS, *P. Jensen.—10th May, 1881.—(A communication from E. J. Erichsen.)* 4d.

This relates to the combination of pulverised asbestos with various silicious solutions and with metallic or other colours or pigments, and according to requirements, with plaster of Paris, chalk, lime, clay, sand, or other loading material, to produce anew material of the nature of stone or enamel.

2042. ROOT-CUTTING MACHINES, &c., *J. Hornsby and J. Money.—10th May, 1881.—(Void.)* 2d.

This relates to the machine for cutting roots known as "Gardner's," and it consists in fixing to the underside of the barrel a plate or bars, which serve as guides to prevent uncut portions of the root falling from the surface of the barrel, and direct them round and up again into the hopper.

2043. CONVEYING HEAT AND POWER TO A DISTANCE, &c., *W. T. Whiteman.—10th May, 1881.—(A communication from J. Newton.)* 6d.

This relates to the supply of heat and power from a central source to public and other buildings by generating and distributing through mains a suitable agent, and conveying it to interior apparatus in the buildings, such as engines, radiators, ranges, and the like, for producing motive power and heat for warming, cooking, &c. One method consists in the use of saturated steam, and another in the use of water heated in boilers under pressure and conveyed thence n mains.

2044. FIREGRATES, *W. Clapham.—10th May, 1881.—(Not proceeded with.)* 2d.

This consists in making the bottom of the grate adjustable by means of a rack and pinion, so as to regulate the height of fire.

2047. COMPOUND FOR REMOVING HAIR FROM SKINS OF HUMAN BEINGS AND OF ANIMALS, *J. Blumm.—10th May, 1881.—(Not proceeded with.)* 2d.

The compound consists of mona sulphide of barium, flour, starch, and orris root powder, or alkanah root powder, to which water is added to form a paste, which is applied to the part where the hair is required to be removed.

2048. MAKING JOINTS FOR SHEET METAL ARTICLES, *M. Benson.—10th May, 1881.—(A communication from A. H. Fancher.)—(Complete.)* 4d.

A suitable soldering material is interposed between the folded edges of an interlocking sheet metal joint, so that after such joint is formed the solder enclosed within it may be melted by heat applied externally.

2050. TRAM RAILS, *W. Sterling.—11th May, 1881.* 4d.

The head of the rail is rolled in one piece and the foot and web in two similar pieces of angle iron, between which the head is inserted, and the whole then bolted together.

2051. HATS RESEMBLING FELT, &c., *J. H. Neave.—11th May, 1881.* 6d.

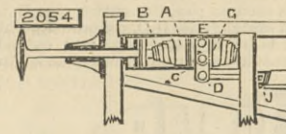
Shapes of buckram, calico, or other woven, felted, or other material is covered with water-proof varnish or other adhesive substance, and flocks or other short stapled material, such as wool, cotton, silk, or fur, is blown thereon. The flocks are then pressed on by hydraulic or screw pressure, or by ironing.

2053. PRODUCTION IN STEEL OR IRON OF PATTERNS OR DESIGNS FROM COPPER MATRICES, *J. H. Noad.—11th May, 1881.—(Not proceeded with.)* 2d.

The copper or other matrix is placed in a bath consisting of a saturated solution of an iron salt, muriate of ammonia, and boracic acid. This solution is diluted with an equal bulk of water, and the matrix is placed therein, and treated in the ordinary way of electrotyping, when a coating of iron will be deposited thereon.

2054. RAILWAY BRAKES, &c., *H. H. Duke.—11th May, 1881.* 6d.

The invention relates, First, to brakes actuated by compression of the buffers consequent on the retardation of the tractive power, and consists of spring A, placed in cylinder B, in which is a piston C connected to arm D. The cylinder B is capable of moving in



cylinder E, behind which is a spring G. The arm D is connected to brake block J. The invention relates, Secondly, to the application of a toothed disc to the wheel axle, and a metallic piece operated by cord or lever is capable of engaging with the teeth so as to stop the rotation of the wheel.

2055. LOOMS, *E. Wilson.—11th May, 1881.* 6d.

This relates principally to the arrangement of dobby or jacquard mechanism, and consists in attaching the upper and lower staves of the healds by means of cords to the upper and lower ends respectively of flat vertical slide rods, to which an up-and-down motion is imparted by levers operated by a double cam wheel on tappet shaft. The levers at one end are supported on pivots, the opposite ends having anti-friction rollers entering a pair of grooves in the cam wheel. On each lever near the tappet shaft is a grid, answering the purpose of the ordinary "knife." The slide rods, to which the healds are connected, pass through the two grids on the upper and lower lever, each rod having a pair of notches placed so that as the grids approach each other at each revolution of the tappet shaft, the entire set of slide rods is brought in line with one another. To each slide is rivetted a hook, to catch on to the grids. An ordinary card barrel acts upon these hooks.

2056. DRIVING AND DRAWING TACKS, *W. R. Lake.—11th May, 1881.—(A communication from G. J. Capewell.)* 6d.

The main tube of the driver is formed in sections, and held together by elastic pressure, and within it works a plunger. Near the bottom of the main tube are two feed tubes, which deliver the tacks into the main tube below the plunger. The tacks drawer consists of two plates forming a bifurcated jaw, between which is pivotted a single jaw with a rearward extension to act as a fulcrum.

2057. MAGNETIC COMBS, *J. M. Richards.—11th May, 1881.—(A communication from P. H. Drake.)—(Not proceeded with.)* 2d.

This consists in combining a permanent magnet with the comb.

2058. PREPARATION OF PETROLEUM, &c., *S. Pitt.—11th May, 1881.—(A communication from P. Dittmar.)—(Not proceeded with.)* 2d.

This consists in mixing from 3 to 5 per cent. of common soap, either alone or mixed with ozokerit, with crude petroleum heated to 150 deg. Cent., whereby on cooling the petroleum will solidify, when it can be more easily transported. The distillation of such mass is effected directly by heating to a high temperature.

2059. PRODUCING DESIGNS UPON MARBLE, &c., *A. Guattari.—11th May, 1881.—(Not proceeded with.)* 2d.

This relates to machines for producing designs in relief on marble by means of the percussive action of moulds, the surface of which is covered with fine pyramidal teeth to render the percussive action effective for removing the stone from the intaglio portions of the design, this action being still further assisted by the abrasive action of emery powder introduced by means of water between the mould and the surface to be carved.

2060. WINDOW-CLEANING CHAIR, &c., *A. M. Clark.—11th May, 1881.—(A communication from M. A. Dormitzer.)* 6d.

This consists in the combination with a platform, folding guards, supports, steps, and braces, of improved devices to secure the chair in position on the sill and in an open or folded position.

2061. PRODUCING AND REVIVIFYING ANIMAL CHARCOAL, *D. A. Fyfe.—12th May, 1881.* 6d.

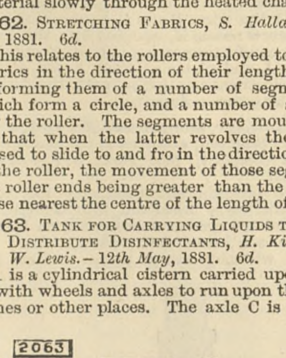
The object is, First, to manufacture and revivify animal charcoal suitable for sugar refining; and Secondly, to carbonate and manufacture soda ash, carbonise wood, and other substances to produce charcoal for sanitary and other purposes, and it consists in the use of a self-acting retort of rectangular form with double chambers set in brickwork and heated by fireplace and flues carried beneath them, an endless chain with scrapers being employed to move the material slowly through the heated chamber.

2062. STRETCHING FABRICS, *S. Hallam.—12th May, 1881.* 6d.

This relates to the rollers employed to stretch woven fabrics in the direction of their length, and consists in forming them of a number of segments, a set of which form a circle, and a number of such sets forming the roller. The segments are mounted on a shaft so that when the latter revolves the segments are caused to slide to and fro in the direction of the length of the roller, the movement of those segments nearest the roller ends being greater than the movements of those nearest the centre of the length of the roller.

2063. TANK FOR CARRYING LIQUIDS TO LAY DUST OR DISTRIBUTE DISINFECTANTS, *H. Kirkhouse and H. W. Lewis.—12th May, 1881.* 6d.

A is a cylindrical cistern carried upon the framing B, with wheels and axles to run upon the tram rails in mines or other places. The axle C is shown double-



cranked, from which the pumps D are driven. E is a circular discharge pipe fixed at one end, and F F are straight pipes fitted at both sides, which pipes are perforated and supplied with the liquid from the pumps. G is the ordinary air chamber of the pumps for the purpose of causing a regular supply of liquid. The pumps are fitted with balance relieving valves and stop-cock, so that the liquid can be worked through the pumps and back into the tank without forming a jet or spray in case it should not be required.

2064. DRIVING GEAR OF TRICYCLES, &c., *S. H. Saxby.—12th May, 1881.—(Not proceeded with.)* 2d.

The band or chain which communicates motion from the crank passes over two cones, so that by shifting it the speed can be varied.

2066. CARBURETTING AIR, *W. P. Thompson.—12th May, 1881.—(A communication from F. Chavée.)* 6d.

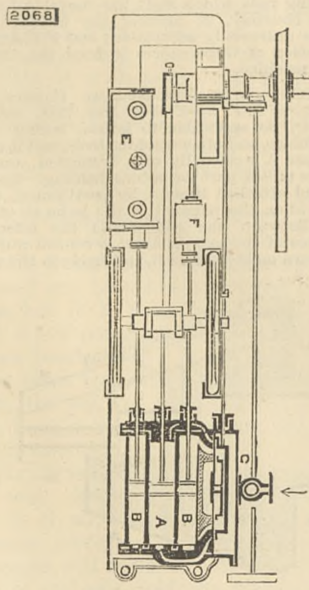
The apparatus consists of an aspirator furnishing air in regulated quantities, the regulation being effected by clockwork or other governing mechanism. The aspirator furnishes air to the carburetters where it is carburetted by contact with gasoline.

2067. LAWN TENNIS BATS, &c., *W. P. Thompson.—12th May, 1881.—(A communication from R. Gordon.)—(Not proceeded with.)* 2d.

This relates to means for regulating the tension of the gut strings, and consists in a movable slider which receives the longitudinal strings, and can be re-adjusted by means of a screw.

2068. STEAM ENGINES, *J. H. McFerran and W. Rennie.—12th May, 1881.* 6d.

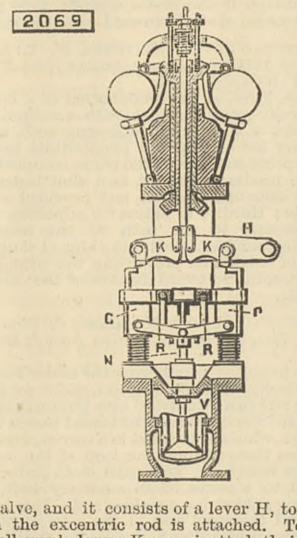
The high-pressure cylinder A is placed within the low-pressure cylinder B, the former having an ordinary piston and the latter an annular piston. The slide valve C is actuated from crank shaft, and is arranged to work in common relation to both cylinders. The



condenser E is operated by one of the low-pressure piston-rods, and the force pump F is worked by the other. The supply valves of the low-pressure cylinder also serve as the exhaust valves for the high-pressure cylinder.

2069. EXPANSION GEAR OF STEAM ENGINES, *C. Pieper.—12th May, 1881.—(A communication from W. R. Proell.)* 6d.

This relates to liberating expansion gear—that is, to means for disengaging the parts which transmit motion from the excentric to the admission or expan-



sion valve, and it consists of a lever H, to the end of which the excentric rod is attached. To the lever two bell-crank levers K are pivotted, their horizontal arms being jointed to the sliding governor rod by means of links, while their vertical arms act on sliding pieces G connected by levers R to valve rod N. Springs act on the pieces G so as to close valve V when the crank levers K cease to act on them.

2070. STOPPERING BOTTLES, *J. J. Broadbridge.—12th May, 1881.* 6d.

A hollow tube of hard wood is placed within the neck of the bottle, and at its lower end is fitted a valve connected to a rod, by pressing down which the valve w be opened, to allow the bottle to be emptied.

2071. CORKING MACHINES, *A. Weir.—12th May, 1881.—(Not proceeded with.)* 2d.

A vertical bar moves in guides, and is counterbalanced by a weight and chain, and operated by a treadle. To its upper end is fixed a block capable of sliding on the frame, and having a pair of inclined prongs. The driver or ram to act on the cork is fixed in the block, and on the frame is a box with part to compress each cork before being driven into the bottle.

2072. TREATMENT OF THE DATE FRUIT, *T. F. Henley.—12th May, 1881.* 6d.

Whole dates are placed on removable trays within a close oven containing tubes partly filled with water, and which are continued outside the oven into a flue or chamber, where they are heated by a furnace. The dates so treated are browned by a dry heat, and retain all the nutritive properties, and they are afterwards employed to prepare food beverages.

2073. INDICATING THE PRESENCE OF FIRE-DAMP IN MINES, &c., *H. J. Haddan.—12th May, 1881.—(A communication from L. Somzee.—(Not proceeded with.)* 2d.

Two metallic plates, bands, or wires of different capacity of dilatation, and rendered susceptible to slight variations of temperature, are placed in connection with an electric current, which, at a certain temperature, will give alarm by ringing a bell. For indicating the presence of fire-damp, the pressure of such gas is allowed to act upon the surface of mercury, and, by raising its level, complete an electric circuit, and so ring an alarm.

2074. PACKING FOR THE STUFFING-BOXES OF ENGINES, *W. W. Whiteman.—12th May, 1881.—(A communication from Defalque and Co.)—(Not proceeded with.)* 2d.

The packing consists of rings of rectangular section made of metallic wire and inserted in the stuffing-boxes conjointly with rings of cotton, hemp, or other fibrous material, steeped in tallow or grease mixed with alum and talc and wound round with cotton, string, hemp, or thread.

2076. TRANSMITTING MOTION AT VARIABLE RATES AND POWER, *J. F. Hoskins.—12th May, 1881.—(Not proceeded with.)* 2d.

This relates to imparting pressure by means of a body, to which a rectilinear reciprocating motion is imparted, the transmitted force being comparatively rapid at its commencement, increasing in energy as its motion declines, or *vice versâ*, and it consists in giving the reciprocating body the form of a wedge.

2077. AXLE-BOXES, *G. E. Vaughan.—12th May, 1881.—(A communication from H. Christin.)—(Not proceeded with.)* 2d.

The axle-box has two lugs, by which it is keyed into the nave of the wheel. Between the axle and the box is a series of rollers, the ends of which are supported by rings connected together by rods.

2084. CAPSTANS, *B. C. Scott.—13th May, 1881.* 6d.

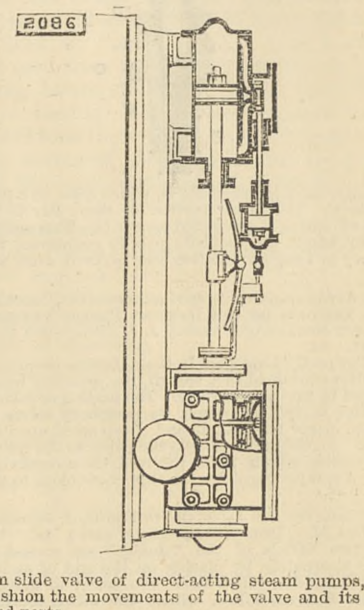
The object is to form a capstan suitable for vessels of small tonnage, such as yachts, &c., and it consists of a circular bed secured to the deck and forming the path or support for a capstan block. In its centre is a hole to receive the capstan spindle on which the truncated capstan block is mounted, its under side being fitted with balls placed in recesses and resting on the circular bed. On the top end of the spindle a lever is mounted, and carries pawls gearing with a ratchet wheel on top of the capstan block, which may thus be driven by imparting a reciprocating movement to the lever.

2085. ARRANGEMENT OF PROJECTIONS FOR OBTAINING SPACES IN APPARATUS FOR THE MANUFACTURE OF GAS, *S. and J. Chandler.—13th May, 1881.* 4d.

The object is to effect the better and more accurate maintenance of spaces or channels between sheets of iron or clusters of such material which are used in the purification of gas from ammonia and other impurities, and between which spaces or channels the gas to be purified has to pass, and it consists in stamping sheets of iron on both sides in such a manner that projections are formed, which, when the sheets are placed together, coincide, and coming in contact they maintain the bodies of the plates at fixed distances apart.

2086. STEAM PUMPS, *F. and S. Pearn and T. Addyman.—13th May, 1881.* 6d.

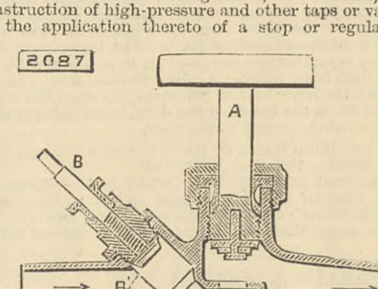
This consists in the combination of a small steam cylinder, or of two cylinders, with ports, slide valve, and piston, or pistons, arranged to actuate the main



steam slide valve of direct-acting steam pumps, and to cushion the movements of the valve and its connected parts.

2087. HIGH-PRESSURE REGULATING TAPS OR VALVES, *G. Osborne.—13th May, 1881.* 6d.

This consists in the arrangement, combination, and construction of high-pressure and other taps or valves by the application thereto of a stop or regulating



valve, such as B B', the stem of such valve being placed on the upper side or upon the same side as the stem of the ordinary valve A A' of such taps or valves, in order to afford greater convenience for regulating or cutting off the flow of fluids through such taps or valves.

2088. CONVEYING INTELLIGENCE FROM OR TO VESSELS, *J. M. B. Baker.—13th May, 1881.* 6d.

The apparatus employed consists of a spherical, cylindrical, or oval vessel, preferably of india-rubber, and within it is placed a tube to receive the message, such tube being closed by a suitable stopper. The vessel is inflated by means of air tubes, so that it will float on the surface of the water.

2089. VELVETS, *J. Newton and J. E. Harrison.—13th May, 1881.—(Not proceeded with.)* 2d.

This relates to pile velvet, the object being to obtain a close and erect pile, and also to secure the pile more fully so as to produce a fabric having a fast pile. Only one binding pick is used, but the arrangement of the pile causes it to be well tied in.

2090. LOCKING BOTTLE MOULDS, *W. Arthur and R. W. Smyth.—13th May, 1881.—(Not proceeded with.)* 2d.

The object is to lock and securely hold bottle moulds during the blowing process, and it consists in a collar suspended over the mould by a lever caused to oscillate on the frame, and operated so that the closing of the mould causes the collar to fall over it and thus clasp the mould securely.

2091. GAS, *J. Keith.—13th May, 1881.* 6d.

This relates to apparatus for the manufacture of gas from oil, and consists of a special arrangement of two or more retorts over the same fire, being protected from the direction of the fire, and having over them a special arrangement of brickwork to retain the heat and bring the gas and flames all over the top. The invention further relates to the construction of the washer and cooler, the former being provided with a flat corrugated spreader on the end of the pipe from the retort, which causes the gas to be more completely washed. The cooler consists of a series of pipes, the ends of which dip into water, and through which the gas is caused to travel until it is thoroughly cooled.

2092. HARVESTING AND SHEAF-BINDING MACHINES, *J. Miller.—13th May, 1881.—(Not proceeded with.)* 2d.

A longitudinal platform is fitted over the side of the framing, and between it and the opposite side is a transverse bar on which is fitted a set of curved prongs extending forwards and downwards to the ground and adjustable by a chain. A transverse platform is fitted at the back behind the centre shaft of the prongs, and on to which the sheaf is gathered by an oscillating rake in front, the teeth of which pass through the lower guide prongs. The binding of the sheaf is effected by a long bent binding arm provided with twine and suitable mechanism to form the same into a knot after it has been passed round the sheaf.

2093. Corn Mills, &c., *A. T. Chattaway.—13th May* 1881. 6d.

This consists in arranging the mill stones so that the running stone may be driven at any velocity, and this is effected by making the running stone the lower one, and fixing it in a frame vertically adjustable; the stone is fixed to a central spindle passing upwards freely through the top stone. The lower end of the spindle is turned to work in a toe brass in the bottom bar of the frame, and the upper end in a step in the top bar. The top stone is hung on a universal joint. The stones can be adjusted vertically relatively to each other by making the frame telescopic.

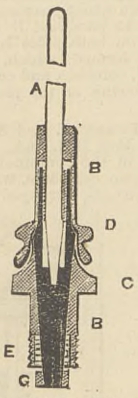
2094. Tuck-pointing Walls, *W. N. Bunday.—13th May*, 1881.—*(Not proceeded with.)* 2d.

This relates to an apparatus for laying the plastic material evenly along the wall, and it consists of a cylinder containing a plunger actuated by a spring, which forces out the material into the groove of a wheel which is run along the wall.

2095. Spinning Fibres, *S. Tweedale.—13th May*, 1881. 4d.

This relates to the construction of spindles so as to counteract the tendency to lateral motion and vibration by reason of the bobbin and yarn not being equally balanced round its axis. A is the spindle, and

2095



B its collar having a shoulder D, which rests on a face on base C. The lower portion of the collar is by means of spring E connected to nut G. This spring and joint admit the requisite play to counteract the tendency to irregular rotation and make it even and true.

2096. Apparatus for Supplying Adhesives, Colours, or Varnish, or for Damping Paper, Veneers, Sheet Metals, or Fabrics, *J. J. Allen.—13th May*, 1881. 8d.

A roller partly immersed in the adhesive or colouring matter contained in a trough, the quantity being regulated by means of a valve. The pasting or colouring roller is spiked around its periphery so as to draw the paper between it and a cap acted upon by springs. A guide plate directs the paper to the roller, after passing which it is received on a receiving plate. A scraper regulates the supply of colour to the roller.

2098. Dobbies and Jacquard in Looms, *J. Garstang.—13th May*, 1881.—*(Not proceeded with.)* 2d.

The two barrels of the "dobby" are caused to revolve alternately by placing on the end of each a disc with spokes, which allow one barrel to move a portion of a revolution whilst the other remains stationary.

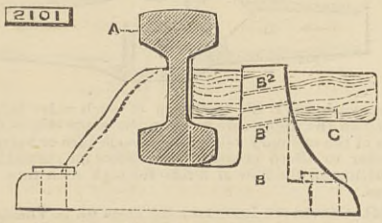
2100. Locks or Fastenings, *A. A. Bedford.—13th May*, 1881.—*(Not proceeded with.)* 2d.

This consists in a handle with a central stem fitted to and working through a plate secured on the outside face of the door. On the stem is an arm to engage a catch on the door jamb. The inner part of the stem is screw-threaded, and on it is a nut with a plate which bears against a plate in the door. Surrounding the inner end of the stem, between the nut and a plate on the inside of the door, is a spiral spring, the plate being secured to the door.

2101. Securing Railway Rails in their Chairs, *W. H. Nevill.—13th May*, 1881. 6d.

A is the rail, and B the chair, which latter is formed with a circular hole B^1 at right angles to the rail, such hole being provided with projecting ribs B^2 at such an angle that when the key C is driven into

2101



position, the return thereof shall be prevented, unless by the application of a force equal, or nearly so, all other circumstances being equal, to that required to drive it in.

2103. Printing Ink, *C. T. Bastand.—13th May*, 1881. 4d.

This relates to the manufacture of printing ink, and consists in the utilisation of the oily and greasy product extracted from engineers' cotton waste, such product being mixed with some or all of the following substances:—Lamp black or ivory or other black, resin or resin oil, soap, and indigo or other blue.

2104. Bottles and Apparatus for Stoppering Same, *F. S. S. Darby.—13th May*, 1881.—*(Not proceeded with.)* 2d.

Inside the neck of the bottle a screw thread is formed, and on the stopper is a similar thread to screw into it. Beneath the head of the stopper is a cork washer, which, on being compressed between the head and the top of the neck of the bottle, forms a tight joint.

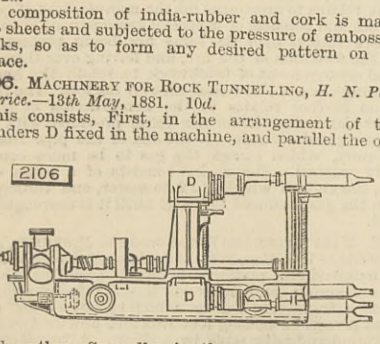
2105. Ornamental Embossed Fabrics for Covering Walls, &c., *F. C. Jeune.—13th May*, 1881. 2d.

A composition of india-rubber and cork is made into sheets and subjected to the pressure of embossed blocks, so as to form any desired pattern on its surface.

2106. Machinery for Rock Tunnelling, *H. N. Penrice.—13th May*, 1881. 10d.

This consists, First, in the arrangement of the cylinders D fixed in the machine, and parallel the one

2106



to the other; Secondly, in the arrangement of the machine with two or more drills close together, producing a long cavity; Thirdly, in the method of tunnelling by drilling two or more holes close together, and three other parallel holes, one on either side and one above, and firing charges in such holes, so as to produce, first, the long cavity and to blow in the sides, and then the roof; Fourthly, in forming a slot along the stem of each boring tool, and laying a tool therein, through which a jet of water may be projected into the bore hole, such tube at its rear end being connected by a flexible tube with a supply of water under pressure by a flexible tube, which allows of the tool being rocked through the arc of a circle.

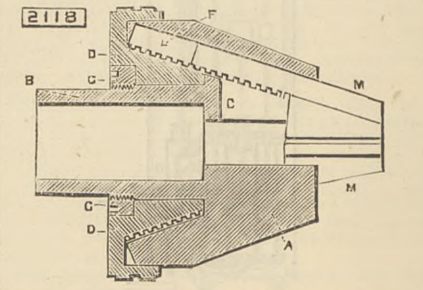
2111. Cropping or Clipping Machines for Treatment of Woven Fabrics, *W. W. Urquhart and J. Lindsay.—14th May*, 1881. 6d.

This relates to the construction of machines which operate upon both sides of the fabric, and consists, First, in the general construction of the machine; Secondly, in placing knives parallel to each other, combined with making the frame movable at right angles to the planes of the knives, such frame carrying the spiral roller with its knife, and a distance guide for the other spiral roller; Thirdly, in making the connecting rods which shift the movable frame adjustable; Fourthly, in making the bearings of spiral rollers universally adjustable; and Fifthly, in the combination of three rollers to draw the fabric through the machine.

2118. Mandril with Concentrical Clamps, *C. Croissant and P. P. Huré.—14th May*, 1881. 6d.

The mandril is applicable to lathes, boring and shaping machines, and other machine tools, and it consists of a case A externally of a truncated conical shape, with a milled part for secure holding. Inside the case, and attached thereto by partition C, is a socket B, to fit on the mandril of the lathe or other machine. Between the socket and the internal conical surface of the case is fitted a conical nut D, adapted to turn on the socket B, and freely in the case

2118



A, being retained in place on the former by a washer nut G. In the case are three mortices F converging to the apex of the cone, and in them move the clamps M. The hinder ends of the clamps are acted upon by the nut D.

2129. Safety Valve Apparatus, *W. R. Lake.—16th May*, 1881.—*(A communication from A M. Pleischl.)* 6d.

This relates to means whereby safety valves may be lifted to a greater extent than usual, and it consists in providing the valve with cowl, hood, chamber, or shell, which surrounds the valve, and which is open at top, and through it the steam escapes, thus preventing the pressure of air downward upon the valve.

2145. Wax-thread Sewing Machines, *W. R. Lake.—17th May*, 1881.—*(A communication from D. H. Campbell.)—(Complete.)* 6d.

This consists, First, in the combination of a hook-needle, a centrally-pointed shuttle with a web on its under side, and a shuttle rail engaging such web, thereby uniting the shuttle to a longitudinal movement with its point and axis in the plane occupied by the path of the needle; Secondly, in a shuttle-driver mounted in a slide upon the rail, and provided with a hinged bridle; Thirdly, in means for adjusting the rail with reference to the path of the needle; Fourthly, in the combination with the hinged shuttle-carrier bridle of a latch for preventing the tilting of the bridle during the rearward motion of the carrier with its shuttle.

2183. Lock-stitch Sewing Machines, *C. Pieper.—19th May*, 1881.—*(A communication from J. Stern.)* 6d.

This relates to means for allowing the under thread to be drawn directly off a common reel, and it consists in placing the reel in a cylindrical case terminating in a cone in front. From the reel the thread passes by a hole in the case, which is enclosed in a carrier, leaving a space between them to allow the loop of the upper thread to pass round it. Below the cloth plate is a hook pivotted to a crank on an auxiliary shaft, its lower end being guided by a radius rod. This hook is carried round the spool case in the vertical plane of same, and also passes close to the needle, the thread of which it draws over the case, and finally allows to slip off when the loop is drawn tight by the take-up.

3707. Water-closet Apparatus, &c., *W. R. Lake.—25th August*, 1881.—*(A communication from the Hartford Sanitary Plumbing Company, Incorporated.)—(Complete.)* 6d.

This relates, First, to improvements in closets called "The Hartford Sanitary Closets," and consists of means to prevent the escape of gas and secure a proper supply of water; and Secondly, to the method of making a blown glass water-closet pan, and consists in blowing the pan in a mould with a cavity round its top corresponding to the flange required round the opening, but broader, so that the glass will enter the

3707

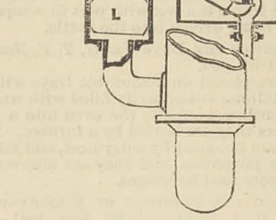
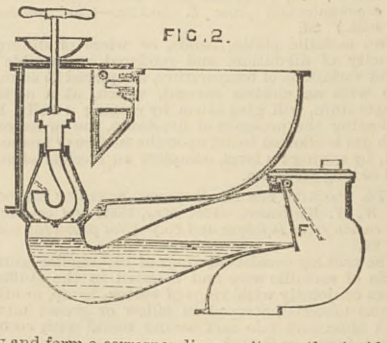


FIG.3.

FIG.2.



cavity and form a corresponding cavity on the inside of the top; the upper edge of the flange projection is then cut away up, so as to form the opening. The drawings show the first part, which consists in the combination of the pan and its outlet valve with a trap valve F, caused to open by the flow of water and closing by its own gravity. A float L serves to close a valve when the water is at a certain level, and by restoring the equilibrium of a valve in the supply cut off the water.

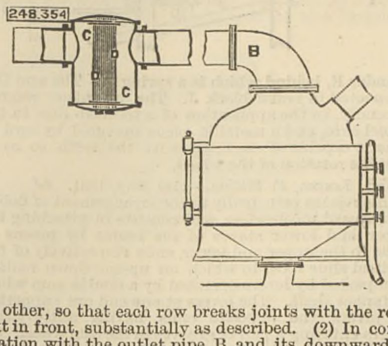
SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

248,354. Deflector for Vacuum Pans, *Charles Schmandt, Brooklyn, assignor to Lewis Colwell and Joseph Colwell, New York, N.Y.—Filed March 19th*, 1881.

Claim.—(1) In a vacuum pan, the outlet pipe B, in combination with upright bars D D, contained within a chamber, that is set into said pipe and extends below it, said bars being arranged in rows one behind

248,354

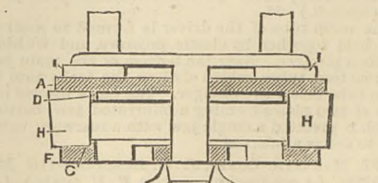


the other, so that each row breaks joints with the row next in front, substantially as described. (2) In combination with the outlet pipe B and its downwardly projecting chamber C, of a vacuum pan, the upright bars D, made V-shaped, and placed with their hollow flaring faces toward the incoming vapours, substantially as specified.

248,370. Pump Piston, *William B. Wert Kellog, assignor of two-thirds to David W. Lytle, Newton, Iowa.—Filed March 23rd*, 1881.

Claim.—The improved hollow piston and valve, composed of the following elements, to wit: the valve

248,370



seat A D C D, the washer plate F G, the rubber ring H, the butterfly valves I I, and a T-shaped clamping device substantially as shown and described, to be operated in the manner specified.

248,406. Gas and Electric Lamp Fixture, *George Crosby, New York, and Edwin M. Fox, Brooklyn, assignors to the American Electric Light Company, New York, N.Y.—Filed April 20th*, 1881.

Brief.—The gas burner can be exchanged for an electric lamp at will. The gas cock is arranged to turn on the gas and shut off the electricity simultaneously. *Claim.*—A combined gas and electric light fixture consisting of a pipe containing two insulated circuit wires with interchangeable burners for the ends of the pipe for the electric light or gas, combined with a single cock or plug valve, arranged, as described, to control the flow of gas or the electric current, as desired. The combination of the gas pipe, the

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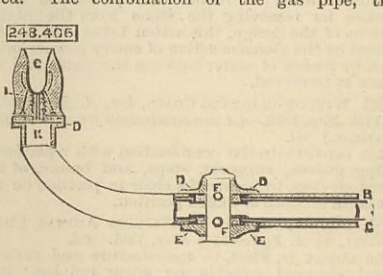

insulated wires B and C, having insulated contact pieces D D^1 and E E^1 disconnected from each other, and the non-conducting cock or plug, having a gas orifice G and metal bars F F, arranged in the plane of the wire contacts, substantially as and for the purpose described. The combination of the gas pipe, the insulating plate D, the wires B and C, having contact faces B^1 E^1, the screw nozzle K, opening into the gas pipe, and the non-conducting socket C, having contact plates H H, wires I, and plates at their lower ends adapted to make electrical connection with the faces B^1 C^1 as and for the purpose described.

248,407. Electric Lamp, *George Crosby, New York, and Edwin M. Fox, Brooklyn, assignors to the American Electric Light Company, New York, N.Y.—Filed April 12th*, 1881.

Claim.—(1) The incandescent conductor for an electric lamp, consisting of broad and thin U-shaped pieces inverted and arranged as described, with their planes bisecting each other and radiating from a common centre, whereby every plane surface is

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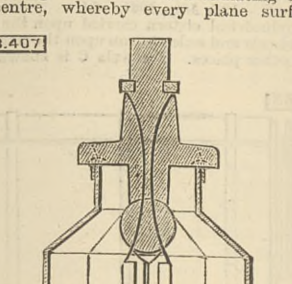
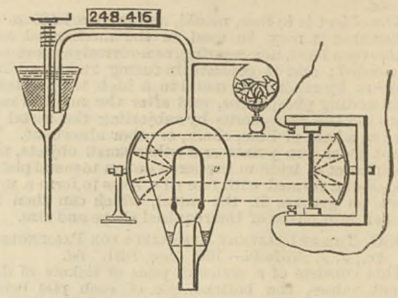


exposed for direct radiation of light, as described. (2) As a new article of manufacture, a heavy cut glass globe for an electric light, made in one piece, with polygonal faces, and a relatively thin teat at the top, as described. (3) The combination, with an electrical lamp, of a heavy glass globe or covering made of one piece, and having polygonal faces, and provided with a relatively thin teat at the top, as and for the purpose described.

248,416. Manufacture of Carbons for Electric Lamps, *Thomas A. Edison, Menlo Park, N.J., assignor to the Edison Electric Light Company, New York, N.Y.—Filed January 11th*, 1881.

Claim.—(1) The within-described process of building up or strengthening a defective point in an incandescing conductor for electric lamps, consisting in heating that point to a high temperature by concentrating thereon the heat from an external source, and at the same time allowing a carbon vapour to enter the globe and deposit additional carbon on the heated point, substantially as set forth. (2) The apparatus for building up or repairing defective carbon filaments, consisting of a separate vessel containing a solid hydrocarbon compound volatisable at low heat, means for passing the vapour into the chamber of the lamp containing the carbon filament,

248,416



and means for raising any desired portion of the filament to a high temperature by concentrating or focussing upon said portion rays of heat, substantially as shown and described. (3) An electric lamp consisting of a globe inclosing a carbon filament and conducting wires, and arranged to contain a portion of a solid compound of carbon volatilisable at low heat, substantially as shown and described.

248,418. Electric Lamp, *Thomas A. Edison, Menlo Park, N.J., assignor to the Edison Electric Light Company, New York, N.Y.—Filed January 31st*, 1881.

Claim.—(1) A carbon for an incandescing conductor for an electric lamp, having one of its ends or portions of less resistance and greater mass of matter than the

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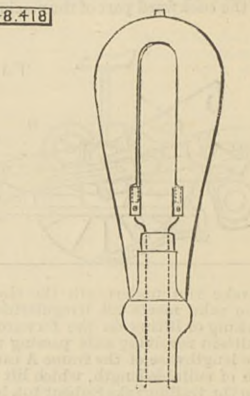

other, substantially as set forth. (2) A carbon for an incandescing conductor for an electric lamp, tapering from one end to the other. (3) The method of utilising defective or spotty carbons for incandescing conductors in electric lamps, consisting in arranging them in the lamps, or the lamps in the circuit, so that the more perfect side is the negative portion, substantially as set forth.

CONTENTS.

The Engineer, December 16th, 1881.