SOME CURIOSITIES OF CHEMICAL ANALYSIS.

FROM time to time some curious features present themselves to the student of published analyses, and a few of the more extreme examples have been put together in the following article :—An interesting instance is afforded in one of the analyses of the mineral water of Buxton. In a paper containing a very complete report on the composition of this water by J. C. Thresh, D.Sc., which has just been read before the Chemical Society, and has been printed in part in the journal of that Society, he says, in a description of the analyses which have been made from the earliest times, after treating of work done in 1819: For thirty-three years the waters remained untroubled by the chemist; but at the expiration of that period Buxton had begun to flourish, all the sciences were advancing with unexampled rapidity, and it was thought advisable that one of the greatest chemists of the day should submit its waters to a searching examination, using large quantities of it for this purpose. A full account of the result of the analysis, executed in 1852 by Professor—now Sir Lyon—Playfair at the School of Mines, London, at the request of the Duke of Devonshire's agent, will be found in Dr. Robertson's "Guide to Buxton and the Peak of Derbyshire." The work bears every evidence of most conscientious care, but is chiefly remarkable on account of a most singular mistake made by him in calculating the amount of nitrogen contained in the water. For the first time the gas evolved at the spring was quantitatively examined, proving to be nearly pure nitrogen. One hundred volumes were found to contain as mean of two experiments: Carbonic acid gas, 1·167; nitrogen, 98·833. He tabulates the results of his analysis of the water, but does not give a similar tabulation of the gaseous ingredients; but he states that he found 3·47 cubic inches of carbonic acid gas, and assumes the volume of nitrogen in the same quantity of water—one gallon—to be 206in.:—Carbonic acid gas, 3·47; nitrogen, 206·0. While Pearson estimated the gaseous constituents at one-fourteenth the volume of the water, or about 19 cubic inches, and Scudamore and Garden at 8¼ cubic inches, three-fourths of which were nitrogen, Playfair assumes the presence of 209·47 cubic inches, of which 206 are nitrogen. The word "assumes" is written advisedly, for this analyst never attempted to estimate the nitrogen directly or by actual experiment, and never asserted positively that so much is present, but in an altogether erroneous manner calculates the quantity from his analysis of the evolved gas, and gives in his report as the reason "that there was no very accurate method for ascertaining the precise quantity of this gas in the water." The grounds for this assumption, he wrote, were :—"Judging from analysis, *i.e.*, of the gas evolved from the spring, and the proportion of the gases, it is assumed that at the moment of issue the water is charged with 206 cubic inches of nitrogen and 15·66 cubic inches of carbonic acid. This assumption is founded upon the proportional relation of the two gases. The proportion of carbonic acid in the water being determined, and the proportion of carbonic acid to that of nitrogen contained in the water being 1·2 to 98·8, the amount of nitrogen contained in the water at the moment of issue may fairly be assumed to be 206 cubic inches per gallon."

Unfortunately Sir Lyon Playfair was entirely in the wrong when he took for granted that the gases existed in solution in the same proportion as in the free evolved gas, for he entirely overlooked the well-known fact of the great difference in the solubility of the two gases. Carbonic acid gas dissolves under the normal pressure and temperature in about an equal volume of water, whilst nitrogen requires from 60 to 70 volumes for its solution. If, therefore, we take an excess of a mixture of these gases in any proportion, and treat it with water so as to cause absorption, it follows that the gas absorbed will be richer in the more soluble constituent than the portion remaining undissolved. Moreover he must have been familiar with the law enunciated by Henry at the beginning of this century, and known as "Dalton's Law of Partial Pressures," from which it was possible to calculate from the composition of the evolved gas that of the gas dissolved. When the proportion and quantity of carbonic acid and nitrogen in the Buxton thermal water are calculated for the result of Playfair's analysis of the gas bubbling up at the spring, the results are very near the truth, as recently shown by Thresh in his new analysis.

While with truth remarking that the nitrogen could only be present in the water in solution, and not in combination, and that there was not then known any "very accurate method of ascertaining the precise quantity of the gas," yet the utter impossibility of the water containing any such quantity of gas as he assumes never for a moment suggests itself to his mind. Otherwise he would have ascertained by some sufficiently approximate manner of direct experiment whether such really could be the case. We feel that here we are in the presence of a psychological phenomenon, which we willingly leave to the students of that science to explain.

In 1860 Dr. Sheridan Muspratt, of Liverpool, published the result of an analysis of the water without giving any details or even mentioning by what process he determined the gases. He found in one gallon of normal water :—Carbonic acid, 3·5 cubic inches; nitrogen, 504·0 cubic inches. We need make no comment on this; and in 1876 Mr. O. Hehner, a London analyst, published the results of an elaborate analysis of the water carried out to five decimal places. With the aid of the spectroscope he found elements which other analysts fail to find, while a number of elements were overlooked which can be detected by the use of that instrument. He found such an amount of nitric acid that it calls for confirmation; and, finally, it is stated that a "London physician and constant visitor to Buxton, contends that such an incomplete analysis, making no mention whatever of the gaseous constituents, was misleading and ought never to have seen the light."

The "Journal" of the Chemical Society contains the papers which were read before the Society, and abstracts of chemical papers published in other journals, the abstracts forming by far the greater portion of the volume. Attention may be directed to a notice in that journal of a paper by E. Reichardt "On the Differences observed in Unadulterated Milk," taken from the *Archiv der Pharmacie*, and appearing in the form of an abstract. After remarking on the variations in respect to specific gravity noticed in the milk of cows of different races, the writer states that the specimen was "subjected to an accurate chemical investigation," and gave the following results:—

			Differences.
Butter fat	3·41	4·02	0·61
Casein	2·37	3·92	1·55
Milk sugar	6·13	6·60	0·47
Water	88·09	85·46	—
	100·00	100·00	

"In practice," he adds, "this difference is of some importance." What, however, is of more importance is that we are called upon to believe that all the numbers in the above columns which carried to two places of decimals, amount, when added together, so exactly to 100·00 in each case, are the result of "accurate chemical investigation." Milk invariably contains inorganic substances in the form of mineral salts, which yield an ash when milk is evaporated to dryness and burnt, and which constitute about 1 per cent. of the milk. These ingredients have been left out of that consideration, which is manifestly indispensable when presenting analytical results supposed to accurately represent the total composition of a substance as arrived at by analysis. Only those ingredients which have actually been quantitatively determined should be recorded in a report of an analysis, and such centesimal numbers only should be added together to form a total. The custom of winding up the results of an analysis with a picturesque 100·00 may sometimes be carried too far. Take, for example, the following instance, which is to be met with in *Nature*. In that journal appeared a sketch outline of a paper by Mr. T. Wills on the coal brought home by the late Arctic Expedition. About half a column is devoted to the physical characters of the specimens of coal found about two miles from Discovery Bay, the winter quarters of H.M.S. Discovery, and appended to this is given the following as the result of several analyses:—

Specific gravity	1·29
Moisture	2·38
Ash	6·21
Sulphur	0·96
Carbon	76·95
Hydrogen	5·43
Oxygen, Nitrogen } by difference	6·78
	100·00

"On comparing these figures with the result of the analyses of a mixture of thirteen different seams from English coal-fields, Mr. Wills found that the Arctic coal possesses very nearly the same composition."

Mr. Wills was Demonstrator of Chemistry at the Royal Naval University, Greenwich, and Secretary for the Chemical Section of the Society of Arts. He died about four years ago. It is hard to conceive the state of the mind of the man who could have written down these numbers as the results of an analysis, let alone the result of several analyses. We doubtless are very dull, but we never, no never, attached such weight to a specific gravity; and that with this extraordinary addition the result should exactly come to 100·00! The whole thing will not bear looking into.

Some of the most astonishing papers of the kind to which we refer have been communicated by Lieut.-Col. Ross to the Royal Society in former years. About ten years ago there appeared one on pyrology, or fire analysis. In his experiments the author used the flame of a lamp containing cocoa-nut oil and an ordinary mouth blowpipe, or, as he terms them, a "hydro-carbonous pyrocone," produced by a "pyrogene." One or two of the reactions which he observed by submitting substances to the action of the "reducing" and "peroxidating pyrocones" will suffice to indicate the nature of his paper. Silica and alumina, which, by the way, he calls "two omnipresent and almost universally combined earths," become quite black and apparently decompose; the alumina "appears to become partially fused," while the silica presents a steel-black mass with shining metallic points in it. Sulphur, when the flame is regulated as he directs, also assumes a metallic appearance, and "has no further tendency to burn," but possesses the—as he rightly names it—"remarkable property" of giving in a bead of phosphoric acid reactions similar to those of copper, viz., green hot and blue-green cold, &c. He even detects nitrogen with the blowpipe. By repeatedly dipping a bead of phosphoric acid into concentrated nitric acid or ammonia, and heating it as often in the "hydro-carbonous pyrocone," a metallic-looking film is formed, and the bead "thus impregnated with nitrogen" developes colour which serves to distinguish this element from alkalies, the "volatisable oxides," &c. Still more unaccountable, perhaps, than any of Lieut.-Col. Ross's results is the fact of their having engaged the serious attention of the learned body in whose journal his paper appeared.

Another paper by him appeared the next year in the "Proceedings" of the Royal Society on Jeypoorite. Twice in this paper he states that the mineral contains 82 per cent. of oxide of cobalt, and, curiously enough, he twice also tells us that it contains 82 per cent. of cobalt as metal. He describes the mineral as a "sulph-antimonial Arsenide of Cobalt," which signifies a compound of cobalt sulphide with sulphides of antimony and arsenic, although, according to his own analysis, Jeypoorite contains altogether over 20 per cent. of oxygen. It will not a little astonish any mineralogist who may peruse this paper to find that these crystals described as "metallic" contain more than one-fifth their weight of oxygen.

The analysis to which we now have to direct attention is one that bears a curious contrast to the foregoing. In 1846 Professor Breithaupt described some new minerals, and amongst them two from the island of Elba, distinguished for their great lustre, with a hardness of 8¼ to 8½, and bearing a close resemblance to each other, so that he gave them the names of Castor and Pollux. They were analysed by Dr. C. F. Plattner, and he made out Pollux to have the composition :—Silicic acid, 46·200; alumina, 16·394; iron oxide, 0·862; potash, 16·506; soda, with a trace of lithia, 10·470; water, 2·321; total, 92·753. The very considerable loss led Plattner to seek for other constituents which might occur in a silicate, but he failed to find any, and published the analysis as above—Poggendorff's Annalen, 1846, lxix. 443. He showed by experiments that neither chlorine nor fluorine was contained in the mineral. In 1860, Bunsen and Kirchhoff, while working with the spectroscope, came across some grey lines which did not correspond with those of any known element, and they found them due to the metal cæsium. In 1864 M. Pisani, of Paris, made a re-examination of the rare mineral Pollux, and found it to contain 34·07 per cent. of cæsium, with traces of potash. The specimen examined came from Elba, and was unquestionably the same mineral species. Here then we have an interesting example of an apparently incorrect analysis being set right by dint of subsequent discovery. The numbers found by Pisani were :—Silicic acid, 44·03; alumina, 15·97; iron oxide, 0·68; lime, 0·68; cæsia, with traces of potash, 34·07; soda, 3·88; water, 2·40; total, 101·71. When in Plattner's analysis the potash and soda are reckoned as cæsia, it too shows some excess, and this in the case of both the analyses would seem to indicate that a portion of the alkalies in the mineral were lithia and potash, although Pisani established the absence of anything more than traces of potash in the cæsium salt obtained in his analysis.

THE S.S. TARTAR.

THE Union Steamship Company has just added to its fleet a very fine vessel—the Tartar—which arrived in the Albert Dock, from Southampton and Glasgow, on Sunday. The Union Company's fleet plies between England and the Cape, and includes about sixteen ships, varying from 1550 tons and 1200-H.P. to the maximum of 4669 tons and 3700-H.P. The Tartar is a Cape mail steamer, 376·5ft. long, 47·2ft. beam, and 30·3ft. deep. Her gross tonnage is 4339, her registered tonnage 2754. She has a displacement of 8000 tons. She is divided into thirty watertight compartments, and has a double bottom constructed on the cellular system; the outside plating has been doubled to insure greater strength amidship, and it may be said generally that she has been built to meet all the requirements of the Admiralty, and has been placed on their list of vessels available in time of war. The ordinary arrangements of passenger accommodation have been altered. The first-class state-rooms and saloons, providing for 160 passengers, have been placed amidships, forward of the machinery space; the second-class cabins for 160 passengers are in the after part, and there are berths and a cabin for 100 third-class passengers forward. The first-class dining saloon on the upper deck is a sumptuously fitted-up, lofty, light, and well-ventilated apartment, 62ft. long, and above are a good music saloon and a ladies' boudoir opening on the promenade deck, which is nearly 180ft. in length. Below this deck a clear space on either side of the great dining saloon forms a covered gangway. Marble baths, tesselated pavements, and ornamented tiles in the lavatories, pneumatic bells, wire wove mattresses in the berths, and special provisions for ventilation and sanitation are among the things supplied in this luxurious travelling hotel. Of eleven boats carried six are lifeboats. She indicates about 3700-H.P.; and on her trial trip on the Clyde she made over 14 knots, and on the run to Southampton over 15 knots. She has three masts and a single funnel, and was built by Messrs. Aitken and Mansel, and engined by Messrs. Thomson, of Glasgow. She is, as we have said, thoroughly divided by watertight compartments, reaching to the upper deck, and these cut up the saloon accommodation. The accommodation for second-class passengers is about as good as that usually provided for first-class passengers. The berths for the first-class passengers are really small, double-bedded rooms, with Turkey carpets on the floor, and have little in common with the ordinary state room. The third-class berths are admirable; in fact we have seldom, if ever, met with a ship in which the comforts of passengers have been so fully studied.

The engines are of the usual compound type, the cylinders being 50in. and 90in. diameter, with a stroke of 5ft. The crank shaft is built up of Vicars' cast steel. Steam is supplied by six boilers, each containing three furnaces—Fox's patent—3ft. in diameter by 6ft. long on the bars. All the furnaces are fitted with Martin's patent doors. The boilers are placed in the wings and fired athwartship. The pressure is 90 lb. The feed-water is heated to about 206 by Weir's patent heater, the water being sprayed through live steam drawn from the intermediate receiver. It might be assumed that the steam could be used to more advantage in the large cylinder; but it is said that the total gain is 8 per cent., but that of this 4 per cent. is lost by abstraction of steam from the low-pressure cylinder, leaving a net gain of 4 per cent. saved in fuel, besides sparing the boilers the strains due to the pumping in of cold water, and diminishing the tendency to prime.

The ship is fitted throughout with hydraulic gear by Messrs. Brown Bros., Rosebank Engine Works, Glasgow. In the engine-room are a pair of automatic engines and an accumulator. Steam is supplied by a donkey boiler on the upper deck. The hydraulic pressure is 800 lb. on the square inch, and this is used to work Messrs. Brown's patent capstans, windlass, and steering gear.

On Wednesday a large party visited the ship, by invitation of the chairman and directors. At the luncheon there were present Mr. Alfred Giles M.P., chairman, and Mr. H. W. Maynard, Mr. F. J. Mercer, Mr. J. Cardus, and Mr. W. J. Rohmer, of the board of directors of the company; Mr. Baughan, C.B., and Mr. Bather, of the Admiralty; Sir W. C. Sargeaunt, of the Crown Agents' Office; Mr. Spencer Todd, C.M.G., Mr. F. S. Murray, Mr. Te. Water, Mr. W. M. Farmer, and Mr. Harvey; Sir Donald Currie, M.P., Mr. R. B. Mackie, M.P., Sir Robert Peel, Sir George Chambers, Colonel Martindale, C.B., Sir James Douglas, C.E., Mr. Messum (Comptroller of Packets), and Mr. Soper and Mr. Lee Wright, of the South African Association. The chairman, in responding to the toast of success to the Union Steamship Company, contrasted the state of things some twenty-six years ago, when they ran a vessel of about 540 tons, whose freight and passage money amounted to £250, with what was done in the present day. Twenty-five years ago people were not unwilling to pay fifty guineas to be taken out to the Cape in forty-two days; now they were taken in eighteen or nineteen days for thirty guineas, a distance of 6000 miles, or at the rate of 1¼d. per mile. Formerly a mail steamer ran to the Cape once a month, now there was one a

week, and he looked forward to the time when, as on the Atlantic, there should be one a day. As the company were returning to town in a special train, attached to one bringing up passengers who had just landed from the Potosi, an accident, happily not of a serious character, happened on the railway. Four or five carriages in the middle of the train left the metals at some points between the Tidal Basin and Canning Town. Two or three first-class carriages were somewhat damaged, but no passengers were injured.

ON METERS FOR POWER AND ELECTRICITY.*

By Mr. C. VERNON BOYS.

THE subject of this evening's discourse—"Meters for Power and Electricity"—is unfortunately, from a lecturer's point of view, one of extreme difficulty, for it is impossible to fully describe any single instrument of the class without diving into technical and mathematical niceties which this audience might well consider more scientific than entertaining. If then, in my endeavour to explain these instruments and the purposes which they are intended to fulfil, in language as simple and as untechnical as possible, I am not as successful as you have a right to expect, I must ask you to lay some of the blame on my subject and not all on myself.

I shall at once explain what I mean by the term "meter," and I shall take the flow of water in a trough as an illustration of my meaning. If we hang in a trough a weighted board, then, when the water flows past it, the board will be pushed back; when the current of water is strong, the board will be pushed back a long way; when the current is less it will not be pushed so far; when the water runs the other way the board will be pushed the other way. So by observing the position of the board, we can tell how strong the current of water is at any time. Now, suppose we wish to know, not how strong the current of water is at this time or at that, but how much water altogether has passed through the trough during any time, as, for instance, one hour. Then, if we have no better instrument than the weighted board, it will be necessary to observe its position continuously to keep an exact record of the corresponding rates at which the water is passing every minute, or better every second, and to add up all the values obtained. This would, of course, be a very troublesome process. There is another kind of instrument which may be used to measure the flow of the water—a paddle-wheel or screw. When the water is flowing rapidly the wheel will turn rapidly; when slowly, the wheel will turn slowly; and when the water flows the other way, the wheel will turn the other way, so that if we observe how fast the wheel is turning we can tell how fast the water is flowing. If, now, we wish to know how much water altogether has passed through the trough, the number of turns of the wheel, which may be shown by a counter, will at once tell us. There are, therefore, in the case of water, two kinds of instruments, one which measures at a time, and the other during a time. The term meter should be confined to instruments of the second class only. As with water so with electricity, there are two kinds of measuring instruments, one of which, the galvanometer, may be taken as a type, which shows by the position of a magnet how strong a current of electricity is at a time, and the other which shows how much electricity has passed during any time. Of the first, which are well understood, I shall say nothing; the second, the new electric meters and the corresponding meters for power, are what I have to speak of to-night. It is hardly necessary for me to mention the object of making electric meters. Every one who has had to pay his gas bill once a quarter probably quite appreciates what the electric meters are going to do, and why they are at the present time attracting so much attention. So soon as you have electricity laid on in your houses, as gas and water are laid on now, so soon will a meter of some sort be necessary, in order that the companies which supply the electricity may be able to make out their quarterly bills, and refer complaining customers to the faithful indications of their extravagance in the mysterious cupboard in which the motor is placed. The urgent necessity for a good meter has called such a host of inventors into the field, that a complete account of their labours is more than any one could hope to give in an hour. Since I am one of this host, I hardly like to pick out those inventions which I consider of value. I cannot describe all, I cannot act as a judge and say these only are worthy of your attention, and I do not think I should be acting fairly if I were to describe my own instruments only and ignore those of everyone else. The only way I see out of the difficulty is to speak more particularly about my own work in this direction, and to speak generally on the work of others.

I must now ask you to give your attention for a few minutes to a little abstract geometry. We may represent any changing quantity, as, for instance, the strength of an electrical current, by a crooked line. For this purpose we must draw a straight line to represent time, and make the distance of each point of the crooked line above the straight line a measure of the strength of the current at the corresponding time. The size of the figure will then measure the quantity of electricity that has passed, for the stronger the current is the taller the figure will be, and the longer it lasts the longer the figure will be, either cause makes both the quantity of electricity and the size of the figure greater, and in the same proportion, so the one is a measure of the other. Now it is not an easy thing to measure the size of a figure, the distance round it tells nothing; there is, however, a geometrical method by which its size may be found. Draw another line, with a great steepness where the figure is tall, and with a less steepness where the height is less, and with no steepness or horizontal where the figure has no height. If this is done accurately, the height to which the new line reaches will measure the size of the figure first drawn: for the taller the figure is, the steeper the hill will be: the longer the figure, the longer the hill; either cause makes both the size of the figure and the height of the hill greater, and in the same proportion; so the one is a measure of the other, and so, moreover, is the height of the hill, which can be measured by scale, a measure of the quantity of electricity that has passed.

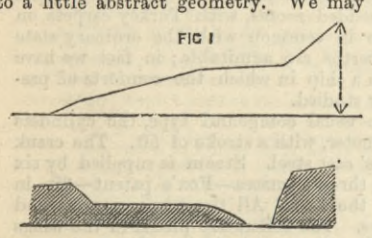


FIG 1

The first instrument that I made, which I have called a "cart" integrator, is a machine which, if the lower figure is traced out, will describe the upper. I will trace a circle, the instrument follows the curious bracket shaped line that I have already made sufficiently black to be seen at a distance, the height of the new line measures the size of the circle; the instrument has squared the circle. This machine is a thing of mainly theoretical interest; my only object in showing it is to explain the means by which I have developed a practical and automatic instrument, of which I shall speak presently. The guiding principle in the cart integrator is a little three-wheeled cart, whose front wheel is controlled by the machine. This, of course, is invisible at a distance, and therefore I have here a large front wheel alone. On moving this along the table, any twisting of its direction instantly causes it to deviate from its straight path. Now suppose I do not let it deviate, but compel it to go straight, then at once a great strain is put upon the table which is urged the other way. If the table can

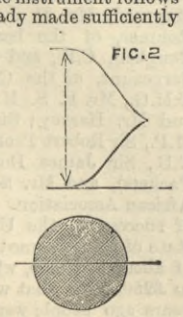


FIG.2

move it will instantly do so. A table on rollers is inconvenient as an instrument, let us therefore roll it round into a roller, then on moving the wheel along it the roller will turn, and the amount by which it turns will correspond to the height of the second figure drawn by the cart integrator. If, therefore, the wheel is inclined by a magnet under the influence of an electric current, or by any other cause, the whole amount of which we wish to know, then the number of turns of the roller will tell us this amount; or to go back to our water analogy, if we had the weighted board to show current strength, and had not the paddle-wheel to show total quantity, we might use the board to incline a disc in contact with a roller, and then drag the roller steadily along by clockwork. The number of turns of the roller would give the quantity of water. Instruments that will thus add up continuously indications at a time, and so find amounts during a time, are called integrators. The most important application that I have made at present of the integrator described is what I have called an engine-power meter. The instrument is on the table, but as it is far too small to be seen at a distance, I have arranged a large model to illustrate its action. The object of this machine is to measure how much work an engine has done during any time, and show the result on a dial, so that a workman may read it off at once, without having to make any calculations.

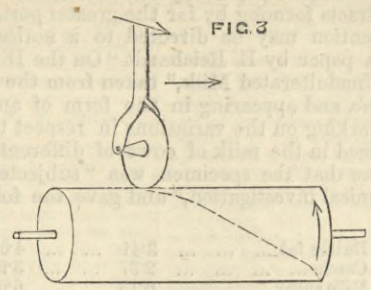


FIG.3

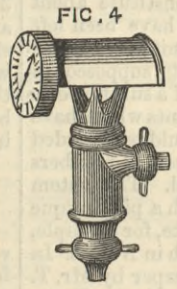


FIG.4

Before I can explain how work is measured, perhaps I had better say a few words about the meaning of the word "work." Work is done when pressure overcomes resistance, producing motion. Neither motion nor pressure alone is work. The two factors, pressure and motion, must occur together. The work done is found by multiplying the pressure by the distance moved. In an engine, steam pushes the piston first one way then the other, overcomes resistance, and does work. To find this we must multiply the pressure by the motion at every instant, and add all the products together. This is what the engine-power meter does, and it shows the continuously growing result on a dial. When the piston moves it drags the cylinder along; where the steam presses the wheel is inclined. Neither action alone causes the cylinder to turn, but when they occur together the cylinder turns, and the number of turns registered on a dial shows with mathematical accuracy how much work has been done.

In the steam engine work is done in an alternating manner, and it so happens that this alternating action exactly suits the integrator. Suppose, however, that the action, whatever it may be, which we wish to estimate is of a continuous kind, such, for instance, as the continuous passage of an electric current. Then, if by means of any device we can suitably incline the wheel, so long as we keep pushing the cylinder along, so long will its rotation measure and indicate the result; but there must come a time when the end of the cylinder is reached. If then we drag it back again, instead of going on adding up, it will begin to take off from the result, and the hands on the dial will go backwards, which is clearly wrong. So long as the current continues, so long must the hands on the dial turn in one direction. This effect is obtained in the instrument now on the table, the electric energy meter, in this way. Clockwork causes the cylinder to travel backwards and forwards by means of what is called a mangle motion, but instead of moving always in contact with one wheel, the cylinder goes forward in contact with one and back in contact with another on its opposite side. In this instrument the inclination of the wheels is effected by an arrangement of coils of wire, the main current passing through two fixed concentric solenoids, and a shunt current through a great length of fine wire on a movable solenoid, hanging in the space between the others. The movable portion has an equal number of turns in opposite directions, and is therefore unaffected by magnets held near it. The effect of this arrangement is that the energy of the current—that is, the quantity multiplied by the force driving it, or the electrical equivalent of mechanical power—is measured by the slope of the wheels, and the amount of work done by the current during any time, by the number of turns of the cylinder, which is registered on a dial. Professors Ayrton and Perry have devised an instrument which is intended to show the same thing. They make use of a clock, and cause it to go too fast or too slow by the action of the main on the shunt current; the amount of wrongness of the clock, and not the time shown, is said to measure the work done by the current. This method of measuring the electricity by the work it has done is one which has been proposed to enable the electrical companies to make out their bills.

The other method is to measure the amount of electricity that has passed without regard to the work done. There are three lines on which inventors have worked for this purpose. The first, which has been used in every laboratory ever since electricity has been understood, is the chemical method. When electricity passes through a salt solution it carries metal with it, and deposits it on the plate by which the electricity leaves the liquid. The amount of metal deposited is a measure of the quantity of electricity. Mr. Sprague and Mr. Edison have adopted this method; but as it is impossible to allow the whole of a strong current to pass through a liquid, the current is divided; a small proportion only is allowed to pass through. Provided that the proportion does not vary, and that the metal never has any motions on its own account, the increase in the weight of one of the metal plates measures the quantity of electricity.

The next method depends on the use of some sort of integrating machine, and this being the most obvious method, has been attempted by a large number of inventors. Any machine of this kind is sure to go, and is sure to indicate something, which will be more nearly a measure of the electricity as the skill of the inventor is greater.

Meters for electricity of the third class are dynamical in their action, and I believe that what I have called the vibrating meter was the first of its class. It is well known that a current passing round iron makes it magnetic. The force which such a magnet exerts is greater when the current is greater, but it is not simply proportional. If the current is twice or three times as strong, the force is four times or nine times as great, or generally, the force is proportional to the square of the current. Again, when a body vibrates under the influence of a controlling force, as a pendulum under the influence of gravity, four times as much force is necessary to make it vibrate twice as fast, and nine times to make it vibrate three times as fast; or generally, the square of the number measures the force. I will illustrate this by a model. Here are two sticks nicely balanced on points, and drawn into a middle position by pieces of tape to which weights may be hung. They are identical in every respect. I will now hang a 1 lb. weight to each tape, and let the pieces of wood swing. They keep time together absolutely. I will now put 2 lb. on one tape. It is clear that the corresponding stick is going faster, but certainly not twice as fast. I will now hang on 4 lb. One stick is going at exactly twice the pace of the other. To make one go three times as fast it is obviously useless to put on 3 lb., for it takes four to make it go twice as fast. I will hang on 9 lb. One now goes exactly three times as fast as the other. I will now put 4 lb. on the first, and leave the 9 lb. on the second; the first goes twice while the second goes three times. If instead of a weight we use electro-magnetic force to control the vibrations of a body, then twice the current produces four times the force, four times the force produces twice the rate; three times the current produces nine times the force, nine times the force produces three times the rate, and so on; or the rate is directly proportional to the current strength. There is on the table a working meter made on this principle. I allow the current that passes through to pass also through a galvanometer of special construction, so that you can tell by the position of a spot of light on a scale the strength of the current. At the present time there is no current; the light is on the zero of the scale; the meter is at rest. I now allow a current to pass from a battery of the new Faure-Sellon-Volckmar cells which the Storage Company have kindly lent me for this occasion. The light moves through one division on the scale, and the meter has started. I will ask you to observe its rate of vibration. I will now double the

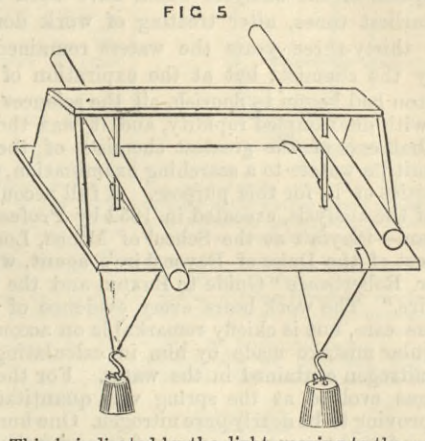


FIG 5

current. This is indicated by the light moving to the end of the second division on the scale; the meter vibrates twice as fast. Now the current is three times as strong, now four times, and so on. You will observe that the position of the spot of light and the rate of vibration always correspond. Every vibration of the meter corresponds to a definite quantity of electricity, and causes a hand on a dial to move on one step. By looking at the dial, we can see how many vibrations there have been, and therefore how much electricity has passed. Just as the vibrating sticks in the model in time come to rest, so the vibrating part of the meter would in time do the same, if it were not kept going by an impulse automatically given to it when required. Also, just as the vibrating sticks can be timed to one another by sliding weights along them, so the vibrating electric meters can be regulated to one another so that all shall indicate the same value for the same current, by changing the position or weight of the bobs attached to the vibrating arm. The other meter of this class, Dr. Hopkinson's, depends on the fact that centrifugal force is proportional to the square of the angular velocity. He therefore allows a little motor to drive a shaft faster and faster, until centrifugal force overcomes electro-magnetic attraction, when the action of the motor ceases. The number of turns of the motor is a measure of the quantity of electricity that has passed.

I will now pass on to the measurement of power transmitted by belting. The transmission of power by a strap is familiar to every one in a treadle sewing machine or an ordinary lathe. The driving force depends on the difference in the tightness of the two sides of the belt, and the power transmitted is equal to this difference multiplied by the speed; a power meter must, therefore, solve this problem—it must subtract the tightness of one side from the tightness of the other side, multiply the difference by the speed at every instant, and add all the products together, continuously representing the growing amount on a dial. I shall now show for the first time an instrument that I have devised, that will do all this in the simplest possible manner. I have here two wheels connected by a driving band of india-rubber, round which I have tied every few inches a piece of white silk ribbon. I shall turn one a little way, and hold the other. The driving force is indicated by a difference of stretching, the pieces of silk are much further apart on the tight side than they are on the loose. I shall

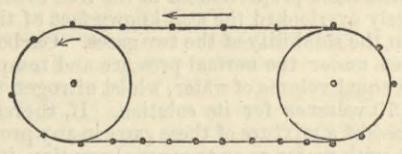


FIG. 6.

now turn the handle, and cause the wheels to revolve; the motion of the band is visible to all. The india-rubber is travelling faster on the tight side than on the loose side, nearly twice as fast; this must be so, for as there is less material on the tight side than on the loose, there would be a gradual accumulation of the india-rubber round the driven pulley, if they travelled at the same speed; since there is no accumulation, the tight side must travel the fastest. Now it may be shown mathematically that the difference in the speeds is proportional both to the actual speed and to the driving strain; it is, therefore, a measure of the power or work being transmitted, and the difference in the distance travelled is a measure of the work done. I have here a working machine which shows directly on a dial the amount of work done; this I will show in action directly. Instead of india-rubber, elastic steel is used. Since the driving pulley has the velocity of the tight side, and the driven of the loose side of the belt, the difference in the number of their turns, if they are of equal size, will measure the work. This difference I measure by differential gearing which actuates a hand on a dial. I may turn the handle as fast I please; the index does not move, for no work is being done. I may hold the wheel, and produce a great driving strain; again the index remains at rest, for no work is being done. I now turn the handle quickly, and lightly touch the driven wheel with my finger. The resistance, small though it is, has to be overcome; a minute amount of work is being done, the index creeps round gently. I will now put more pressure on my finger, more work is being done, the index is moving faster; whether I increase the speed or the resistance the index turns faster; its rate of motion measures the power, and the distance it has moved, or the number of turns, measures the work done. That this is so I will show by an experiment. I will wind up in front of a scale a 7 lb. weight; the hand has turned one-third round. I will now wind a 28 lb. weight up the same height; the hand has turned four-thirds of a turn. There are other points of a practical nature with regard to this invention which I cannot now describe.

There is one other class of instruments which I have developed of which time will let me say very little. The object of this class of instruments is to divide the speed with which two registrations are being effected, and continuously record the quotient. In the instrument on the table two iron cones are caused to rotate in time with the registrations; a magnetised steel reel hangs on below. This reel turns about, and runs up or down the cones until it finds a place at which it can roll at ease. Its position at once indicates the ratio of the speeds which will be efficiency, horse-power per hour, or one thing in terms of another. Just as the integrators are derived from the steering of an ordinary bicycle, so this instrument is derived from the double steering of the "Otto" bicycle. Though I am afraid that I have not succeeded in the short time at my disposal in making clear all the points on which I have touched, yet I hope that I have done something to remove the very prevalent opinion that meters for power and electricity do not exist.

* Royal Institution of Great Britain.

LETTERS TO THE EDITOR.

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

SIR EDWARD REED'S IRONCLAD SHIPS.

SIR,—I extremely regret the course you have pursued in publishing in your last number two very crude sketches purporting to represent my patented improvements in ironclad ships. It is true that you candidly admit that these sketches are of your own preparation, and "elaborated out of your own internal consciousness," but their association with my name and my patent is, nevertheless, likely to do me serious injury; and I have, therefore, to ask you to make it known in some clear and unmistakeable manner that they were in no way submitted to me nor have received in any way my sanction. I do not doubt that they have been prepared and published in good faith, but they have been made in neglect of so many considerations that weigh seriously with me, and convey so false an impression of my designs; moreover, the course which you have taken in the matter is so unusual and open to so much misconstruction, that I feel justified in separating myself altogether from them. At a future time I will send you drawings of my own, when you will see how unlike to your sketches are my designs. E. J. REED.

Broadway-chambers, Westminster,
June 5th.

[We thought we had stated clearly enough that the sketches to which Sir Edward Reed alludes were deductions from the description published in the *Times* and nothing more. That they agree with that description is, we think, clear. Sir Edward Reed does not dispute this. They were merely intended to illustrate our extract from the *Times*, and they were never seen by Sir Edward Reed until they were published in our pages.—ED. E.]

THE PROBLEM OF FLIGHT.

SIR,—Having read Mr. Lancaster's remarks on the flight of birds, I think I may give a few words of advice to those who intend to experiment with parachutes. I write from experience. A parachute will sometimes come to the ground gently, sometimes with a bump; and if imperfectly constructed, will glide about in most inconceivable directions. Mr. Lancaster suggests that the experimentalist should start from a rope stretched between two posts 100ft. high. A good idea; but I think the starting point should be over a good broad sheet of water, the experimentalist wearing a few bladders or a life-belt. Had I the funds I would continue my experiments, and choose to start from some such place as the Britannia Bridge, Menai Straits; and I feel convinced that a well-conducted series of experiments would be a great step towards the discovery of a means of flight, and little risk to life or limb.

My observations lead me to suppose that birds that beat the air propel themselves up an inclined plane by means of the elasticity of the extreme back ends and back edges of the feathers—in fact, an elastic vibrating propeller, the effect of which can be easily calculated. In horizontal flight a certain number of foot-pounds of muscular exertion is expended to drive the bird up an inclined plane, which is the hypothenuse of a right-angled triangle, the perpendicular of which is the distance the bird will descend by force of gravity. The base will be the resultant of muscular and gravitating powers. I do not give figures, as at present I could not state the value of the perpendicular; for the velocity of the bird will cause the plane of its wings to press on inert particles of air, and I have seen no formula for wind pressure under such circumstances—and undoubtedly the value of the perpendicular is most important to the theory of flight.

With regard to sailing birds, I will take those first that frequent the mountain ranges, the steep cliffs, the coast line, or the crests of waves. They are known to move at various velocities against, but mostly at right angles to, strong winds, with no apparent muscular exertion. Having lived for some years on the sea coast I think I can give an explanation—from personal observation—which is simple, and will in no way clash with the known laws of mechanical forces. In such places the direction of the wind must be considered, for when moving air meets with any obstruction it is not stopped, but forces round or over it. Therefore, if the wind blows in shore, it must be thrown in an upward direction by the incline of the beach and other obstacles; and a close observation will show that birds can soar at a much greater distance above high cliffs than they can above the top of a low line of beach or crest of wave. With the above explanation it is needless to demonstrate how the force of the wind could overcome the force of gravity, and *vice versâ*. Thus far the theory of flight appears simple, and can be accounted for by known mechanical laws. The gravitation is overcome by an upward current of air or a muscular propelling force. But now I must take into consideration the wondrous movements of high soaring birds. I have daily opportunities of observing the almost incredible flight of vultures. They weigh from 16 lb. to 20 lb., and have less than 14 square feet of spread for support. I can confidently assert that I have repeatedly seen these birds start from the ground, and after a few seconds of muscular exertion, they then on rigid wings sail far up into the sky, beyond the power of the unaided vision to follow.

My usual mode of observation was when a dead animal attracted them to the foot of a high hill—1600ft.—to take a position on the top and get someone to shoot at them below. I had a good field glass to assist the vision. I have also when at an altitude of about 10,000ft. observed them sailing far above in what must be very rarefied air. The direction of flight when soaring is constantly that of a circle, but when taking a direct course muscular effort is frequently observable. From my information I believe the flight of large soaring sea fowl to be constantly in curves. Therefore one may conjecture that their movement in curves is the secret of their overcoming the force of gravity without any apparent exertion. Now I will assume that, first, in circling flight the plane of the bird's wings is on such an angle to the plane of its circular path that the centrifugal force developed shall drive the bird up the incline corresponding to the plane of its wings, and the result of the different forces acting on the bird are such that they will accelerate the velocity during the time that the circumference of its circular course is increasing. Then I will suppose the bird to change the plane of its wings to such an angle to its previous position that the force of gravity overpowers the centrifugal and draws the bird down an incline, thereby decreasing the diameter of the circle of its flight. And then also the different forces acting on the bird are such as to greatly accelerate the velocity during the time that the circle of its course is decreasing in diameter.

It appears at first sight a monstrous anomaly that both approaching and receding from the centre of a circular course should accelerate motion. But I will endeavour to show that under the assumed positions of the bird, and consequent directions of central and gravitating forces, that the two ways of accelerating velocity are possible, and in no way contrary to the properties of inertia. If a body is travelling along the circumference of a true circle with a given velocity, and is retained to its course by external limits, the direction of centrifugal force will be along a straight line from the centre; and the counteracting external pressure will be at right angles to a tangent of its course. The straight line from the centre must also be at right angles to same tangent. Therefore the two forces are acting in opposite direction on the same right line, and being equal, they cannot affect the momentum of the body, which is tangential. But if the circumference of the retaining circle be gradually increased or decreased, it is, I think, evident that the two forces mentioned will not act in a right line, and the resultant of the two forces will be the amount of accelerating or retarding force upon the momentum of the body. When the circle is increasing the effect will be to accelerate, and when decreasing to retard velocity. But when a body travels round a centre, retained to its course by a central attractive force, the increase of the circumference of its course will retard, and the decrease will accelerate its velocity. A good illustration of my meaning is the varying velocities of heavenly bodies that have an elliptical path. Their velocities vary as they approach or recede from the centre of attraction. And I have often thought that the planets must owe their enormous momentum to an accumulating central force that first drew their component particles from the vast limits of our solar system. But a mere simple illustration is the small eddying whirlpool caused by the flow of water through an orifice. It will revolve in any direction when once started.

Before closing I think I may add a few remarks for the benefit of those who intend to experiment with parachutes. If the parachute is very concave the direct falling velocity might be calculated from formulæ of wind pressure. But with a simple plane moving through the air the effect will be very different. The front of the plane would have its falling tendency resisted by inert air, whereas the back would only be supported by air that had acquired a downward motion. This may be seen at once by throwing a small flat surface as nearly horizontal as possible. It will, instead of following the ordinary course of projectiles, show a tendency towards the opposite parabolic curve.

My object in writing is to encourage a controversy that must be welcome to all who are struggling to solve the problem of artificial flight. And if my views are not so clearly expressed as they might be, I hope your readers will be lenient—for I don't profess to have a mathematical education; in fact, some of the terms I have used I have never even heard pronounced. J. G. HOUSHOLD.

Natal, April 24th.

STEPHENSON'S LINK MOTION.

SIR,—In the number of the 25th of May of your paper, THE ENGINEER, is printed a letter from Mr. Falkenburg on "Stephenson's Link Motion," in which he says that the first who wrote a theory about it is Mr. Phillips—myself—a French engineer, who made two capital mistakes, which were adopted straight away by several German authors, like Professor G. Zeuner, Gustav Schmidt, Emil Blaha, Otto Grove, J. Weisbach, and Alb. Fliegner. Having asserted this, Mr. Falkenburg discussed throughout the whole of his note Mr. Zeuner's methods and proceedings. I hope you will do me the favour to insert in your paper this short answer as respects me.

My first work on the subject was printed in the *Annales des Mines*, tome iii., 1853. It contains a theorem, giving rigorously, at any instant, the instantaneous centre of rotation of the link. From this I concluded the comparative motions of the crank—in French, "manivelle"—and of the slide valve—in French, "tiroir." These last calculations are not complicated, and the results are nearly approximated. Several years afterwards, in 1863, I published another work on this same subject, in which, after having given my previous theorem on the instantaneous centre of rotation of the link, I pushed the calculations, giving the comparative motions of the crank and of the slide valve, to a higher degree of approximation than in my previous work, and I am conscious that the approximation is perfectly sufficient in all cases of usual practice, as is shown by several examples inserted in this latter work, which is published and may be actually got at M. Gauthier-Villars, editeur, Quai des Augustins, 55, Paris.

The following examples, of which the whole calculations are contained in this work, show an accordance of the theory and practice, which would be impossible if any capital mistake had been made by me. Those examples apply to locomotives built by MM. Cail and Co. The conditions in which the distribution of steam took place were given to me by M. Cail's engineers from the drawings used for the construction, and I proposed myself to calculate by my formula:—(1) r, the radius of excentricity; (2) θ, half of the angle of the two radii of excentricity; (3) e, the lap, what is called in France "le recouvrement extérieur du tiroir."

First Example.—Engines for the Russian railways:—

By theory.	Really.
$r = 0{\cdot}075073$ m.	$r = 0{\cdot}075$ m.
$\theta = 78$ deg. 31 min. 50 sec.	$\theta = 77$ deg. 41 min.
$e = 0{\cdot}022143$ m.	$e = 0{\cdot}0225$ m.

Second Example.—Engines for the railroad of Madrid to Alicante and Sarragossa:—

By theory.	Really.
$r = 0{\cdot}073971$	$r = 0{\cdot}073$ m.
$\theta = 79$ deg. 13 min. 50 sec.	$\theta = 78$ deg. 57 min.
$e = 0{\cdot}018793$ m.	$e = 0{\cdot}01875$ m.

Third Example.—Engines for the Lyons Railroad:—

By theory.	Really.
$r = 0{\cdot}084639$ m.	$r = 0{\cdot}085$ m.
$\theta = 77$ deg. 55 min. 40 sec.	$\theta = 77$ deg. 42 min.
$e = 0{\cdot}0257064$ m.	$e = 0{\cdot}02575$ m.

ED. PHILLIPS,
Member of the Academy of Sciences of the French Institute.
27, Rue de Marignan, Paris, May 30th.

CUT RAILS.—GAS EXPLOSIONS.

SIR,—In THE ENGINEER, April 27th, 1883, is an extract from a correspondent of the *Railway Gazette*, who says: "To find how many cut rails to order, or how many will be required, on a given curve, so that the sleepers may remain parallel, and the joints opposite." Now if we assume $\pi = 3{\cdot}14159$, his rule is quite correct, until we come to where he says, "Make $m = 1$, and we have $d = \frac{29{\cdot}58}{360}$ $= 0{\cdot}986$in." Here there is certainly an error, as $\frac{29{\cdot}58}{360} = 0{\cdot}821$in. (nearly $\frac{7}{8}$in.). But further on he says: "For instance, if we have 870ft. of 4 deg. curve, the central angle subtended by this curve is $8{\cdot}70 \times 4 = 34$ deg." And further he says: "To correct this we shall require eleven rails 29ft. 9in. and one rail 29ft. $10\frac{3}{10}$in. long." He also says: "or one cut rail to one and a-half whole rail." More correctly this would be 1 to $1\frac{1}{4}$.

Would any of your readers be good enough to answer the following queries, as the statements given are not quite clear to me?

(*a*) From "870ft. of a 4 deg. curve," how does he get "the central angle subtended by this curve is $8{\cdot}70 \times 4 = 34$ deg."?

(*b*) How does he first arrive at this, that "eleven rails 29ft. 9in. and one 29ft. $10\frac{3}{10}$in. will make up the inner curve with joints opposite and sleepers parallel"? I assume that he takes 30ft. as his standard length of rail.

Secondly, I should also be glad to be informed what may be correctly assumed as the expansion of gas when exploded. Mr. J. D. Shakespear, in a letter to the *Times*, July 8th, 1880, says: "At the moment of explosion gas expands about 500 times its volume, and generates at least 1500 deg. Fah." The correctness of this, however, I have heard questioned.

With regard to the proportions of gas and air required to produce an explosive mixture, there appears to be some difference of opinion. At the inquiry into the explosion of gas at Tottenham-court-road, July, 1880, three witnesses assigned the proportions as follows:—Mr. A. G. Hearsey: Gas, 1; air, 10. Professor Wm. Foster: Gas, 1; air, 8. Mr. A. G. Vernon Harcourt: Gas, 1; air, 4 to 10. Mr. Shakespear says, "1 of gas and 8 to 10 of air." While Colonel Majendie, in his report on the explosions at Glasgow, in January, 1883, says, "1 of gas and 5 to 8 of air." He also states that "if there is more or less than those proportions, the explosiveness diminishes." INQUIRER.

London, May 31st.

THE VENTILATION OF THE CHANNEL TUNNEL.

SIR,—Mr. C. Palmer, M.P., while being examined before the Channel Tunnel Committee, stated in reply to Lord Aberdare that there were twenty miles of passages in Killingworth Colliery, and that the ventilation was perfect. If the inference was that, therefore, the Channel Tunnel, which is also twenty miles long, could be as easily ventilated, there could be no greater fallacy. There can be no proper comparison between the workings of Killingworth Colliery and the Channel Tunnel unless the pits were twenty miles apart. In a mine where the shafts are, say, a mile apart, with twenty miles of passages, there are many leakages, some of which have only to travel one mile, and only a very small proportion of the total quantity travels the whole distance. Hence it is that the water gauge may be only 2in. or 3in., which is less than what I have heard any one say would be in the Channel Tunnel. The laws of resistances of speed in air currents are exactly the same as those which govern the speed of vessels. I venture to state that Mr. Palmer knows little about the theory or practice of ventilating coal mines, but I presume he knows something of the laws which regulate the speed of steam vessels. He knows that he can make a vessel to run twenty miles an hour, but if he wanted to make one run sixty miles an hour he would require to make engines twenty-seven times more powerful—in short, that the hull could not contain the machinery necessary.

The same difficulty will exist in ventilating the tunnel, only it may be possible to use machinery heavy enough to do it. Perhaps I might illustrate this by the St. Gothard Tunnel, which is nine miles long, or, say, nearly one-half of the length of the Channel Tunnel. If the current of air is sufficient for ventilating the St. Gothard Tunnel, then the current in the Channel Tunnel will require to be nearly three times as fast, and, therefore, about twenty-seven times as much power will be required to ventilate it as well as the St. Gothard Tunnel. I think sufficient attention has not been given to this most important matter. R. T. M.

Rutherglen, May 28th.

TESTING AGRICULTURAL MACHINERY.

SIR,—I beg to thank you for sending your representative over here to test my new thrashing machine. If the trials of the Royal Society were conducted as they ought to be, there would have been no occasion for you to go to the expense you have done to test a machine which could have been tested in a showyard.

I fully concur with the opinion expressed in your leader of May 25th, that it is high time for the Society to adopt a more liberal policy, or else to think of starting one that will. Should you think fit, you are at liberty to publish this letter; it may perhaps tend to show that inventors will find out some way or another to get their inventions impartially tested in spite of difficulties.

Eckernförde, A. W. MANTLE.
June 4th, 1883.

CUTTING SPIRALS WITH A PLANING MACHINE.

SIR,—When I was a pupil at the Katesgrove Ironworks, Reading, more than thirty years ago, I recollect the late Mr. Exall designed an arrangement for accomplishing this object on corn mill rollers almost exactly similar to that lately illustrated by you; and if I am not mistaken, the same thing is in use at the Reading Ironworks at the present time. WM. BROWN.

Devizes, May 30th.

TRIPLE EXPANSION ENGINES.

SIR,—Having noticed in your last impression the letter relating to triple expansion engines, I would be much obliged if through your kindness I could know a few details of the boiler working at 150 lb., also weight and thickness of plates. A boiler of this kind is impossible to be constructed according to the Italian Government regulation. A.

Arona, June 4th.

TENDERS.

TENDERS for the New Lenton Boulevard, for the Nottingham Corporation. Mr. Arthur Brown, Borough Engineer.

	£	s.	d.
W. Cordon, Nottingham—accepted	18,612	0	0
S. Thumbs, Nottingham	19,461	0	0
Meak Bros, Nottingham	19,580	0	0
Kellett and Bentley, London	19,985	0	0
G. Smith, Newcastle-on-Tyne	21,074	0	0
J. Knight, Loughborough	22,067	0	0
Forster and Barry, Nottingham	22,073	0	0
Tomlinson Bros, Derby	22,519	0	0
J. Dixon, St. Albans	22,984	0	0
T. Smart, Nottingham	23,968	0	0
P. Smith, Manchester	28,088	0	0
Kirk and Parry, Sleaford	29,214	0	0
Hampshire, Lincoln	33,600	0	0
Scott, Wigan	34,400	0	0
Borough Engineer's estimate	21,900	0	0

THE WATER SUPPLY OF SMALL TOWNS.

No. VII.—BRADFORD WATERWORKS.

THE question of obtaining a water supply to the town of Bradford, Wilts, has been under the consideration of the Commissioners for some years, and has been the subject of several Local Government Board inquiries held by Major Tulloch. The population to be provided for has been taken at 7000. The works, which are just being completed, are illustrated partly by a page of engravings in our issue of the 25th ult., and further by engravings on page 434. The water for supplying the town is obtained by excavating a chamber (Fig. 17) in the water-bearing beds of the oolitic formation, and by driving adits to supplement the volume obtained in the course of this excavation. The walls and floor of this underground chamber are constructed with concrete, the proportions being 1 of Portland cement, 5 of broken stone, and 2 of sand. Where the concrete was exposed to the action of the incoming springs, a larger proportion of cement was used. The roof of the chamber is constructed of two rings of brickwork supported on brick piers, the whole covered in with concrete.

The water is pumped from this chamber through a 6in. rising main to a service reservoir at a distance of 1400 yards and a height of 300ft., which elevation commands the whole town. The engines are compound horizontal, having high-pressure cylinders 8in. diameter, low-pressure cylinders $13\frac{1}{2}$in., and pumps, 6in. diameter. The stroke is 20in. There are two Cornish boilers 16ft. long, 4ft. 6in. diameter.

In order to economise engine power, and to provide also for the stopping of the engine for repairs, each engine and boiler is capable of doing the whole of the pumping by working extra hours. The two engines together are able to pump the maximum amount of water required in the future when working, at the outside, ten hours per day. The engine and boiler-house, &c., are shown in Figs. 1 to 6. They are built of hammer-dressed rubble masonry, obtained from the excavation from the service reservoir, the quoins being of Westwood stone. The water after being raised by the engine to the reservoir—Figs. 7 to 12—can either be delivered on to the filter bed—Figs. 14, 15, and 16—or into the reservoir or past both filter bed and reservoir direct into the town by means of valves, shown in the valve chamber. The filter is composed of 3ft. 6in. of filtering material, varying from $1\frac{1}{4}$in. gravel at the bottom to fine sand at the top. The bed of the filter is made with open brickwork, and the water passes off through a 6in. open jointed pipe. The reservoir holds 300,000 gallons, and is excavated in the oolite in a bed of very hard rock locally termed "firestone." The walls and floor are made of concrete, consisting of 5 of broken stone, 2 of sand, and 1 of Portland cement, the whole being rendered with $\frac{1}{2}$in of cement, and sand, 1 to 1, and floated with $\frac{1}{4}$in. of neat cement.

The roof of the reservoir consists of a series of brick arches in

NEW WATERWORKS, BRADFORD, WILTS.

MR. HENRY ROBINSON, M.I.C.E., WESTMINSTER, ENGINEER.

FIG 11
PLAN OF MANHOLE OF FIG 12

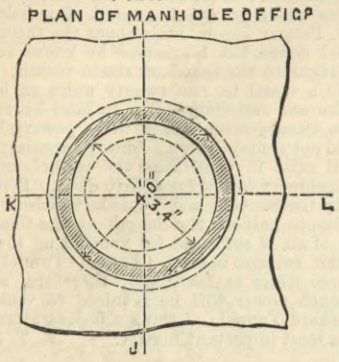


FIG 12
SECTION ON LINE C.H OF FIG 11A

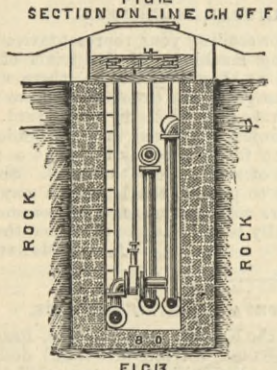


FIG 13
SECTION ON LINE I K

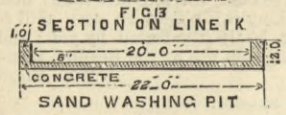
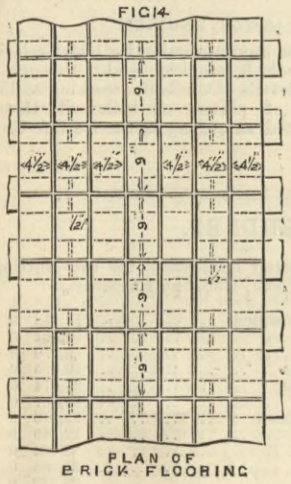


FIG 14



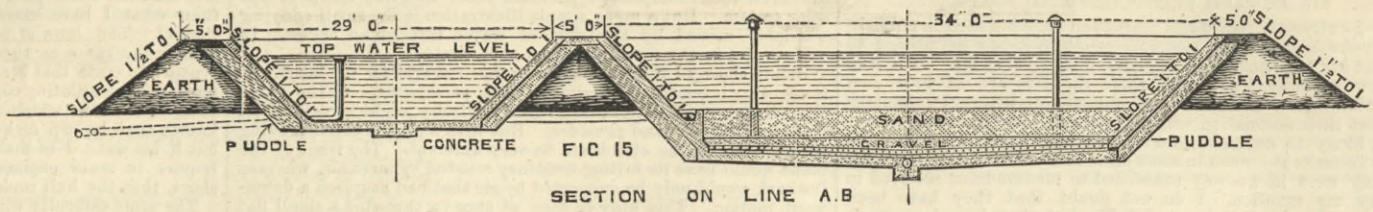
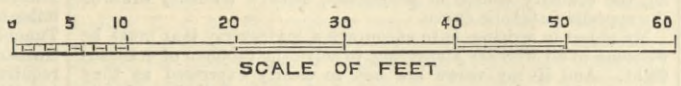


FIG 15
SECTION ON LINE A.B



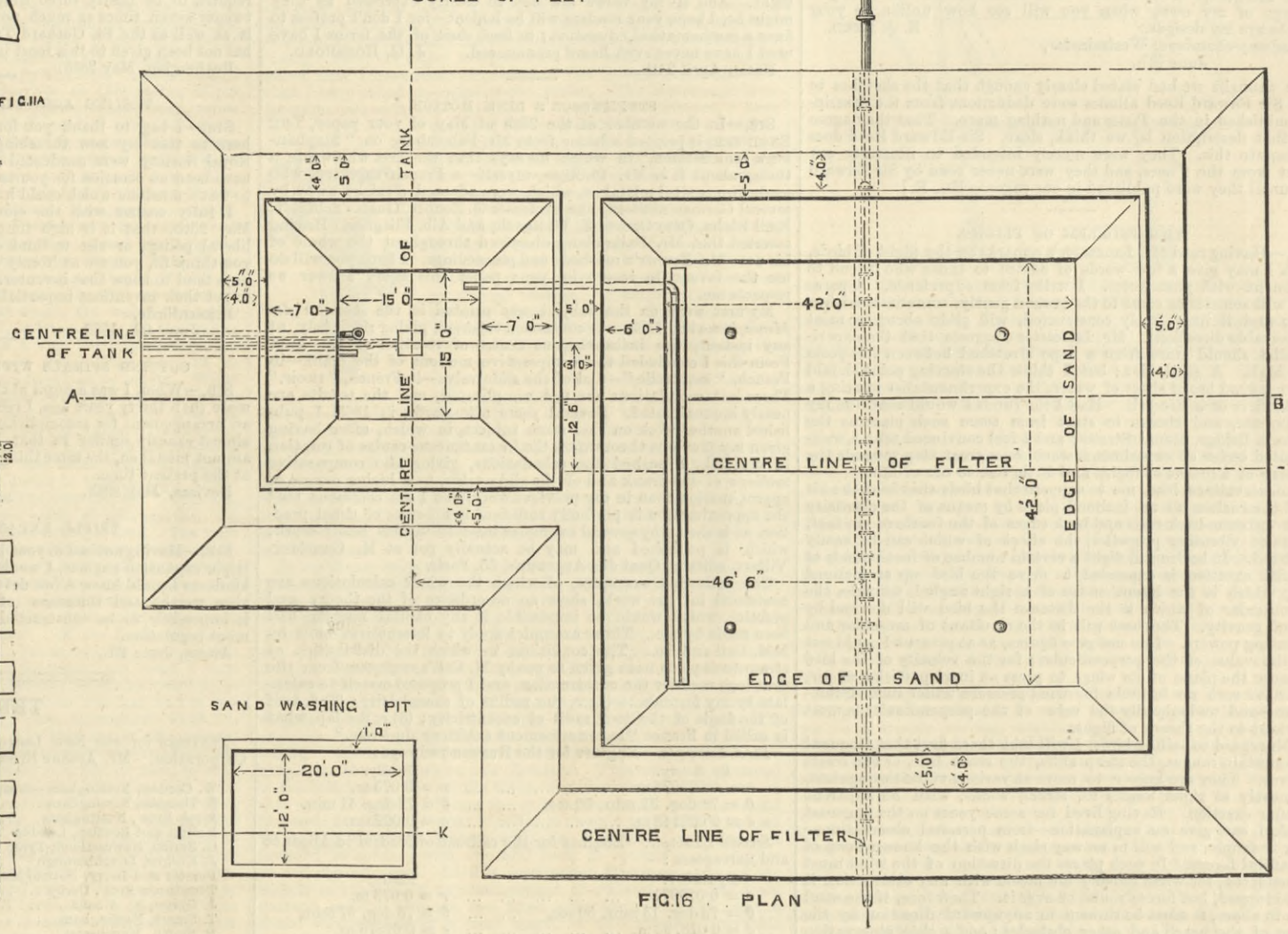
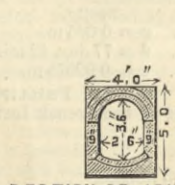
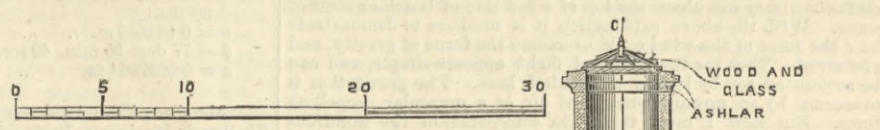


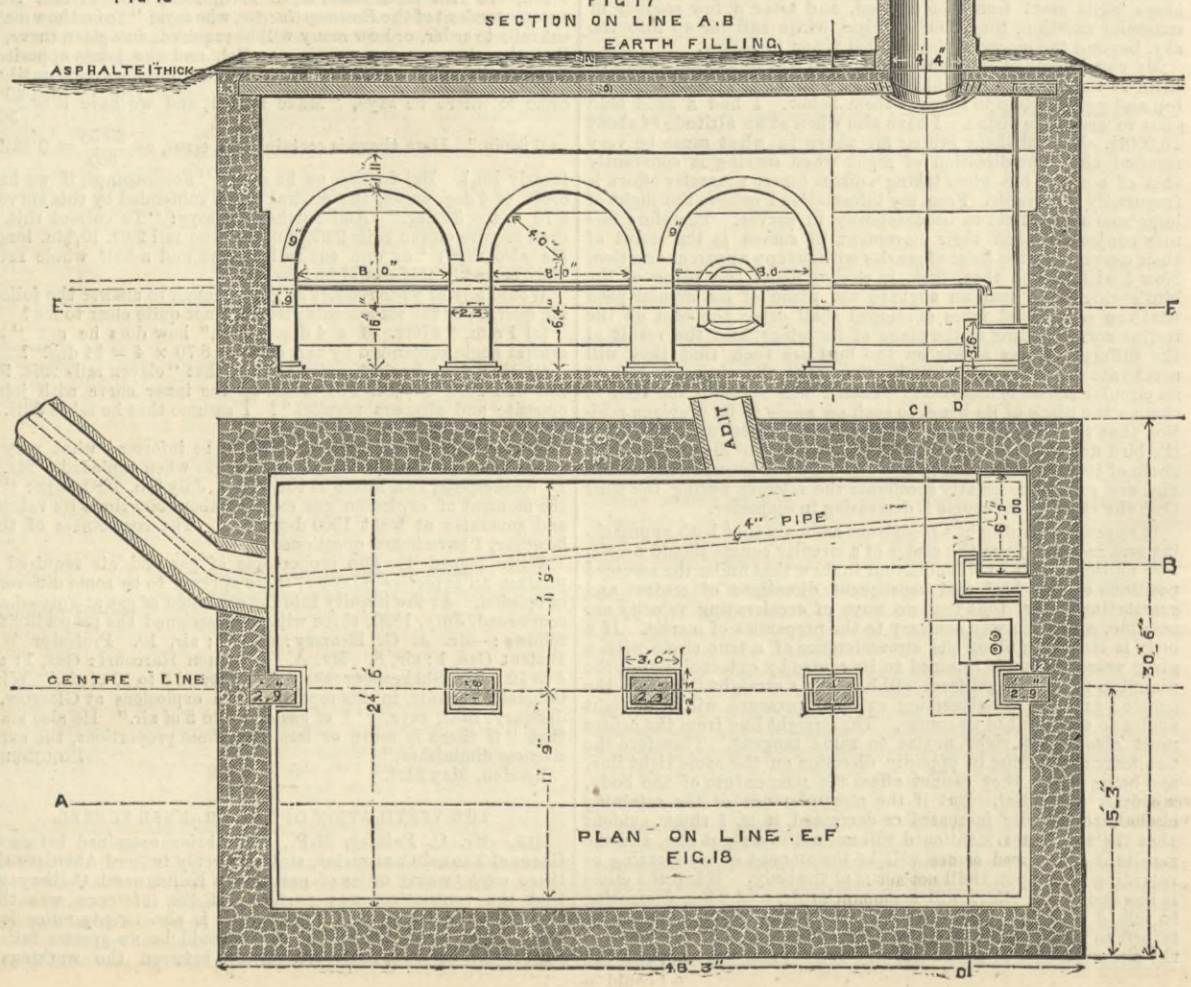
FIG 16 PLAN



SECTION OF ADIT
FIG 19



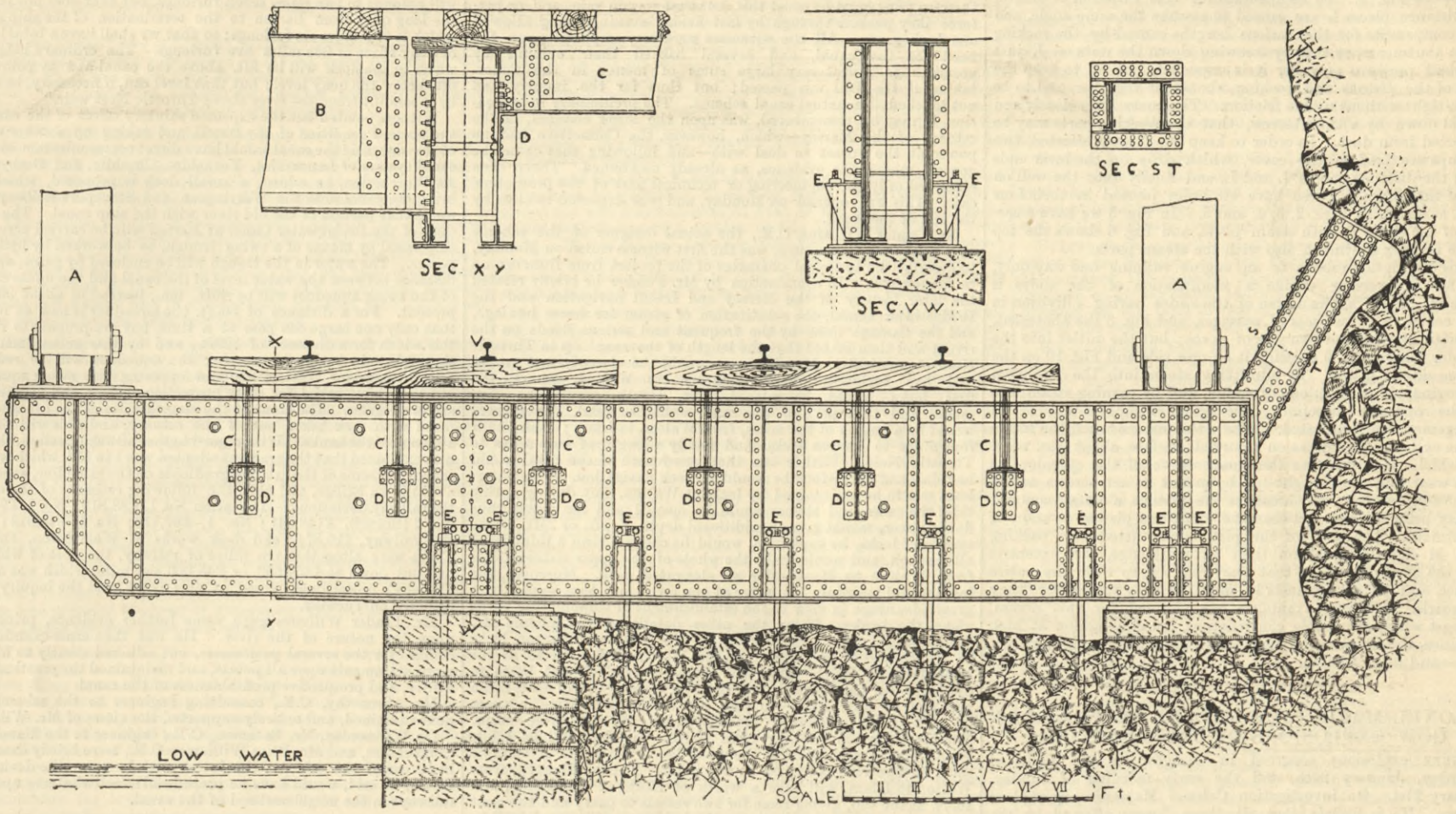
UNDERGROUND STORAGE CHAMBER
FIG 17
SECTION ON LINE A.B



SECTION ON LINE C.D

cement, asphalted over and covered with concrete and earth. The roof is carried on a series of brick piers in cement. All the Portland cement stood the test of 750 lb. on a section of 2½ square inches after seven days' immersion. Some fissures were met with in the rock, which were closed in with stones in cement before the concreting was done. The delivery of water from the pumping engines to the filter and reservoir will be controlled by self-acting floats and cut-off valves. A 7in. service main conveys the water from the reservoir to the town, where it is distributed in the usual way through pipes varying from 7in. to 3in. The trenches for the pipes are in many parts excavated in the hard firestone already referred to as being met with in excavating for the reservoir, and powder had to be used in some of these trenches as well as in the reservoir. The cost of the water supply to the town will be about £10,500, of which the works herein described cost as follows:—Underground chamber, adits, and engine house, £2000; engines, boilers, pumps, &c., £1000; service reservoir and filter, £1700; pipes, valves, and hydrants, £3700; certain trial shafts, preliminary works, land-water rights, &c., cost £2000. The engines and machinery have been supplied by Messrs. Spencer and Gillett, of Melksham. The contractor for the rest of the works is Mr. Griffith Griffiths, of Gloucester. The engineer to the Commissioners is Mr. Henry Robinson, M. Inst. C.E., of Westminster.

BRACKET GIRDER ON THE NEW YORK AND BUFFALO RAILWAY.



A NOVEL and interesting piece of what might be aptly termed complicated engineering has recently been completed on the New York, West Shore, and Buffalo Railway, at a place called Cozzen's, in Orange County, N.Y. The complications arose from the necessity of building a bracket girder to support the track and also two bridges, one of long span. The road runs along the bank of the Hudson River at an elevation of only a few feet above the surface of the water, and hills of solid rock dip into the river, forming only an insignificant shore. Along the line tunnelling, excavating, filling, and bridging, have been resorted to in order to secure a firm bed. At Cozzen's there is a little bay, or cove, about 120ft. wide and reaching inland about half as far. It was decided to bridge this bay, but at the side under consideration the rock did not form shore enough to allow the full width of the road, and it shelved too abruptly into the water to permit of building a support either by piling or masonry. The line of the road was such that excavating in the side of the hill to the distance needed was out of the question. To overcome these difficulties, the bracket shown in the engraving was decided upon.

This consists of two rigidly connected plate girders placed 1ft. 10in. between centres, and having a length of 35ft. The web is $\frac{5}{8}$in. thick, stiffened with angle irons 5in. by $3\frac{1}{2}$in. by $\frac{1}{2}$in. The ends of this twin girder rest on masonry, as illustrated. Not quite one-third of the girder projects over the water. The trusses for the long span bridge over the bay—span 134ft. 9in.—rest on this girder, one at each end, as indicated at A A′. The stringers C C C are supported on the brackets D D D, the sleepers being laid as shown. The cross section through X Y shows this arrangement, and also the supports for the plate girder comprising the short bridge, which is 89ft. $1\frac{1}{2}$in. long. There are two of these longitudinal girders placed about 8ft. apart, and upon which the outer track runs until it reaches land some 50ft. from the twin girders. The outer support of the twin girders is so located relative to the outer track that the moving load of a train on this track is just balanced over the edge of the masonry, and does not, therefore, affect the stability of the structure. In order, however, to guard against all contingencies, the girder is secured to the rock at regular intervals by bolts 9ft. long, shown at E E E. The cross section V W shows the method of fastening these bolts to the girder. The bolts are held in the rock by splitting the lower ends and driving them upon feather wedges of steel, the spreading thus caused bearing firmly against the sides of the holes and preventing any liability of drawing. The holes were then carefully filled with Portland cement, and it may be stated in this connection that the spaces beneath the girders and also between them will be filled with concrete in order to exclude all water which might spray up from the river.

The rock has been cut away as shown at the right of the engraving and a strut inserted. This is a square column—cross section S T—having interior dimensions of 16in. by 18in., and exterior of 2ft. 5in. by 2ft. 7in., with plates 1in. thick. The length is 5ft. 9in. To make a perfect fit a slightly tapering plate was driven in at the top, after which the bolts were screwed up.—*Railroad Gazette.*

PINCHBECK'S EXPANSION AND REVERSING ROTARY ENGINE.

THE problem of constructing a really satisfactory rotary engine remains a difficult one, and though many attempts are made every year, few accomplish any real advance. Our attention has recently been called to a rotary engine patented by Mr. J. Pinchbeck, of Victoria-chambers, which has some novelties that may be described by reference to the accompanying drawings. We are informed that one engine of this kind has been constructed by Messrs. Waygood and Co., of Newington Works, Great Dover-street, S.E., with cylinders 8in. diameter, and that at a velocity of 500 revolutions per minute the power taken on the dynamometer was 8 horses. It will be noticed that the angles made by any radius or any tangent of the pistons in their revolutions give a lateral motion to the rocking abutments, which is utilised for the purpose of admitting and cutting off steam in the cylinder, thus dispensing with the employment of a separate valve and excentric for that purpose. The abutments are held down on to the pistons by a mechanical connection between them, the ascent of one piston causing the descent of the abutment on to the descending piston, only sufficient pressure being applied to keep the surfaces in contact.

In the engravings, Figs. 1, 2, 3, are sections of the cylinder, showing the piston in different positions. In Fig. 1 the ports are beginning to open, and the abutment valve E is turning towards the exhaust port in the direction shown by the small arrow. Fig. 2 shows the piston at 90 deg., the steam ports being fully open. Fig. 3, the piston is at 180 deg., and the ports are closed, the abutment turning away from exhaust, as shown again by the small arrow. From this point the steam expands till the piston

FIG 1.

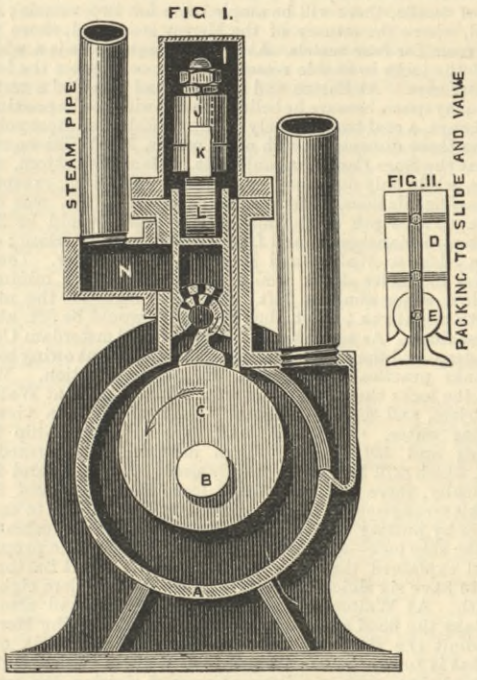


FIG.II.

FIG.2.

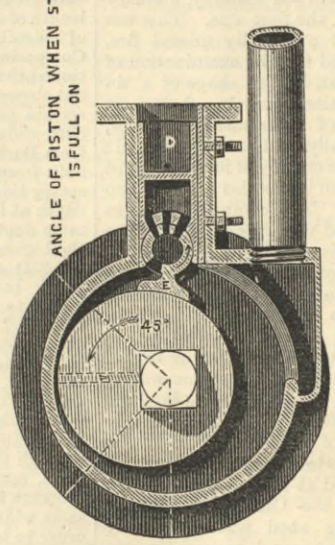


FIG.3.

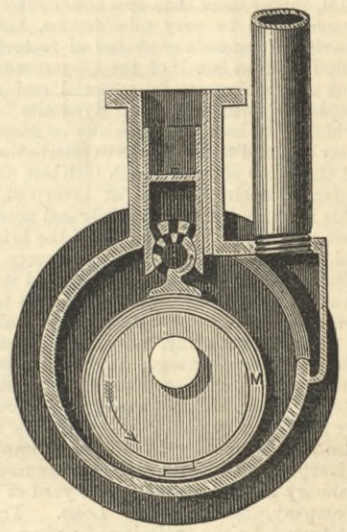


FIG.4

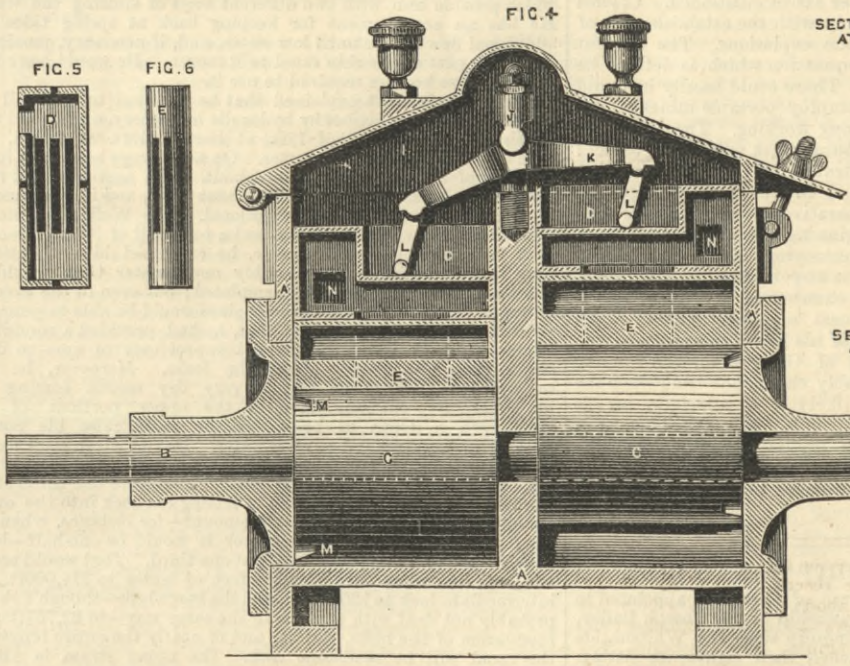


FIG.5

FIG.6

FIG 10 SECTION AT C D

FIG.8

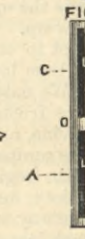


FIG.7 PLAN OF REVERSING SLIDE

FIG 9 SECTION AT A.B.

reaches the exhaust port, when it is discharged into the atmosphere. The travel of the abutment is rapid, both at the top and bottom, but is almost *nil* from 45 deg. to 135 deg., when, at that angle, the shutting of the ports is as rapid as was the admission.

The radial slides D D are hollow, and are always open to the steam through the openings N N. They are fitted with metallic packing held forward by spiral springs, as shown in Fig. 11, and their faces are brought in contact with the inner faces of the slide case by set screws, shown in Fig. 2. Fig. 4 shows a longitudinal section, one piston being at the top, the other at the bottom of the cylinder, which is divided by a partition into two parts. The slides D D, upon which the abutments rock, are held down by the distant pieces L L, and these are held down by the lever K, which rocks on the centres J. Now, as the pistons have equal diameters and excentricity, their velocities are similar, though the pistons are travelling one up and the

other down. As the abutments rock it will be readily understood that the distance from the top of the lever K to the face of the pistons will vary according to the sines of the angles they make—see Fig. 2. To compensate for this variation of length, the distance pieces L are caused to assume the same angle, and thus compensate for the various lengths caused by the rocking of the abutments, so that by screwing down the nuts on J, just sufficient pressure may be, it is expected, put on to keep the faces of the pistons and rocking abutment together, and to be steam-tight without undue friction. The cover I fits closely and is held down by a thumbscrew, that the working parts may be protected from dust. In order to keep the faces lubricated, two oil cups are fixed on the cover, which drop on the lever ends down the distance pieces L and L, and finally into the well on top of the slides. These have oil holes pierced in their four sides, as shown in Figs. 2, 3, 4, and 5. In Fig. 5 we have a section of the slides D with steam ports, and Fig. 6 shows the top of the rocking abutment, also with the steam ports.

This description relates to an engine running one way only, but for a reversing engine a modification of the slides is required. Fig. 7 shows a plan of the slides having a division in their centre, with two sets of passages, and Fig. 8 the abutment, also with division and two sets of ports; but the outlet into the cylinder differs, Fig. 9 showing it on one side and Fig. 10 on the reverse side of piston. By admitting steam into the passage p the engine will turn in one direction, and by turning steam into p^1 the opposite direction. The exhaust pipes for such an arrangement are duplicated. Where the pistons touch the inside of the cylinder they do so on a curved surface about $\frac{1}{2}$in. wide, and which corresponds to the inner curve of the cylinder; as these wear they are brought up by means of set screws acting on the square shaft, which carries the pistons, a certain amount of play being allowed between the shaft and pistons to allow of adjustment. The ends of the pistons are fitted with packing rings M slightly bevel on their external edge, and excentric with the covers, in order that they may sweep over the entire surface, and not cut channels in them, as they would were they concentric. Several advantages are claimed for this design, amongst which are simple construction, noiseless action at high velocities, the few wearing parts—and these become tighter from wear—and small friction.

COLONEL MAJENDIE'S REPORT ON THE GLASGOW EXPLOSIONS OF JANUARY, 1883.

Three explosions occurred in Glasgow on the night of Saturday, January 20th, and the early morning of Sunday, January 21st. On investigation Colonel Majendie reported as follows. He is certain that all three "were effected by the agency of a nitro compound, and that they were wilfully effected by some evil-disposed person or persons," the discovery of whom is a matter for the police. The first explosion occurred at 10.10 p.m. on Saturday night, January 20th, at the Tradeston Gas Works. It appeared to be well established by the evidence of results of the explosion that a charge of some very violent explosive had been fired, probably of the nitro-compound class, which had been detonated in the space between a pillar and the plates of a gas-holder. The theory of the effects being produced by an explosion of gas and air in any accidental way is carefully considered by Colonel Majendie in his report, and dismissed as out of the question. The second explosion took place on the Possil-road Canal Bridge about 12.30 a.m. on Sunday, January 21st, rather more than two hours after the first one. This was intended to be very mischievous, but practically missed fire, leaving of course a good deal of material for the examination of Dr. Dupré on behalf of the Government, in the shape of a tin box containing woody material and nitro-glycerine, being an explosive termed "lignum dynamite" of an unlawful character, which must have been specially or illegally made or imported. It may be noted that the same explosive was employed in the attempt at the *Times* office on March 15th last, and it was also found in two infernal machines seized at Liverpool. The compound had in this instance been badly made and acted very imperfectly. The box was left near the middle of the bridge, and was noticed by a soldier named Adam Barr and a party of men and women with him. He lifted the box and carried it a few paces. He opened it and touched what appeared to him to be brown sand inside it, when it began, as he stated, to fizz, and shortly exploded, but in a very imperfect way, knocking him down and injuring five of the party more or less. Without question the intention was to destroy the bridge and allow the canal water to escape into the streets below. The *débris* of an apparatus for firing the charge by means of sulphuric acid, chlorate of potash, and sugar was also found; another in a more complete state being found at Liverpool. The third explosion occurred at 1.15 a.m. on Sunday, January 21st, in a shed in the yard of the Caledonian Railway Company, near Dobbies Loan. The shed was completely destroyed by the explosion of a nitro compound apparently contained in a tinned iron box, and probably prepared and employed in the same way as in the other cases above mentioned. Colonel Majendie's report of course deals only with the establishment of the evidence as to the nature of the explosions. The element which concerns the public is the question which is left, as he says, for the police to follow up. There could hardly be found more distinct proof that a plot to employ portable mines of the most violent character had been long working. The plan must have been long matured. We naturally ask with what object? Either the conspirators were frustrated in their original aim, which it is impossible to divine, and in disappointed rage employed their mines for objects comparatively beside their purpose, or else their intention from the beginning was to make war in an indiscriminate way upon society, destroying life and property in as reckless and indiscriminate way as any heathen fanatic "running a muck," but with much less excuse and in a more despicable way. The fanatic is an honest man who pays for his enthusiasm by the certain sacrifice of his life. The creature who crept through the neighbourhood of Glasgow on the Sunday morning of January 21st had probably chosen the time when the Sabbath-keeping northeners were likely to be asleep, to lay his traps to destroy the lives of poor people who must have been unknown to him, as well as the public property, which he attacked, and to escape perhaps with little risk to himself. We trust that the police will take precautions to prevent this being the case in any future attempt.

THE MANCHESTER SHIP CANAL BILL.

The Select Committee of the House of Commons appointed to consider this Bill under the chairmanship of Sir Joseph Bailey, have been steadily pursuing their inquiry since the Whitsuntide recess, until they have at last reached their eighteenth sitting. Since we last noticed the investigation up to the close of last week, the evidence has consisted almost entirely of testimony by local authorities, merchants, manufacturers, and traders as to the great necessity in the interests of commerce of the projected canal. Ten days ago the promoters presented a list of 136 witnesses whom they wished to call upon this aspect of the case, but the Committee at once intimated that they were not prepared to go through so formidable a list, and peremptorily required the counsel to make such selection as would enable them to close this part of the case by Thursday last. The learned gentlemen in charge of the case tried hard to resist this, but that was in vain, and so perforce they pushed through by last Friday evening, being allowed one day's grace. All the witnesses were very emphatic upon the need for the canal, and several backed their opinion by promises to invest very large sums of money in the undertaking if the Bill was passed; but thus far the inquiry had not touched the actual canal scheme. The preliminary investigation, it may be remembered, was upon the lower channel, in the estuary of the Mersey—which, however, the Committee had no power at the outset to deal with—and following that came the general mercantile evidence, as already mentioned. There then remained only the engineering or technical part of the promoters' case. This was opened on Monday, and was expected to close by the end of the week.

Mr. Leader Williams, C.E., the actual designer of the scheme now before the Committee, was the first witness called on Monday, to describe the technical character of the project from Runcorn up to Manchester. In examination by Mr. Pember he briefly related the later history of the Mersey and Irwell navigation and the Bridgewater Canal, the substitution of steam for horse haulage, and the damage done by the frequent and serious floods on the river; and then stated that the length of the canal up to Throstle Nest — practically Manchester — would be twenty-one miles and five furlongs. From Runcorn to Walton, where the first locks would be placed, the length would be five miles; and that part of the canal would be tidal. Then there would be a length of ten miles, from Walton to Irlam; then one of four miles to Barton locks, and finally a length of two miles to Throstle Nest. Rather less than one-fourth of the canal would be tidal, and three-fourths would be lock navigation. The water-level was to be maintained by locks at Walton, but during spring tides the gates and sluices would be opened, and the water thus flowing over, would give an additional depth of 2ft. or 2½ft. This system of locks, he explained, would be cheaper than a tidal canal all through, and would make the whole of the upper sixteen miles from Walton to Manchester an elongated dock. Moreover, the locks would maintain the water at one level, and that would be a great advantage in view of the establishment of shipbuilding yards along the banks. Upon the other details of the scheme Mr. Williams said: The bottom width of the canal from Barton locks to Manchester—two miles—will be 170ft., with a width at the water level of 200ft. This will enable a vessel of 45ft. beam to discharge on the Salford side, and two vessels—one of 45ft. beam and one of 40ft. beam—to pass her at the same time, a space of 20ft. being preserved between each of the three ships. The next section running from Barton to Irlam will be 120ft. at the bottom, and 172ft. at the water level, which will give ample room for two vessels to pass at any point. The next length, from Walton to Irlam, will have a width of 120ft. at the bottom, and 168ft. at the top, giving room for two vessels to pass; and the next length, from Walton locks to the tidal portion of the canal, will be 120ft. wide at the bottom and 174ft. wide at the water level. The canal will then widen out for a quarter of a mile of 160ft. at the bottom, and 214ft. at the water level, until at the commencement of the canal in Runcorn the bottom width will be 200ft. and the top width 254ft., which will enable four vessels to pass. A number of vessels might go down to wait for the tide, and this width would allow them to pass out of the canal readily, so that at the Manchester end, where ships will be delayed, there will be plenty of room for three vessels to pass; in the middle, where it is merely a question of traffic, there will be ample room for two vessels; and at the end, where the estuary of the Mersey is entered, there will be ample room for four vessels. At certain points there is a widening out of the locks to enable vessels to turn or to enter the locks with greater ease. At Barton and Irlam he had provided a certain length of quay space, because he believes that, owing to the proximity of the railways, a coal trade is likely to be established at those points. Comparing these dimensions with other canals, Mr. Williams mentioned that the Suez Canal was only 72ft. wide at the bottom, with flat slopes, while only one vessel could pass at one time, except at certain passing stations. The Amsterdam Canal, too, was only 89ft. wide. The depth of the Manchester Canal would be 26ft. from Barton to Manchester, and from Barton locks to Irlam; and 24ft. from Irlam to Walton and Runcorn at low water. During spring tides the latter depth would be 26ft. 6in. The minimum depth at low water would be 24ft., but during high tide the maximum depth might run to 50ft., but the banks would be 5ft. above the highest tides. As against these depths the Amsterdam Canal was 23ft. deep, and the Suez Canal nominally 26ft., but owing to the sandy banks practically only 22ft. for safe navigation. With regard to the locks the witness said we shall have three at Walton, three at Irlam, and three at Barton. These are with a view to economising water. First, we shall have one large ship lock 550ft. long and 60ft. wide. Then another, or intermediate ship lock, which will be the one mainly used, 300ft. long and 40ft. wide. Finally, there will be a barge lock, 100ft. long and 20ft. wide. This arrangement would enable them, if necessary, to economise water by putting barges through the barge lock instead of through the ship lock—witness here produced plans of the proposed locks, and explained the same to the Committee. At Barton he proposes to have six sluices, each 20ft. wide, and at Irlam eight of same width. At Walton he has six similar sluices, and also—in order to take the flood water down the old channel of the Mersey, and to admit the tidal flow into the new ship canal—six other sluices, that is to say, he has altogether at Walton twelve sluices, which provide him with two different ways of sluicing the water. He has an arrangement for keeping back at spring tides the additional flow of 2ft. until low water, and, if necessary, passing it down the part of the ship canal to Runcorn. He would have that power in case he ever required to use it.

Mr. Williams next explained that he proposed to work all the lock apparatus and sluices by hydraulic machinery, and stated that he should have a fall of 17ft. at Barton, 19ft. at Irlam, and 23ft. 6in. at Walton, at low water. On an average he should lower the level of the water 10ft. throughout. The aggregate fall from Runcorn to Manchester would be about 60ft., and in this amount of fall there was nothing exceptional. The Welland Canal in Canada had twenty-seven locks, and a total fall of 330ft. Dealing next with the question of water, he expressed himself satisfied that there would be considerably more water than would be required for the navigation contemplated; but even in the event of excessive drought, the hydraulic engines would be able to pump up an extra supply; and besides that, he had provided a conduit at Irlam—which, however, he did not expect ever to use—to draw water from the Mersey above the locks. Moreover, he had so provided that if he saw a very dry season coming on, he could, he showed, have in the upper portions of the river such a depth of bank that he could raise his pounds another foot or two and so store water. Having given some figures respecting the recent slight rainfall in Manchester and the district, Mr. Williams said "I assume that we shall save one-third of the quantity of water by the system of letting one lock into the other. I might have taken a much larger amount—for instance, when the small lock ascends to the large lock it would be one-half—but I have chosen to average the saving at one-third. That would reduce the large lock from 561,000 cubic feet of water to 374,000ft., the intermediate lock to 136,000ft., and the barge lock—though I should probably not deal with this one in the same way—to 22,767ft; the foundation of the locks, sluices, and of nearly the entire length of the canal will be sandstone rock. The upper strata is alluvia deposit, clay, gravel, and sand—highly favourable material for dredging. The dock at Manchester will be entered by two locks, one of which will be 550ft. by 60ft., and the other 300ft. by 40ft. The dock will be about 70 acres, and will occupy the entire site of the present Manchester racecourse. There are to be four arms to the dock—the first 1700ft. long and 250ft. wide, the second 1300ft. by 250ft., the third and fourth each 900ft. by 250ft. These four arms are to be divided by three piers each 200ft. wide. The whole of the dock will be in Salford, and the four arms will point in the direction of Manchester and Salford. The quay space at Salford will amount to two miles seven furlongs, but that does not include the long quay from Barton to the termination of the ship canal, which is two miles six furlongs; so that we shall have a total length of quay space of five miles five furlongs. The ordinary height of water in the dock will be 8ft. above the canal at that point, and 6ft. below the quay level; but that level can, if necessary, be raised by a conduit from the river above Throstle Nest weir."

Witness pointed out the expected salutary effect of the canal on the present condition of the Irwell, and taking up another aspect of the case, said the canal would have direct communication with the canal system of Lancashire, Yorkshire, Cheshire, and Derbyshire. At Warrington, he added, a small dock is proposed, which will bring the canal near the Warrington and Stockport Railway, and unite that portion of the old river with the ship canal. The aqueduct of the Bridgewater Canal at Barton will be carried across the ship canal by means of a swing trough, to be worked by hydraulic power. The water in the trough will be enclosed by gates, and the distance between the water level of the canal and the under surface of the swing aqueduct will be 40ft. 6in., instead of about 30ft. at present. For a distance of 800ft. the aqueduct is now so narrow that only one barge can pass at a time, but we propose to double this width for a distance of 323ft., and by this arrangement the time taken by barges in crossing the aqueduct will be reduced. The Bridgewater trustees are not opposing this swing aqueduct, but they have asked for some protection clauses, and negotiations are in progress. The front of the sloping sides of the canal will be faced with rock taken out of the estuary, and this will prevent abrasure of the banks. With regard to the railway question, the witness explained that the gradient adopted was 1 in 114, which was not so sharp as some of the existing gradients on the same line, especially at Runcorn Bridge, and gave the following estimate of the cost of the railway deviations:—Deviation No. 1, £88,819; No. 2, £94,086; No. 3 (tunnel), £148,041; No. 4, £67,112; No. 5, £48,918; junction railway, £10,374; and dock works at Warrington, £60,508. There were altogether ten miles of railway, the cost of which he had put down at £454,652, or £45,000 per mile, which was ample. The day's proceedings closed at this point, and the inquiry being resumed on Tuesday,

Mr. Leader Williams gave some further evidence, principally upon the nature of the river. He was then cross-examined by counsel for the several petitioners, but adhered stoutly to his previous statements upon all points, and maintained the practicability, utility, and prospective profitableness of the canal.

Mr. Abernethy, C.E., consulting engineer to the scheme, was next examined, and entirely supported the views of Mr. Williams.

On Wednesday, Mr. Bateman, C.E., engineer to the Manchester Corporation, and Mr. Price Williams, C.E., were briefly examined in favour of the scheme; the latter mainly upon the deviations, which, he said, would have no prejudicial effect whatever upon the railways in the neighbourhood of the canal.

Steam Tug and Trawl Fishing Trade.—The prices of paddle and screw tugboats have considerably advanced—in second-hand iron paddle-boats to the extent of nearly 100 per cent. This sudden enhancement of value is principally attributed to numerous purchases made by parties engaged in trawl fishing. Messrs. Sharp Brothers, of Sunderland, who have much to do with this class of boat, state that no fewer than 150 paddle tugs have been drafted from their ordinary towing business and engaged in trawl fishing on the north-east coast of England, and in Scotch waters as far as Inverness. If the *furore* for trawl fishing should continue, it is possible that the price of such boats will rise still higher; and this is very likely, because of the successful operations and immense catches of fish the boats have been taking lately, and more particularly from the result of the last deputation of Scotch line-fishermen to Mr. Chamberlain, who assured the deputation that the prohibitory measures asked for in connection with trawl fishing, in the majority of instances, could not be conceded, for various causes and interests. We cannot find, however, that fish is cheaper.

A New Phenomenon in Acoustics.—In *Hibernia*, a monthly Irish science and art publication, Mr. J. H. Pentland calls attention to a phenomenon, the existence of which has not been before recognised:—Some few months ago it occurred to Mr. T. H. Maxwell to introduce a tuning folk whilst sounding into a flame. The performance of the experiment is simple in the extreme. The properties required are a flame and a tuning fork. On introducing the fork whilst sounding into the flame, the sound of the fork will be observed to increase in intensity. It is well known that the intensity of any sound depends on the density of the medium in which it is generated, not on that in which it is heard. But as flame is a much rarer medium than the air we breathe, this, in the absence of other causes, should diminish the intensity. It is equally well known that any want of uniformity in the density of the medium between the sounding body and the ear diminishes the intensity of the sound; but as the introduction of the fork into the flame renders such medium anything but uniform, we should, as before, look for a diminution of intensity, whereas it is palpably increased. The two diminutions, familiar to us from the experiences of Mr. Tyndal on the Mer de Glace and of M. Humboldt on the Orinoco, doubtless take place, and might possibly be observed did not some other cause or causes produce an opposite and more powerful effect. As a similar effect has been observed with a variety of flames, it has been suggested that the only body that could augment the intensity by resonance is the flame itself and possibly its envelope. A sounding box usually consists of a uniform body of air inclosed by a solid envelope, both of which are thrown into vibration by the neighbourhood of a sounding body. In the present case the solid envelope is absent; the included gaseous body has not an uniform density, and it passes, more or less *per saltum*, into the gaseous envelope, which itself passes gradually into the medium in which the sound is heard. The flame may, however, be virtually considered as a tolerably uniform body of gas contained in an envelope of much greater density, and as such should possess all the characteristics of a sounding box. A very obvious *experimentum crucis* at once follows from the foregoing. A sounding box, in order to produce its greatest augmentation on a given sound, should bear a certain proportion to the wave of the sound. Could one, therefore, obtain a flame whose length was one-quarter of the wave-length of the fork, that flame should give the greatest effect for the particular fork. In order to calculate the length of this flame we should obtain its average temperature by a suitable pyrometer, such as Becquerel's or Siemens. The temperature of the particular flame being determined, the velocity of sound in that flame, and consequently the wave-length required, would follow from Poisson's and Biot's formulæ. The proper length of the flame, one-quarter of the above wave-length, might be impossible to obtain, even in coal gas, without a very unusual pressure; but it might be confined within reasonable limits by the use of a fork of high pitch. Such a theory would at once decide for or against the theory of flame resonance. König's manometric flames have proved very efficient in exhibiting the nature of compound vibrations, and much for or against resonance might be learnt from the application of the revolving mirror to the present phenomenon and a study of the serrated edge. There may be some reflection from the surfaces of the flame, but the transference of the fork from one side to the other makes no perceptible difference; or the phenomenon may be in some way connected with the expansion of the fork. There are many flames besides gas flames, and many sounding bodies besides tuning forks, so that the field is large. Oxyhydrogen flame, owing to its extremely high temperature, might possibly afford the most valuable results. It is quite within the range of possibility that the sound may undergo changes in *timbre* and pitch simultaneously with the change in intensity, and these again would require to be studied in "König's Analyser."

RAILWAY MATTERS.

IN reporting upon an accident which occurred on the 3rd April, at Northampton station on the Midland Railway, Major Marindin shows how serious may be the results of the failure of leaking-off brakes and the employment of brakes which require the use of two ejectors.

OF the 14,680 miles of railroad, exclusive of local roads, in France in 1881, 12,738 miles were owned by the six great companies, the cost of which was about £378,000,000, towards which the Government had contributed £62,000,000, besides advances of about £24,000,000 for interest, which it had guaranteed.

THE Great Northern Railway Company has just given out a good order for wheels and axles, which has been divided between the Leeds Wheel and Axle Company and Messrs. Craven Brothers, Darnell. The latter firm have also got a considerable contract for wheels and axles from the North British Railway Company.

THE opinion of the Wolverhampton Chamber of Commerce having been sought by Sir Edward Watkin on the Channel tunnel, the Council have replied that they do not doubt that the commercial value of the proposal would be great, but that they cannot rid themselves of the knowledge that the commercial interest forms only a small part of the question, and that their feeling on the whole is adverse from the undertaking.

THE rolling stock of the principal French lines is as follows:—Nord, 1138 locomotives, 2021 passenger cars, and 33,971 goods wagons; (East) Est, 922 locomotives, 2359 passenger cars, and 22,401 goods wagons; (West) Ouest, 1045 locomotives, 2881 passenger cars, and 17,465 goods wagons; Orléans, 970 locomotives, 2100 passenger cars, and 20,433 goods wagons; P. L. M., 1960 locomotives, 3489 passenger cars, and 62,200 goods wagons.

THE *Carlisle Journal* states that the London and North-Western Railway Company is taking preliminary steps for the construction of a branch railway from the main line to Ulleswater Lake. The route projected is from Yanwath, about two miles south of Penrith, on the Lancaster and Carlisle Railway, to Pooley-bridge, at the north end of Ulleswater, a distance of about four miles along the vale of Eamont. At present the communication between Penrith and the Ulleswater steamers is by coaches. The branch would be mainly intended for passenger traffic, but it will also accommodate the lead mines at the head of Ulleswater, the produce of which is now carted thirteen miles to a railway.

THE question of using two engines on express trains was discussed at a recent meeting of the Railway Association at Berlin, when Herr Illing reported that in his district—Berlin to Lehrte—the use of two engines on express trains was of frequent occurrence, although the general principle was recognised of only making the trains so heavy that they could be propelled at normal speed in ordinary weather by one of the locomotives at the disposal of the company. The requirements of traffic cause frequent deviations from this principle, but Herr Illing maintained that the use of two engines diminishes the injurious effects of accidents and abreviates the period of traffic disturbance in such cases.

ON the 1st inst., at 7.30 p.m., the new quick railway service between Paris and Constantinople, *vid* Vienna and Giurgevo, came into operation. For the present it will be a bi-weekly service both ways, leaving Paris at half-past 7 p.m. on Tuesdays and Fridays; and the train will consist of three saloon carriages, fitted with forty-two beds, a refreshment saloon, and a sufficient number of luggage vans, in which the luggage will be so arranged that it can be examined in the vans by the Customs officers at the frontier stations, thus avoiding the delay and annoyance unavoidable when the luggage has to be removed from the train. There will be no change of carriages between Paris and Giurgevo, and it is expected that the entire journey between Paris and Constantinople will be completed in about seventy-five hours.

THE French Government owns 2316 miles of railroad, including a large number of short lines in various parts of the country; but there are 1260 miles in lines which form something like a single system. These are chiefly roads which the companies that undertook them were unable to complete, because they did not seem likely to be profitable. Some of these lines the Government lease to the great companies, some to companies organised especially to work them, and some it works itself. As a whole, they are very unprofitable, the working expenses being 96 per cent. of their gross earnings. On many lines the expenses are more than the gross earnings—30 per cent. more on one line, and 17 per cent. more on others. Including interest, this system has cost £1,600,000 more than it has brought in during three years.

THE construction of a big bridge is now likely across the Misssouri, and the construction of the Burlington and South-Western branch of the Chicago, Burlington, and Quincy Railway into Kansas city will, it is expected, now be pushed forward rapidly. The *Chicago Times* states that an unusually favourable charter for a bridge across the Missouri river at that point was procured at the last session of Congress. The Council Bluffs and the Rock Island roads will in all probability also use the new bridge as a means of entrance to Kansas city. The immediate result will be to bring the Chillicothe and Kansas city road, which, it is openly stated, is an extension of the Burlington and South-Western, into Kansas city, giving the Burlington a new line between Kansas city and Chicago. It is also intimated that the bridge will furnish an entrance into Kansas city for any new roads which may desire it in future.

ACCORDING to experiments made upon the Hanover, Cologne, and Minden Railway, fir sleepers injected with chloride of zinc required a renewal of 21 per cent. in eleven years; birch sleepers injected with creosote required a renewal of 46 per cent. at the end of twenty-two years; oak sleepers injected with chloride of zinc required a renewal of about 21 per cent. at the end of seventeen years; while the same kind of sleepers in their natural state required a renewal of at least 49 per cent. at the end of a like period. The conditions in each of these cases were very favourable for obtaining trustworthy proofs. The subsoil of the line was good; the non-renewed sleepers showed, when cut, that they were in a sufficiently good state of preservation. Upon another line where the oak sleepers were not injected, it was necessary to renew them in the proportion of 74 per cent. at the end of twelve years; these same sleepers injected with chloride of zinc required a renewal of only 3·29 per cent. at the end of seven years; whilst those injected with creosote required a renewal of only 0·09 per cent. at the end of six years.

A REPORT by Colonel Yolland has been issued on the circumstances connected with a collision that occurred on 17th February, at London Bridge station, between a London, Brighton, and South Coast Railway Company's down passenger train, and a Midland Railway Company's goods engine. The conclusion shows that it was a "miscellaneous" accident, Colonel Yolland saying: "Three causes have combined to permit this collision to occur, viz.: (1) A faulty construction of the South-Eastern Company's goods yard at London Bridge low level station in the absence of catch points, &c., to prevent an engine from running out on to the down main passenger line when the signals are against it. (2) The absence of a proper look-out on the part of the driver of the London and Brighton Company's train as he was passing under the girder bridge signals, when there would have been ample distance for a train, fitted throughout with the Westinghouse continuous brakes, to have been pulled up before it reached the Midland engine. The driver does not appear to have been on the look-out until his engine was close to the Midland engine. (3) The misconduct of the engine driver of the Midland engine in having passed out on to the main down line, apparently passing the disc signal at 'danger,' which should not have been passed at 'danger,' and further running on until foul of the main down line when there was a signal off over the A.B. box, 100 yards in front of him, for a train to come out from the Brighton station."

NOTES AND MEMORANDA.

TO increase the proportion of nitrogen which is given off as ammonia during the destructive distillation of shales for the manufacture of oils, Mr. D. Urquhart mixes with the shale, before introducing it into retorts, an alkali or alkaline earth, and thus facilitates the combination of the hydrogen with the nitrogen.

A PATENT was taken out last July for a process of preparing a material having the pretty little compound name, orthonitrometamethylbenzaldehyde from metamethylbenzaldehyde. Tollyaldehyde, obtained from metaxylene, yields on nitration the orthonitro product. This, when dissolved in acetone and treated with weak soda ley, gives methylated indigo blue, which differs, the "Journal" of Chemical Industry says, from natural indigo by its solubility in alcohol.

IT is said that Herr Fahdt, of Dresden, uses metallic wires heated to redness by electricity, for cutting glass. When the circuit is closed the wire communicates its heat to the glass, which cracks under the influence of a sudden cooling by contact with a moist body. The advantage, however, does not appear, for to remove the inequalities of the section it has to be exposed to a flame, and the object is then placed in an oven, in order to prevent the parts which have been heated by the flame from cooling suddenly.

BY a consideration of Helmholtz's hypothesis, that the difference of potential between two conductors which are in contact implies the presence of a double electric layer, situated at the surface of contact, Mr. G. Lippmann says in the *Comptes Rendus* that the hypothesis leads to a parabolic relation of the second degree between the capillary tension and the difference of potential, and admits of quantitative experiments, from which he infers that the mean value of a molecular interval is $\frac{1}{3000000}$ of a millimetre. This value is $\frac{1}{2}$ as great as that which was found by Sir William Thompson by an entirely different method.

M. C. PASCHER finds, the *Chronique Industrielle* says, that the only substance which is really efficacious for rendering cements unalterable by the air is a cold solution of one part of sulphate of iron in three parts of water. The cement articles are left in the solution for twenty-four hours; at the end of this time they take a greenish-black tint, due to the hydrated protoxide of iron. The absorbed solution is decomposed in the interior of the cement; the weight of the cement is increased 10 per cent.; all the pores of the mass are thus stopped by the hydrate, and as this combination is not attacked by the air, the cement itself becomes unalterable.

ON the production of organic acids by electrolysis MM. Bartoli and Papasogli have published some curious experiments. They employed as electrodes, in a water voltameter, carbons of coke or of wood purified by chlorine, and noticed that the carbons were attacked, so that the liquid became black; with 1200 Daniells acting for a month without interruption, the liquid acquires an acid reaction and yields the compounds of the benzo-carbonic series, mellitic acid, with its derivatives, and a black substance composed of carbon, hydrogen, and oxygen, slightly soluble in water and insoluble in alcohol and chloroform. The same results were obtained in various acid or alkaline solutions. If graphite is employed the liquid does not become coloured.

A DESCRIPTION of the hektograph or gelatine pad now so extensively used for re-producing copies of letters is given by the *Glassware Reporter* as follows:—"An old French method of printing and transferring was to cast a sheet of glue, ¼in. thick, diluted, while warm, to such a consistence that when cool it was perfectly flexible and pliable as leather. The impression was first taken from the copper plate upon this sheet of glue, and then transferred to the article requiring decorating. The glue could be applied to the ware two or three times before it became necessary to take a fresh impression from the plate. Black printing, in the Staffordshire potteries, was at one time done by a similar process, the gelatine bats being cast on dish bottoms, and then cut to the size required for the patterns. But this printing from bats has now fallen into disuse."

SOME varieties of South American wood have been described by M. Thanneur which seem likely to become valuable for engineering purposes. The yandubay is exceedingly hard and very durable. The couroupay is also very hard and very rich in tannin. It bears some resemblance to the quebracho, which is perhaps the most interesting of all and the most used. It is very abundant in Brazil and La Plata. Its diameter varies within the same limits as that of the oak, but the trunk is shorter. It is used for railway sleepers, telegraphic poles, piles, &c. It is very durable, especially when well seasoned. Its specific gravity is from 1·203 to 1·333. Its colour is reddish, like mahogany, but it becomes darker in time. On account of its hardness it is difficult to work, and it cannot be readily cut with an axe, but it has been introduced into France on account of its richness in tannin.

IN a recent *Chronique Industrielle* an account is given of the examination of a large cylinder in a Woolf engine employed in the mines of Sarrebruck. On opening the cylinder there was found upon the piston a brown, wax-like mass, weighing more than 150 kilogrammes. It contained 60 per cent. oxide of iron, 26·77 per cent. of organic matters soluble in alcohol, 5·7 per cent. of insoluble organic matter, the residue being composed of water with a little silicic acid. The cylinder had been in use for about a year, during which time 192 kilogrammes of suet had been employed for lubrication. The decomposition of the suet by steam into glycerine and fatty acids led to the formation of a soap of protoxide of iron. The oxidation of the iron, which is limited chiefly to the interior surface of the cylinder, gradually produces an enlargement of the diameter. The evil may be obviated by using as a lubricant mineral oil of good quality, which boils only at a very high temperature.

ALLOYS of metals are often difficult to make and very small quantities greatly affect alloys. The presence of $\frac{1}{3000}$ of a pound of antimony in a pound of melted lead increases the rapidity with which the lead oxidises and burns. Lead which contains more than $\frac{1}{1000}$ of its weight of copper is unfit for the manufacture of white lead. *Der Techniker* says gold with an alloy of $\frac{1}{2000}$ of lead is extremely brittle. Copper with ½ per cent. of iron has only 40 per cent. of the electric conductivity of pure copper. Nickel was regarded as a metal which could be neither rolled, hammered, nor welded, until it was found that the addition of $\frac{1}{1000}$ of magnesium, or of $\frac{3}{1000}$ of phosphorus, makes it malleable. Some varieties of cast steel are exceedingly brittle, but the addition of $\frac{1}{2}$ of 1 per cent. of magnesium makes them malleable. At the Paris Exposition of 1878 a great difference was found in the toughness of sheets which were made of Swedish puddled iron. The only difference which chemical analysis showed was that the good plates contained $\frac{20}{1000000}$, and the bad $\frac{21}{1000000}$, of phosphorus.

AT a recent meeting of the Paris Academy of Sciences M. Loewy explained his new method for determining at any moment the relative position of the instrumental equator in relation to the real equator. This method is analogous to that already given for right ascensions, being founded on the observation of the stars near the pole, and on the variations in the relations of the co-ordinates due to the deflection of the instrument. M. Leowy demonstrates mathematically that his plan combines all the theoretical and practical conditions required for the complete solution of the problem. It is based on the theorem here demonstrated that when the track described by a star in apparent distance from the pole coincides with its distance in relation to the instrumental plane, the angle may be exactly determined which is formed by the terrestrial axis with the line of the instrumental poles, by means of the variation observed between the apparent polar distance and the distance in relation to the instrumental plane. The method is independent of any possible variations in the state of the instrument during a period of twelve hours, and it excludes the cause of systematic error due to refraction. It is, moreover, capable of extreme accuracy, which, by multiplying the points, may be carried as far as is desirable.

MISCELLANEA.

THE steamship Adelaide, now finishing at Messrs. D. and W. Henderson and Co.'s yard, Partick, near Glasgow, is to be lighted throughout, by the Edison Company, on the incandescent system.

AN electric railway is being constructed connecting Frankfort-on-the-Main with Offenbach, a distance of about eight miles. The dynamo machines are to be driven by steam engines stationed at a village about half way between the two towns.

THE authorities of Sir Josiah Mason's College, Birmingham, propose to give a series of lectures in aid of mining science during the coming session, and the South Staffordshire mining engineers have appointed their council to consult with the authorities upon the matter.

MESSRS. JOHN BROWN AND CO., Limited, Atlas Steel and Iron Works, Sheffield, have obtained the order for the armour—1000 tons "Ellis" compound plates—for the new Brazilian warship now being built by Samuda Brothers, London. She is a sister ship to the Riachuelo, recently built by the same firm.

DURING the past twelve months there has been an increase in the ranks of the Institute of Civil Engineers of 1 honorary member, 51 members, 172 associate members, and 40 students, with a decrease of 10 associates, making an aggregate gain of 254, and bringing up the total to 4400 of all classes, or an addition in the year at the rate of more than 6 per cent.

WE understand that the committee of the Gloucester County Asylum have decided to light a portion of their new buildings with electric light, and have entrusted the contract to Messrs. Woodhouse and Rawson, of Queen Victoria-street, London. Otto gas engines with Dowson's patent gas, Sellon-Volckmar batteries, and Woodhouse and Rawson's incandescent lamps are to be used.

THE Earl of Shaftesbury has consented to preside over a public meeting at Willis's Rooms, London, on Thursday, July 12th, the object of which is to make a national effort to save the lives of our fishermen and sailors by providing more efficient refuge harbours for safety in time of storm and danger. The subject gains especial interest now that our fishermen are placed so prominently before the world by the International Fisheries Exhibition.

THE South Staffordshire Electric Lighting Company, of Birmingham, has obtained a provisonal order from the Board of Trade to supply electricity in Wolverhampton. The capital of the company is £20,000. The order requires them to set aside £15,000 for the undertaking; one half of that sum to be deposited as security. A portion of the town has been divided into two areas, upon which operations may begin so soon as the company wish, after they have given five weeks' notice to the corporation.

THE French scientific commission, appointed to visit the Isthmus of Krau, have reported that the work of piercing it, so as to connect the Chinese Sea with the Gulf of Bengal, would be easy, as the soil is not hard; and there would be only 50 kilometres—thirty-one miles—to cut through, while 61 kilometres—38 miles—of river can be turned to account. Besides, the line passes through a forest, which, in addition to supplying timber for the works, would yield a good return on account of sales.

THE annual meeting of the Society of Chemical industry takes place on the 11th, 12th, and 13th July. Visits will be made to the works of Messrs. Doulton and Company's art pottery, South Metropolitan Gas Works, the Electrolytic Company, the Vacuum Ice Company, Messrs. Duncan's sugar refinery, Messrs. Ohlendorf's Guano and Chemical Manure Works, Messrs. Knight and Son's Soap Works, the Lager Beer Brewery and Ice Factory, Woolwich Arsenal—inspection of factories and workshops.

MESSRS. POWELL, RIGBY, AND CO., New York, have taken out a patent for the production of iron water pipes which will not easily burst with hard frost. These pipes have an elliptical instead of the usual circular cross-section. The area of an ellipse is less than that of a circle of equal circumference. When water freezes in an elliptically-shaped tube it tends to make it more circular, and hence does not burst. If the tubes be examined every two or three years safety may be insured, for if they have become circular in section they can be knocked back again to their original shape.

THE steamship Clan Macarthur, which has been built for Messrs. Cayzer, Irvine, and Co.'s Clan line by Messrs. Scott and Co., of Greenock, started from the Clyde on Saturday, the 2nd instant, for a preliminary cruise with a large party on board. The vessel has been lit throughout with incandescent lamps by the Glasgow branch of the Edison Electric Light Company. We understand that the owners have been so pleased with the complete success of the lighting that they have placed the lighting of another steamer, the Clan Macintosh, with the Edison Company, without inviting tenders from other firms.

MAJOR MARINDIN, on behalf of the Board of Trade, has held an inquiry in the Council Chambers, Edinburgh, regarding an application which had been made by the Electric Brush Light Company of Scotland for a provisional order for a specified area in Edinburgh. He said that the inquiry was held exactly under the same conditions as those with regard to applications of gas and water companies. It was the first inquiry under the Electric Lighting Act. It embraced the questions of capital, area, and the ability of this company to carry out the works which they proposed to construct. Several witnesses having been examined, Major Marindin stated his intention of reporting against the preamble of the Bill, on the ground that the company had failed to make out their case.

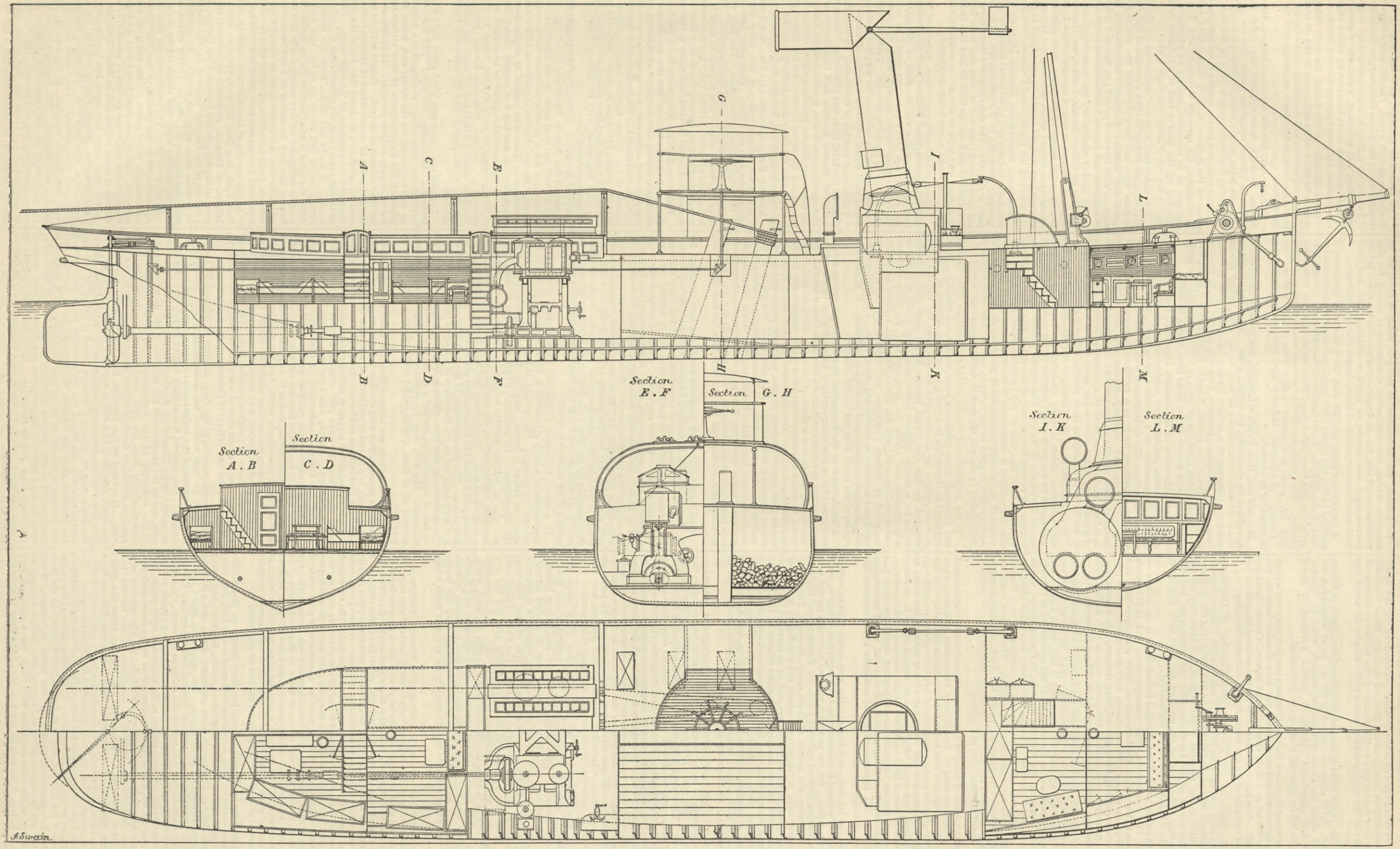
THE *Scientific American* gives some facts relating to the manufacture of fiddle strings, and says: "The name 'catgut,' as applied to the animal fibre strings, is altogether a misnomer. The cat is in no wise responsible for the string, and, much as the fact is to be deplored, the manufacturers of such strings refuse to utilise cats for the supply of their material. That disposes of the last excuse for the existence of the cat. Catgut is of no use to anybody but the cat; hence no consideration of damage to valuable raw material need hereafter stay the hand that hurls the avenging bootjack at the nocturnal serenader on the back fence. Violin strings, and all sorts that come under the general head of 'gut,' are made from the entrails of lambs and cattle, from the delicate threads used for sewing racket ball covers up to the half inch thick round belts. After the lamb is seven months old its entrails are no longer fit for making strings for violins; consequently this branch of the manufacture can only be carried on a few months in each year. The only man who now carries it on in America says that he cannot, without tariff protection, compete with the cheap labour of Germany and France, and he is going to give it up."

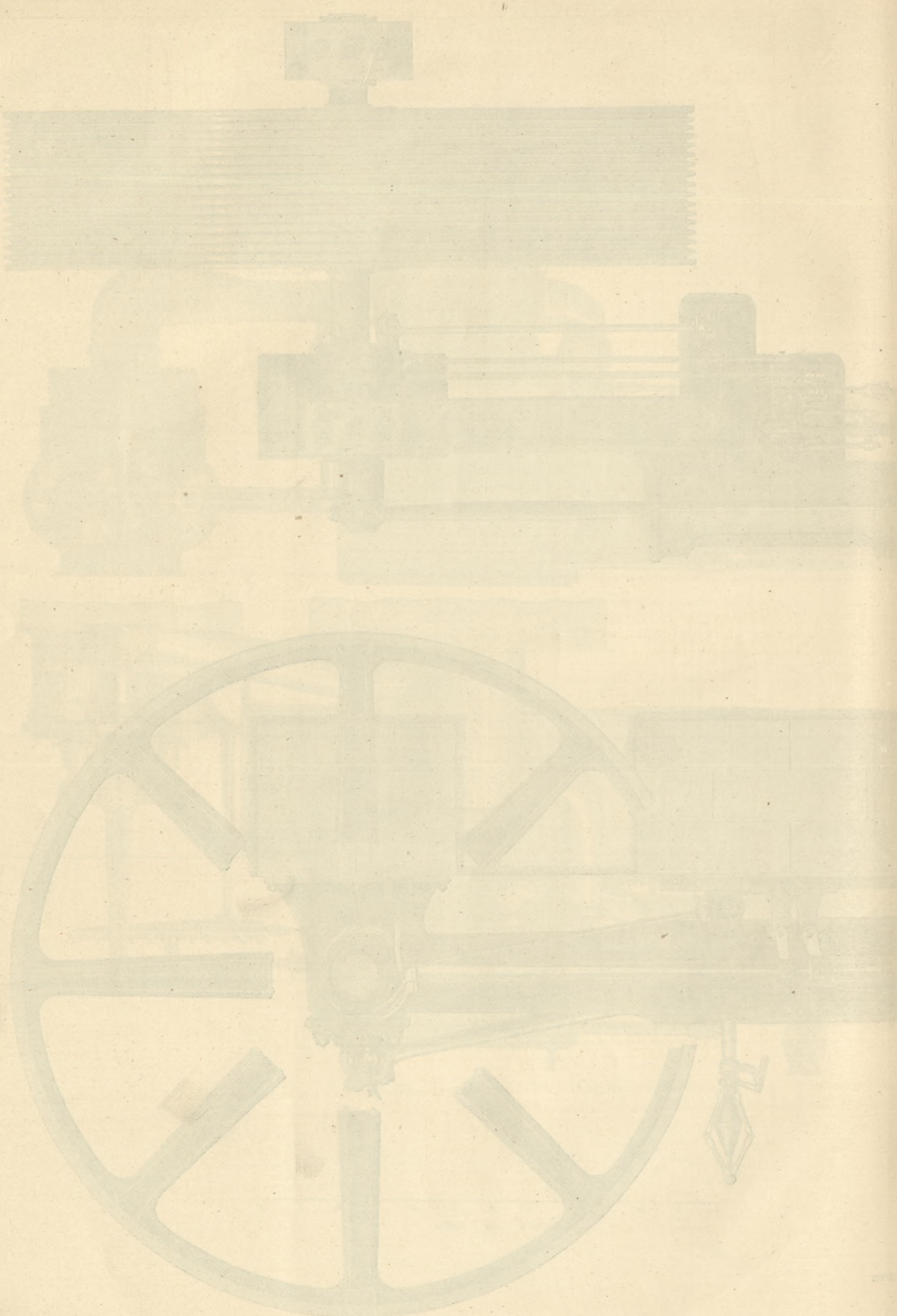
AT the meeting of the American Society of Civil Engineers in New York, May 16th, Mr. F. J. Cisneros, who recently visited the Isthmus of Panama, presented an informal statement of the progress of the work on the Panama Ship Canal. He stated that the purchase of the Panama Railroad by the Canal Company seemed to promise most excellent results. In reference to the canal, he said that the line had been completely staked, cross sections taken, and the location made and stakes set for definite work for a large portion of the line. The line is entirely cleared and grubbed from Kilometre 40 to the mouth of the Rio Grande, and is rapidly advancing to other points. The valley of the Chagres has been surveyed, and it has been found that the high water lines above the high dam will cover an area of about 6750 acres, and that the volume of water stored will be about 1,000,000,000 cubic metres. Actual work upon the canal has been commenced at six points. The contractors, Messrs. Slaven and Co., for dredging the canal from Colon, have their first "Hercules" dredge in place, and will commence work directly. The Canal Company has been working with two French machines, at the rate of 1000 cubic metres per day for each machine. The Franco-American Trading Company has contracted for the excavation of about 10 kilometres of the canal beyond the Bay of Panama. Its machines are being built at Lockport, N.Y. There are now about 6500 men on the work, chiefly Jamaicans, Carthagenians, and a few Martiniqueans,

TWIN SCREW TUG BOAT FOR THE RHINE.

MESSRS. SACHSENBERG BROS., ROSSLAU, ENGINEERS.

(*For description see page* 441.)





PATENT COMPOUND HORIZONTAL ENGINE, 400-I.H.P.

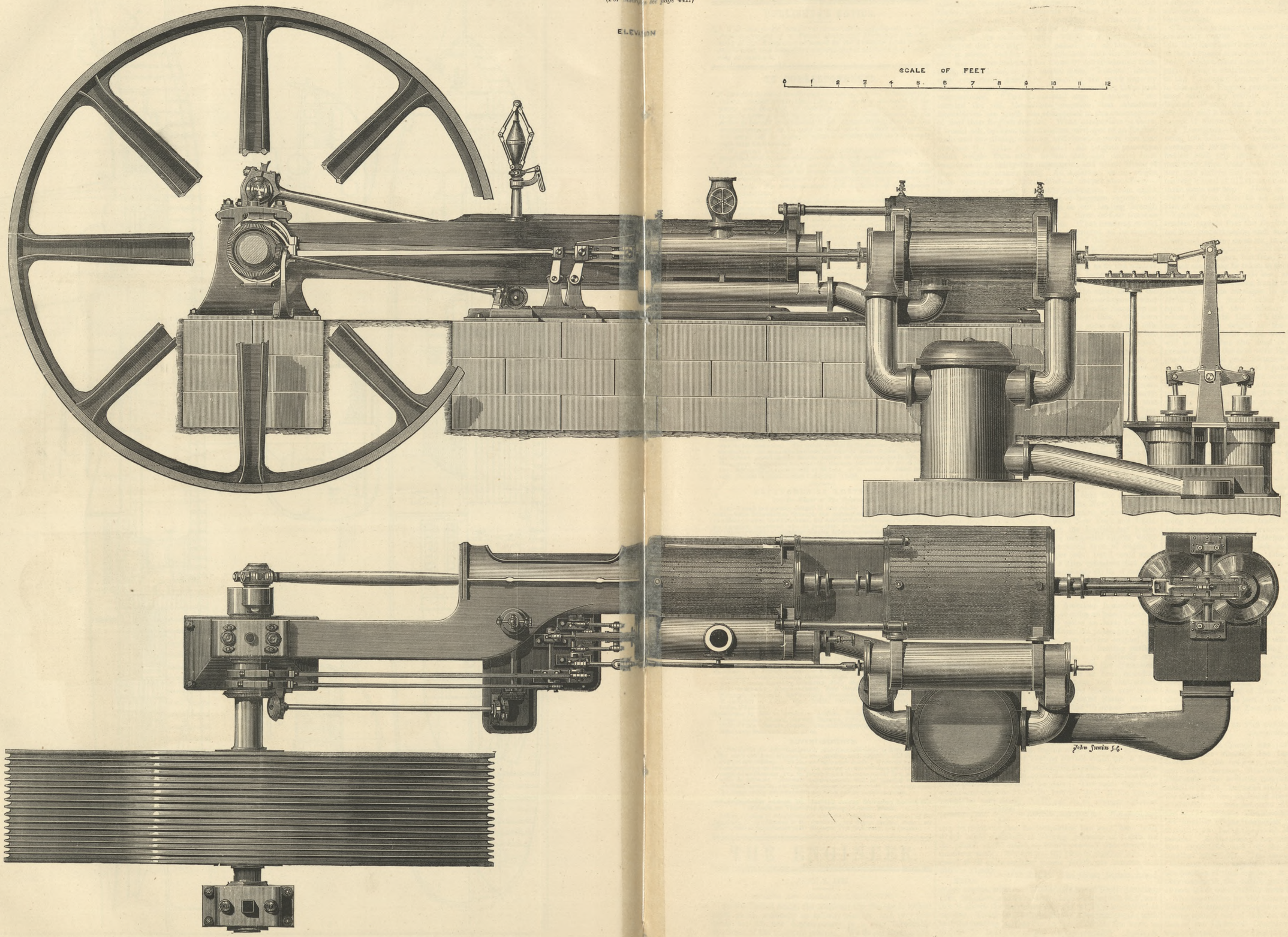
MESSRS. G. K. STOTHERT AND CO., BRISTOL, ENGINEERS.

(For Description see page 441.)

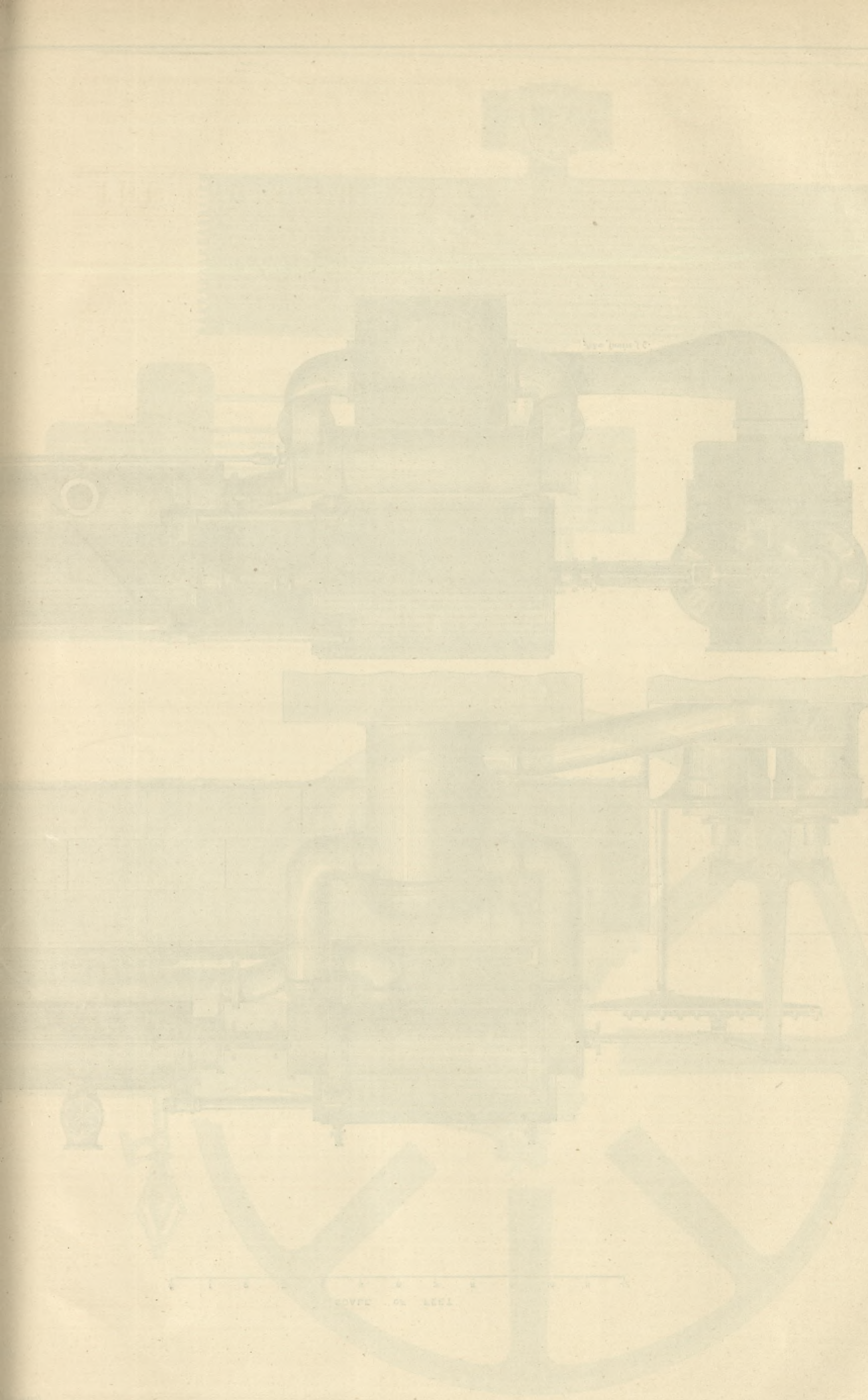
ELEVATION

SCALE OF FEET

0 1 2 3 4 5 6 7 8 9 10 11 12



John Swain, S.C.



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

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

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a supplement, a Two-Page Engraving of a Patent Compound Horizontal Engine, 400-I.H.P. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

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.*

T. M. *If you like to send a sketch of your invention in confidence, we shall be able to advise you.*

R. T. T. AND S. E. D.—*India-rubber cement, made by dissolving india-rubber in naphtha and bisulphide of carbon, can be procured at most shops selling india-rubber goods, and will probably answer your purpose.*

ROLLER.—*All your troubles are due to want of truth in your rolls. To turn out such thin stuff they must be dead true all over, and the axes must be precisely parallel. Great care must be taken on this point when the new brasses are being fitted. Do not put on too much pressure while the sheets are going through. Unless the material is very pure it will not roll into sound sheets, but will tear and crack.*

H. W. (New Plymouth, Taranaki) —*Your scheme would not answer, because the air would exert precisely the same retarding pressure as the water which it drove away before it. If, for example, a hole were made in the bow, water would rush in unless the air was of the same or greater pressure. The idea, too, is not new; it was proposed years ago. The adoption of your smoke-consuming scheme would simply put one of the fires out.*

K.—*Nothing more than a general answer can be given to your questions. A valid patent can be got for a new combination of old devices. In the case cited by you, it is to be presumed that the new process would result in greatly cheapening the production of the stated material. This would be a substantial advantage gained, and the inventor of the new combination of two old processes would clearly be entitled to a share in the advantage he conferred on the community, provided, of course, that there is invention in effecting the combination.*

ENQUIRER.—*Pampour's rule for calculating the tractive force of a locomotive is now universally used. It is as follows:—Multiply the square of the diameter of one piston in inches by the length of stroke in inches and by the average pressure in pounds, and divide by the diameter of the driving-wheel in inches. Thus, in the case you cite, we have* $\frac{15^2 \times 20}{40} = 112{\cdot}5$ *lb. per pound of effective pressure. The figures you quote are correct on the assumption that the driving-wheels being new are a little over* 40*in. diameter by the allowance made for turning after being on the road for awhile.*

G. B. S.—*By far the quickest way of finding out the lifting power of your winch will be to measure the distance moved through by the chain while the engine makes, say, ten revolutions. The effective driving power will be found by multiplying the area of the two cylinders in square inches by the average cylinder pressure, and by the distance passed over by the two pistons in making ten revolutions. The result divided by the distance passed over by the chain in the same time will give the ratio of power to load. Thus, let the distance passed over by the two pistons in ten revolutions be* 30*ft. and the average pressure one ton, and the distance passed over by the chain be* 6*in, then the lifting power will be* 60 *tons. It is usual to deduct* 30 *per cent. for loss by friction when screw gear is used.*

ENGINEERS IN AUSTRALIA.

(To the Editor of The Engineer.)

SIR,—I shall feel greatly obliged if any reader will kindly furnish me with a little information through the correspondence columns of your excellent journal, THE ENGINEER. (1) Are there good openings in Australia for a general machinist who is practical as engineer, millwright, &c.? (2) Can any reader recommend me any Australian publication containing information of such openings, advertisements, &c.? (3) If so, would it be cheaper to take tools from England than purchase them there? (4) And is there much call for engineers out there? L. S.

Gloucestershire, June 5th.

SUBSCRIPTIONS.

THE ENGINEER *can be had, by order, from any newsagent in town or country at the various railway stations: or it can, if preferred, be supplied direct from the office on the following terms (paid in advance):—*

Half-yearly (including double numbers) .. .. .. £0 14s. 6d.
Yearly (including two double numbers) .. .. .. £1 9s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made. THE ENGINEER *is registered for transmission abroad.*

Cloth cases for binding THE ENGINEER *Volume, price* 2s. 6d. *each.*

A complete set of THE ENGINEER *can be had on application.*

Foreign Subscriptions for Thin Paper Copies will, until further notice, be received at the rates given below:—Foreign Subscribers paying in advance at the published rates will receive THE ENGINEER *weekly and post-free. Subscriptions sent by Post-office order must be accompanied by letter of advice to the Publisher. Thick Paper Copies may be had, if preferred, at increased rates.*

Remittance by Post-office order. — Australia, Belgium, Brazil, British Columbia, British Guiana, Canada, Cape of Good Hope, Denmark, Egypt, France, Germany, Gibraltar, Italy, Malta, Natal, Netherlands, New Brunswick, Newfoundland, New South Wales, New Zealand, Portugal, Roumania, Switzerland, Tasmania, Turkey, United States, West Coast of Africa, West Indies, Cyprus, £1 16s. China, Japan, India, £2 0s. 6d.

Remittance by Bill in London. — Austria, Buenos Ayres and Algeria, Greece, Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Mauritius, Sandwich Isles, £2 5s.

ADVERTISEMENTS.

*** *The charge for Advertisements of four lines and under is three shillings; for every two lines afterwards one shilling and sixpence; odd lines are charged one shilling. The line averages seven words. When an advertisement measures an inch or more the charge is ten shillings per inch. All single advertisements from the country must be accompanied by a post-office order in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.*

Advertisements cannot be Inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

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

THE ENGINEER.

JUNE 8, 1883.

ENGLISH AND AMERICAN LOCOMOTIVES.

IN the United States the *National Car Builder* is looked upon as an authority on railway matters; and very properly so; for our contemporary is a very favourable specimen of the technical journal. We do not assume that the *National Car Builder* holds itself responsible for the opinions of its correspondents; but we think we may venture to say that it does not altogether dissent from the views expressed by a gentleman signing himself "Yankee," a letter from whom appears in the May number of our contemporary. "Yankee" is a little angry with us, because we ventured some time since to make certain statements concerning the railway traffic of the United States, and to these statements he takes exception. It appears, however, that he is speaking of what may be termed the metropolitan traffic of his country, while we referred to the country traffic—which is a very different thing; so that we might have passed over all that he has said in silence, but for the circumstance that the *National Car Builder* has endorsed his views by not dissenting from them, and because, in the second place, "Yankee" makes such remarkable assertions regarding the work done by American passenger engines that we cannot let them pass unquestioned. "THE ENGINEER," says "Yankee," "reiterates the old, threadbare assertion that American locomotives are much less economical in the consumption of coal than English engines. What comparison is there, I would ask, between the miniature carriages of an English train and the dining, sleeping, and drawing-room cars that compose the trains on our roads? An English passenger coach weighs from seven to ten tons, and carries from twenty-four to thirty-two passengers; and about fifteen of these coaches make a train. An American coach weighs from twenty-five to thirty tons—a sleeper about forty—and carries from sixty to seventy passengers. From eight to ten of these coaches, exclusive of baggage, express, and mail cars, make an average train on our leading through lines, and the aggregate weight is three or four times as much as that of an English train. What headway would an English passenger locomotive, restricted to its regular home rations of coal, make with one of these trains? To borrow a phrase, I should say, 'on the whole, very little.'"

Now, it so happens that there is no need to refer to this country for authority for the proposition as to the relative economy of American and English locomotives. The statement that American locomotives are not as economical as English locomotives originated at the other side of the Atlantic, and if "Yankee" had but kept his ears open to what is being said by master mechanics and traffic managers in the United States he would have known this. We have no doubt that American engines burn more coal per mile than English engines. We know that they evaporate less water per pound of coal, and that because of the spark arrester they carry more back pressure than our engines do. But we only know all this because we have been told as much by American engineers, who have made no secret of the matter. Indeed, "Yankee" himself seems to be unable to dispute the heavy consumption per mile; but he excuses it on the ground that the passenger trains are also heavy. This is quite a legitimate argument, but we fear that "Yankee" has overdone it a little. According to him, ten 30-ton passenger cars, exclusive of baggage, express, and mail cars, say one of each, make an average passenger train. The weight of this train cannot with its freight be less than 400 tons. If we add 60 tons for engine and tender we have a gross load of 460 tons, and we hasten to admit that we never heard of a passenger train of such dimensions being run in this country, or indeed anywhere else, with one engine. It might be assumed that such huge trains as this are run at slow speed, but this would be a mistake. "As regards speed," says "Yankee," "it appears that the average of express and fast passenger trains on the New York Central is fully up to the average of English trains, while the trains on the Bound Brook route between New York and Philadelphia, which are heavier than the English fast trains, make still better time. Webb's compound engine, which is admitted to be the most economical type of engine in England, burns 23 lb. of coal per mile; but I could name an American engine with 16in. × 24in. cylinders that runs an accommodation train and burns only 20 lb. of coal per mile. With the same indifference evinced by THE ENGINEER to weight of trains, I can claim that this beats Webb's compound."

It appears from this that the American locomotive can run a train of 460 tons at about 48 miles an hour, including stops, which means at least 55 miles an hour for long stretches of road. The average American passenger locomotive has cylinders 17in. by 24in., four drivers coupled, 5ft. in diameter, 1100 to 1200 square feet of heating surface, and carries 140 lb. pressure. Now, it is perfectly well known in this country that no engine of the dimensions stated could possibly run at 48 miles an hour, including stoppages, with a gross load of 460 tons; and coal, steam, iron, and water being in the United States very much what they are in this country, the United States locomotive is no more competent to do what "Yankee" says it does than is the English engine. "Yankee" has been misinformed, and the *National Car Builder* ought to have corrected his statements.

There is no species of argument that can be used which will prove that an engine with 17 by 24 cylinders and 1100 square feet of heating surface could run a train of 460 tons at the speed of an English express. The resistance of such a train and engine on the level cannot be less than 25 lb. per ton at 50 miles an hour. The total resistance would therefore be 11,500 lb., but the pull of the engine would be very nearly 116 lb. per lb. of average cylinder pressure, and $\frac{11500}{116} = 99{\cdot}1$ lb., say 100 lb. We need not stop to point out that no locomotive has ever been built which could maintain an average pressure of 100 lb. on the piston at 50 miles an hour; one-half this would be excellent work. We can put the facts in another way. A speed of 50 miles an hour means 4400ft. per minute, and $\frac{4400 \times 11{,}500}{33{,}000} = 1533$ I.H.P. The Great Britain broad gauge engine, with over 2200 square feet of heating surface, 18in. cylinders, and 24in. stroke, has indicated 900-H.P, and this is about the maximum effort of which a locomotive is capable. To ask us to believe that an American engine with half the heating surface can do nearly double the work, is to draw too heavy a draught on our credulity. Again, it may be pointed out that such an engine as that of which we speak could not develope an indicated horse-power for less than 4 lb. of coal per hour, because the steam could not be used expansively. Consequently the engine must burn coal at the rate of 6000 lb. per hour, or at the rate of 120 lb. per mile. We never heard of a consumption like this being reached in the United States. One-half as much is regarded even there as too great; one-third more than suffices an English express locomotive, with fifteen or sixteen coaches.

The truth is that "Yankee" has made statements which are simply untrue. We are charitable enough to believe that they have been made in ignorance. Indeed, ignorance of facts appears almost in every line of his letter. By the irony of fate a letter signed "Veritas" appears on the same page, giving a statement of the performance of an engine on the Kentucky Central Railway. It will be seen that in this engine English practice has been followed with the most satisfactory results. "The engine was built at the Baldwin Works, has 17 by 24 cylinders, a brick arch in fire-box, and a straight stack with 4¾ nozzle. During the month of February she ran 4000 miles between Covington and Lexington—the distance between the two places being 100 miles—and consumed 117,000 lb. of coal, or an average of 29·25 lb. per mile run. The number of cars hauled each trip ranged from four to six; twenty-four mail train trips were made with thirty-four regular stops each, and sixteen fast line trips with six regular stops each, making a total of 912 stops, or an average of nearly twenty-three stops per trip." Here we find that the trains consisted of from four to six cars. This gives a different idea of American railway traffic from that conveyed by "Yankee." We may, for the benefit of our American readers explain that the English passenger coach usually has five compartments, each seating ten second or third-class, and in some cases six, in others eight, first-class passengers. Consequently each coach will hold, not only from 24 to 32 passengers, but from 30 to 50. The dead weight of each coach may be taken at about 10 tons; on some lines it is more, in others a little less; and Mr. Webb's engine, to which "Yankee" refers, hauls twenty such coaches. There are besides bogie carriages in use on the Great Western, Midland, and some other lines, each of which is equal to about two ordinary coaches. We have no reason to doubt that "Yankee" is, in the main, correct about the weight of the American car. Sleeping cars have been built which weighed over 65 tons; and it will be seen that the dead or non-paying load is much greater than is the case with English rolling stock. It is possible that the great distances which have to be travelled in the United States render palace cars and their congeners a necessity; but they have never quite met the taste of the British public; and the American ordinary cars, after being tried for a short time on the Midland Railway, were discarded. No doubt the principle of the survival of the fittest has a great deal to do with the type of railway vehicle used in any country, and the influence of distance must not be forgotten. What will answer well for short runs of an hour or two will not answer, perhaps, for trips of several days' duration; and we are quite content to admit that Americans have got the right type of railway vehicles for their country; but we ask to be permitted to maintain that we have got in this country what suits us best. We may not know what is good for us, but it will require a great deal of argument to prove that Americans are wiser in this respect than we are.

We cannot conclude without making one more extract from "Yankee's" letter:—"THE ENGINEER asks, in summing up, 'Have British traffic managers anything to learn from their American brethren?' and answers, 'On the whole, very little.' Considering the comparative territorial dimensions of the English and American systems, the answer is very pertinent. One of our western farmers, if he had a genius that way, could operate the English system in his back yard and still have a little room left for new construction; but the traffic managers of our great continental lines would hardly go to the said back yard for instruction." "Yankee" has evidently much still to learn, but he must take his first lessons in the United States. If he could only manage to "interview" any traffic manager of a great American line, he would learn perhaps a great deal. He would see for himself at all events that such men possess a modesty which he lacks, possibly does not even understand. Failing the necessary opportunity for interviewing, we would recommend him to consult the back volumes of the *National Car Builder*, and the *American Railroad Gazette*, and the transactions of the Master Mechanics' Institution. We venture to think that he will rise from the perusal of these volumes with the conviction that perhaps he was just a little too hasty when he undertook to criticise THE ENGINEER.

AMALGAMATION OF THE LONDON WITH THE CHARTERED GAS COMPANY.

AN Order in Council has just been issued, giving effect to a scheme whereby the London Gas Company will become, on the 1st July, part and parcel of the Gaslight and Coke Company, otherwise known as the Chartered. This makes the seventh company which has been amalgamated with the Chartered since 1868. At the close of 1869 the share and loan capital of the Chartered was a little over £1,300,000; it now becomes £10,356,391, with power to rise to £11,878,610. The absorption of the London reduces the number of gas companies in the metropolis to three, the other two being the South Metropolitan and the Commercial. At the close of last year the capital of the former was £2,092,221, and of the latter £745,845, making together £2,838,066. The immense preponderance of the Chartered is thus apparent, affording a striking contrast to the position of that company in 1869, when it possessed only one-sixth the entire gas capital of the metropolis. It now takes considerably more than two-thirds.

The acquisition by the Chartered of the district of the London Company is fraught with some remarkable results, arising mainly out of the fact that it carries the jurisdiction of the Chartered Company across the Thames. It was originally thought that the amalgamation of the Lon-

don Company with the Chartered would be only partial, and that the southern portion of the London Company's district would have to be given up to the South Metropolitan. This would have taken from the Chartered an area extending from the Westminster Bridge-road nearly to Kennington Park, and occupying the heart of Lambeth. Another area would have been taken, comprehending the neighbourhood round Battersea Park. As it is, these two areas will remain with the Chartered as portions of the absorbed district of the London Company. On the Middlesex side of the Thames the Chartered Company acquire an area having Lincoln's-inn-fields for its centre, and reaching from Gray's-inn-lane to the southern extremity of the Tottenham Court-road. The boundary travels round Seven Dials, and then recedes eastward to Drury-lane, passing down to the river between Somerset House and the Temple, so as just to lop off the eastern end of the Strand. It is a curious example of the erratic manner in which the gas districts grew up in the metropolis, that the remaining portion of the London Company's district lies so far west of this Strand portion that we have to seek its commencement at Pimlico, whence it spreads into Belgravia, Chelsea, and Fulham, to the borders of Hammersmith.

A glance at the map will show that so far as consolidation is concerned, the metropolis north of the Thames will be immensely benefitted by the new arrangement. All London north of the river will now come under the Chartered administration, except the district of the Commercial Company, into which the Ratcliff was absorbed some years ago. It is true the exception is a large one, but the area is reasonably compact and does not fling itself in disjointed portions all over the field. The Chartered district will now run continuously from the Tower to Wormwood Scrubs, and from the Thames to Finsbury Park. It is an odd fortune which carries this old company south of the Thames, and some persons will think that the Board of Trade have made a mistake in letting the northern colossus of gas plant its foot in Lambeth and Battersea. But if something has been sacrificed in the shape of geographical simplicity, much has been gained to the public financially. This intrusion—if so it may be called—of the Chartered Company into South London has been purchased at a price, and we may presume that nothing short of a decidedly good bargain for the public would have induced the Board of Trade to let the Chartered Company cross the Thames. The scheme of amalgamation provides that in the areas of the London Company south of the Thames the Chartered Company shall not charge a higher price for 16-candle gas than that which is charged by the South Metropolitan Company. This is an advantage to the consumers of the old London Company south of the Thames, seeing that they have been paying 3s. per 1000ft. for their gas, and the price of the South Metropolitan is 2s. 10d. Accordingly these parties will forthwith experience a reduction of twopence per 1000ft. The same rule applies to public lamps. The difference to the Chartered Company is greater still, seeing that its present charge for gas is 3s. 2d. per 1000ft., thereby making a difference of 4d. between its present scale and that which is to be observed by it in South London. But a peculiar question arises with reference to the northern areas of the London Company. The Chartered Company may, so far as the scheme of amalgamation is concerned, establish its present rate in those areas. But some dissatisfaction will inevitably arise if the consumers in the Strand, in Holborn, in Pimlico, Belgravia, Chelsea, and Fulham, find that they are to pay 2d. per 1000ft. more for their gas than heretofore. Yet it will seem strange if Chartered gas is cheaper in Chelsea than in Westminster. Why should the charge be 3s. in Red Lion-square and 3s. 2d. in Bloomsbury? One way of meeting the difficulty is to charge 3s. 2d. throughout, on the plea that the Chartered gas has a higher illuminating power than that hitherto supplied by the London Company. The Chartered gas is equal to 16 candles, while the gas of the London Company is reckoned at 12. But people will be slow to believe in this difference, however real it may be. In fact, the actual difference is not likely to be so great as this; but if it be only two candles, it would justify the higher scale of charge. There is also the additional advantage of having the supply duly examined and reported upon by qualified officials; a system which applies to the Chartered gas, but from which the gas of the London Company has been exempt. Perhaps the Chartered Company is prepared to make a general drop of twopence per thousand. Yet it would still appear anomalous that the same gas for which 2s. 10d. was charged on one side the Thames was subject to a charge of 3s. on the other. There is also the possibility that the South Metropolitan Company will bring its scale down to 2s. 8d. It may even descend to half-a-crown. According to the new regulations, the Chartered Company south of the Thames must fall to the same maximum as the South Metropolitan, whatever it may be, with the certainty that people will ask why it should not sell its gas equally cheap in Middlesex.

The mode of dealing with public lights is a remarkable feature in this present amalgamation. It is a well-known regulation that a gas company shall not charge more per 1000ft. for gas supplied to a public authority than the lowest price charged to a private consumer. By the scheme just confirmed, this rule is made to apply to the entire Chartered district, as created by the amalgamation. The effect is that the public lights supplied by the Chartered Company north of the Thames—more than 37,000 in number—will have to be supplied with gas at the South Metropolitan rate, in addition to the 6237 public lamps of the London Company. This represents a fall of 10 per cent., constituting a very material difference in the sum total. The ratepayers, therefore, have reason to be grateful, as well as certain of the consumers; and there is again the rule operating that the price must fall still further should the South Metropolitan price go down. It is also a condition that the rate of dividend payable on the ordinary stock of the Chartered Company, under the provisions of the sliding scale, shall be governed by the maximum price charged for the time being for the company's gas. With a reduction in the price of gas, the company is allowed to pay a higher dividend. But a reduction in one part of the district will avail nothing if the price is kept up in another. The low scale in South London will not entitle to a proportionate dividend if a higher price is maintained elsewhere. It may be a matter for surprise that the Chartered Company should accept terms so onerous. But the affairs of this great corporation have hitherto been managed so well—certainly in all that relates to Parliamentary and official proceedings—that we must presume the policy now adopted is a perfectly sound one. It may be that the amalgamation averts some peril which has threatened the company, or, possibly, some project is about to be developed which will be assisted by this scheme. If any portion of the public have reason to look upon the amalgamation with disfavour, it must be the consumers who reside in the districts of the London Company north of the Thames. These will feel themselves prejudiced if they are charged the Chartered price, thus mulcting them in twopence in each 1000ft. of gas. The only answer must be that the new gas is better than the old, and that they are getting their light as cheap as ever, if not cheaper, so that the quarterly gas bill need be no higher than heretofore. We presume this will be the explanation; but a good many people will be sceptical on the point, and will declare that the London Company's gas gave quite as brilliant a light as that of the Chartered. One decided advantage accruing from the amalgamation is that the supply in the London district will come under regulation in the same way as the rest of the Chartered supply. Thus there will be an official guarantee for lighting power and purity. There has been no such guarantee hitherto in the territory of the London Company, whatever the directors may have done of their own free will.

Amalgamation was prescribed by the Act of 1868 on the ground of economy. The public are much less anxious for amalgamation now than formerly, but the process has been steadily carried on, so as to combine thirteen companies into three. The Commercial absorbed one company—a little one; the South Metropolitan absorbed two—one bigger than the absorber; and the Chartered, as already stated, will now have absorbed seven. If the Chartered Company could bring the price of its gas down to 2s. 10d. per 1000ft. all over its district, it might attempt to take up the Commercial, unless in the meantime that company reduced its price still further. Amalgamation has now gone so far that the whole gas supply of London is brought under supervision, and default may be punished by penalty, excepting only that the enforcement of this system in the London Company's district is deferred for eighteen months. Concerning the effect of amalgamation in reducing the expenditure of the companies, sufficient experience has now been acquired to afford a practical test. In 1869, when there were thirteen gas companies in the metropolis, the annual charge for directors and auditors was nearly £23,000. By 1881 the companies were reduced to four, and the directors and auditors cost a little over £17,000. In the same period the total management charges fell from 2¼d. per 1000ft. of gas to 1¼d. In absolute amount, the cost of management showed a slight advance; but amalgamation is obviously favourable to economy, especially under the influence of the sliding scale, the statutory limit of the dividend being enlarged *pro rata* with a reduction in the price of gas. The supply has been cheapened considerably since 1869, and dividends have gone up. The London Company not being under this system, has not experienced the special inducement which it affords, though the undertaking has, apparently, been well conducted.

The effect of the amalgamation which is now just being consummated will possibly tend to the benefit of the consumer; and credit must be given to the Chartered Company for having the spirit to face the responsibilities connected with the scheme. It is not in the nature of things that the public will feel gratitude to a gas company, or look very favourably upon anything that a gas company may do. But we feel warranted in saying that the Chartered Company has for a long period of time shown unusual readiness to fall in with any reasonable scheme of reform. It has espoused no narrow policy, but has done much to bring about an improved system of gas legislation. As being the oldest of the London gas companies, it has been loaded with burdens, unavoidably created in days when the conditions of the gas supply were very different from what they are now. It has transferred the great bulk of the gas manufacture from the populated districts of the metropolis to a point on the remote outskirts, thereby relieving London of the annoyance inseparable from the presence of large and numerous gasworks. If amalgamation is worth anything to the gas consumer, certainly the Chartered Company is deserving of some approval in that particular. The latest scheme of this nature may not immediately give perfect satisfaction. The arrangement is unavoidably complicated, and may have its drawbacks; but on the whole the change ought to promote the interests of the public, and we are disposed to think that this latest instance of amalgamation may lead on to results even more important and salutary than those which immediately appear. But it must not be forgotten that competition is very valuable, and we should not care to see amalgamation pushed so far that the lighting of the whole metropolis was in the hands of a single company. The electrical engineer will, however, have something to say yet as to the price and quality of gas.

THE YIELD OF RAILWAYS.

THE relative yield of the great railways is a subject that has not been often treated, but it is one that is of the utmost importance. There is very great variation in the yield. If we take one of the fairest tests—that of the return per mile per week—we shall find that in the most recent return the little Metropolitan Railway stands at the head, having an income of £727, whilst the Metropolitan District comes close up with an income from traffic of £644 per mile per week. The Lancashire and Yorkshire received £208 per mile; the Midland £130; the Great Northern £122; the Manchester and Sheffield £129; the London and North-Western £116; and the North-Eastern £95. The Furness Railway has £73 per mile; the Maryport and Carlisle £64; and the lowest seems to be the Eastern and Midland, £11. It is evident that there is very great variation, and so far as the figures are available, there is ground for the belief that it is to the variation in the passenger traffic that the difference in the yield of the respective companies is mainly due. It may be added that the Scotch railways yield generally less than the English, and the Irish less still. Five of the main Scotch lines for the week referred to had receipts that varied from £22 per mile to £75; whilst the Irish railway receipts for the same week ranged from £7 per mile to £65, the bulk being below £30. It must not be supposed that the mere receipts are a test of the amount of the dividends paid by the respective companies, for whilst the Metropolitan Railway pays a steady five per cent., the Maryport and Carlisle, with a much less yield per mile, pays double. The amount of the dividend is determined more by the cost of the line and the working expenses than by the mere yield, but it is interesting to trace the relative yield, and to learn that one of the chief causes of the variation is in the density of the gathering ground that the railway traverses and from which it draws its passenger traffic. There is, moreover, the lesson that some of these companies ought to at once endeavour to increase their passenger traffic, as it is from this that the most money is drawn.

THE DRAINAGE OF MINES.

ALL mines drainage in the colliery districts, whether by individual firms or by commissions, were severely tried by the late heavy and prolonged rainfall; and as the fall was heavier in the Midland Counties, where, indeed, the mines are most honeycombed, there, also, the difficulties have been most felt. But for the existence of the Staffordshire Mines Drainage Commission, the coal supplies from the pits which have been for a long time in course of work in that county, would have been greatly curtailed. Yet all the resources of the Commission were needed to be put into active operation to prevent the flood from overmastering the pumps. These facts have impressed the Commission with the great significance of earlier recommendations which aimed at the carrying out of costly unwatering undertakings with augmented promptitude. Without, therefore, waiting for the completion of specific surface drainage works in hand, it was on Wednesday determined by the Commissioners in Wolverhampton that some £25,000 shall be spent in the ensuing twelvemonth in laying down two new pumping engines, and in driving underground levels to bring the water to the engines. The engine to be placed at the Moat Colliery, Tipton, will cost £8873, and that at Bradley £11,779, inclusive of its bottom lifts, which are set down at £2446. By this expenditure the vast areas of impounded water in the Bilston and the Tipton districts will be attacked at one and the same time. While, therefore, the liability of works in operation to be stopped will be removed, collieries for many years past drowned out ought soon to be once more sending coal into the market.

THE RAILWAY CRISIS IN FRANCE.

IN a paper lately read by Dr. Von der Leyen before the Railway Association at Berlin, the fact was referred to that the action of the Railway Commission appointed last year has not yet brought about the hoped for mitigation of the crisis which has now existed since 1877 in French railway matters. The railways in France were only in part built by private enterprise, the help of the State having been given in various ways. The policy of the various succeeding Governments seems, however, to have led to a practical monopoly being obtained by the six large companies, and it is asserted that the traffic was on the whole badly carried out. The present crisis began in 1877, when two of the large railways—the Northern and Orlean lines—had been trying to purchase some of the competing lines in their districts, which had been supported by M. Philippart, the Belgian contractor. They had previously reduced these lines almost to a state of bankruptcy by keen competition. The Northern line succeeded in its project, as it did not require Government sanction. The Legislature rejected the proposal of the Orleans Company, and called upon the Government to purchase the lines which that body wished to acquire. Acting upon this suggestion, the Government concluded arrangements with ten companies—one of the most important of which was the Vendée line—and after much discussion, there was constituted in the spring of 1878 a network of lines called State Railways.

The policy thus inaugurated by M. de Freycinet, in conjunction with M. Gambetta and M. Say, included the construction of 10,000 miles of main lines and 25,000 miles of secondary lines. For this work a period of ten years was estimated to be required, as well as an average expenditure of £12,000,000 a year during that period. This programme met with general public approval, and the law of 17th July, 1879, was passed without difficulty. This measure dealt with the "classification of the competing network of railways of general interest." It would seem that the length of the railways open in France has increased within five years from 13,000 miles in 1877 to 18,000 miles at the close of last year. The difficulties attending the work were not, it is asserted, sufficiently reckoned at the commencement. New railways were called for by the inhabitants of several districts, and from various causes the original estimate of cost has now been almost doubled. In order to treat all parts of the country impartially, operations were simultaneously commenced at a number of places. At the present moment it is said that the State is formally engaged in constructive operations at 114 points. Unexpected difficulties have, however, presented themselves in the working of the small railways situated between the main lines. Nothing remained but to arrange provisionally with the large companies on this matter, on conditions not exactly favourable. The negotiations with the Orleans Company were, however, not successful, and the projects submitted to the Legislature were of so disadvantageous a character that the acquisition of the whole Orleans line by the State was spoken of as affording the only practical solution of the question at issue.

The Freycinet-Say Government, which was in office during the first half of 1882, was more favourable to the private lines than Gambetta's Cabinet had been, and negotiations were reopened with the Orleans Company by which the Government should give up for the term of seventy-five years its legal right to acquire the line, in consideration of certain financial obligations being undertaken by the company. The fall of this Cabinet again altered the state of things, and a plan was suggested by M. Herisson, M. Raynal, and M. Tirard, which included the drawing up of a comprehensive scheme to be submitted to the large railway companies, accompanied by the threat of acquisition by the Government. It is this work which is now being executed by the Extra-Parliamentary Railway Commission established in October, 1882.

Last autumn the adherents of the private railway system re-

commenced in the press their attacks upon the Government proposals, M. Leon Say taking a leading part in this warfare. His attempts to prove that the State railways are a commercial failure have been refuted by M. Raynal and others, but the final result of the struggle is regarded as doubtful, inasmuch as the united power wielded by the large companies is a factor of primary importance in the question at issue.

TWIN SCREW TUG BOAT FOR THE RHINE.

THE twin screw tug boat which we illustrate on page 438 has been recently built by Messrs. Sachsenberg Brothers, of Rosslau, for Messrs. Mellinghoff Brothers, of Müllheim-on-the-Ruhr, and is intended to ply on the Rhine. The dimensions are:—Length, 38·5 m.; breadth, 7·2 m.; and depth, 3·2 m. The keel plates are from 7 to 9 mm. thick; stem, 130 by 25 mm.; stern, 120 by 55 mm.; frames, 50 by 80 by 8 mm., 60 by 80 by 8 mm., and 52 by 65 by 8 mm.; the distance from centre to centre being 550 mm. in the fore part, with intermediate frames. The keelson is of double angle iron 70 by 90 by 8 mm., the side keelsons in the bilge being of double angle iron 50 by 80 by 8 mm. The deck beams, which measure 80 by 130 by 10 mm., stand at a distance of 1100 mm., and are connected to the frames by strong iron knees. The transverse framing of the hatchways is of plate and angle iron, and they are firmly connected together by fore and aft carlings. The vessel is provided with four water-tight bulkheads, 5 mm. thick, stiffened with angle iron. Two coal bunkers, with coal boxes, on deck, capable of holding together 60 tons. The thickness of the outside plating is as follows:—Garboard strakes, 7 to 9 mm.; strakes, intermediate, to garboard and bilge, 6 to 7 mm.; bilge strakes, 6 to 8 mm.; upper strakes, 6 mm. The bulwarks are 3 mm. thick and 600 mm. high. The boilers are two in number, and contain together about 190 square metres heating surface, certified for a pressure of 6½ atmospheres. The engines are independent, with double cylinders of 420 and 700 mm. diameter and 600 mm. stroke. The screws are 2100 mm. diameter. The boat is guaranteed to tow three iron barges, carrying 1600 tons, from Ruhrort to Cologne in from 18 to 20 hours, with an hourly consumption of 500 kilogs. of good Westphalian coal. The cost, including fittings, was 128,000 marks.

400-H.P. COMPOUND ENGINES.

WE this week illustrate a pair of horizontal compound engines of 400-horse power, manufactured by Messrs. G. K. Stothert and Co., of Bristol, on their patent principle. The high-pressure cylinder is 23in. diameter, the low-pressure 43in. diameter, the stroke of piston 4ft. 6in., and the working pressure 90 lb. per square inch. The valves for the distribution of steam are piston valves, having the packing rings of manganese bronze, and the high-pressure cylinder is also fitted with expansion valves entirely of manganese bronze. In this engine these valves are regulated by hand; but when preferred they are connected to the governor in a very simple and efficient manner. The main shaft, piston-rod, and crank pin are of steel, the bearings are 12½in. diameter, and 21in. long, and the gun-metal brasses are adjustable for wear in every direction. The connecting rod, slide valve spindles, way shafts, &c., are all forged from selected scrap iron, and the cylinders are made from a special mixture of cold blast iron, whilst the joints of all the rods are of tough gun-metal.

Messrs. Stothert are now in all their large engines—marine compounds excepted—using two air pumps, as with the balanced buckets much less power is required, the wear upon the joints is much less, a good and steady vacuum is easily maintained, and in the event of a valve giving out, the engine is enabled to run till a convenient time is found for renewing it with only a slightly reduced vacuum. The air-pumps are lined with brass, have brass trunks and brass foot and delivery valve seats and guards.

It will be noticed that although the engine is made upon the girder principle, a light bed-plate is fitted underneath the cylinders, and continued to take the bearings of the way-shafts. This is planed on the bottom as well as on the facing strips, and is intended as an accurate foundation upon which the planed feet of the cylinders shall rest, and the bearings for the valve gearing find a true position. It is, of course, an additional strength for the engine, but is not necessary otherwise than as described. The crank pin, it will be noticed, is secured in a very firm and substantial manner, being shrunk into the eye of the crank, and secured, in addition, with a large hexagonal nut. The fly-wheel is grooved for sixteen ropes, is 17ft. 6in. diameter, 4ft. 2in. broad, and will weigh 20 tons. The governor is driven by gearing, the wheels being of hard gun-metal; there is thus no chance of any slip taking place, and as the form of governor shown has been adopted after many years' practice, and the throttle valve, when used, is of a very improved form, the speed of these engines is very uniform—an important point, especially in spinning and weaving mills. One other feature is the small cost of the foundations; these consist simply of a bed of concrete and a few large stones. In our engraving more stones are shown than are actually used. The saving of cost of this over an engine with a continuous bed-plate, designed to take all the strain of the engine, or a pair of engines side by side with a double throw crank shaft, is considerable, especially in the latter case, where a much heavier and more expensive foundation is necessary, as the least settlement would bring an unequal strain upon the crank shaft, necessarily entailing a considerable expense and long stoppage should a fracture occur. Messrs. Stothert and Co. have made a large number of these engines for cloth, paper, canvas, and cotton mills, and their great aim is to combine simplicity with extreme economy of fuel. Messrs. Stothert state that they do not make any elaborate experiments to show a low consumption by figures, but prefer to rely entirely upon their customers' books. In any tests they have carried out for their own guidance the consumption of coal has been under 2 lb. per indicated horse-power per hour.

As a practical instance giving a trial of over three years' duration, we have a copy of a letter handed us from the well-known firm of Messrs. Richard Hayward and Co., of the Coker Sail Cloth Works, Crewkerne, Somerset. In February, 1880, Messrs. Stothert and Co. erected for this firm one of their patent engines, equal to 250 indicated horse-power, and it has been indicating during the period it has been at work 168-horse power. The consumption of fuel as certified from the letter before us has averaged but eleven tons—slack coal—per week. This is the gross consumption, and includes all used for getting up steam in the morning, banking up fires at night, and all consumed during the breakfast and dinner hours, when the engine is standing. The boilers used for generating steam for the engine and other purposes are two single-flued Cornish boilers, working without an economiser, at 60 lb. per square inch, the engine being designed for an initial pressure of 80 lb. per square inch. The lubricating materials used, as certified by the same letter, are two gallons of oil and 9 lb. of suet per week.

LEGAL INTELLIGENCE.

(*Before the* SOLICITOR-GENERAL.)

THE LANE FOX PATENT.

THIS patent, which is dated 9th October, 1878, came before the Solicitor-General on Friday, 1st June, upon an application made by Mr. Lane Fox and the Anglo-American Brush Electric Light Corporation, to disclaim from the patent all the claims originally made by the patentee and not previously excluded by his first disclaimer, except that which formed the original fourth claim, and which is given below *verbatim*. The application was opposed by the Swan United Electric Light Company, Messrs. R. E. Crompton and Co., and the British Electric Light Company, upon various grounds, among which were that the invention to which the petitioners wished to limit the patent by the proposed disclaimer was wanting in novelty, that it was not the proper subject for a patent, that it was not sufficiently described in his provisional specification, and that the proposed disclaimer would alter the character of the patent.

Mr. Webster, Q.C., and Mr. Moulton—instructed by Messrs. Grover and Humphreys, solicitors, and Mr. J. C. Mewburn, patent agent—appeared for the petitioners in support of the disclaimer. Mr. Aston, Q.C., and Mr. Chadwyck Healey—instructed by Mr. J. H. Johnson, solicitor—appeared for the Swan United Company; Mr. Aston, Q.C., and Mr. Phipson Beale—instructed by Messrs. Brookes and Sons, patent agents—for Messrs. R. E. Crompton and Co., and Mr. E. Carpmael—instructed by Messrs. Wilson, Bristows, and Carpmael, solicitors—for the British Electric Light Company.

Evidence in support of the disclaimer was given by Mr. Lane Fox, the patentee, Professor Fleeming Jenkin, F.R.S., Professor Silvanus Thompson, D.Sc., and Mr. R. Sabine; and in support of the several oppositions by Mr. J. W. Swan, Mr. R. E. Crompton, Dr. Hopkinson, F.R.S., Mr. W. H. Preece, F.R.S., Professor Ayrton, F.R.S., Professor Oliver Lodge, Mr. D. G. FitzGerald, and the Hon. R. Brougham.

After a long hearing, the SOLICITOR-GENERAL observed that all the objections as to the validity of the patent, and as to the propriety of the disclaimer, would be open to the opponents upon the trial of an action, and therefore decided to grant the petitioner's application for leave to disclaim. The only claim, therefore, remaining in the specification will be "the employment as described of secondary batteries as reservoirs of electricity in combination with a mode or system of distribution such as is hereinbefore explained." The full effect of this claim can therefore only be ascertained by a careful perusal of the whole specification.

The opponents asked that the patentee might be put under terms to commence an action against them to test the patent, but the Solicitor-General did not think he could impose those terms. The question of what other terms should be imposed upon the petitioners stood over for the Law Officer's consideration.

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

(*From our own Correspondent.*)

IN a few branches of the rolled iron trade inquiries are a little more numerous, and the order books are filling somewhat better. But the prevailing low prices prevent many of the contracts which are offered from being accepted, and in some of the localities the mills and forges are only partially employed.

Sheets for galvanising and for working-up purposes command slightly better prices. The previous minimum of £8 for doubles is now more nearly £8 5s., yet lattens remain at £9 to £9 5s. Prices of local makers of sheets in the galvanised state keep easy, consequent upon excessive competition, yet the representatives here of the Birkenhead Galvanising Company quote prices up 5s. per ton, leaving doubles at £13 per ton in bundles at Liverpool. For sheets of 26 w.g. the company now quote £14 15s., and for 28 w.g. £15 15s. in bundles.

South Staffordshire tank plates not thinner than 13 w.g. were in the market this—Thursday—afternoon in Birmingham at less than £7 10s. per ton, but the quality was in proportion. Boiler plates of 4 cwt. and 5 cwt. each were quoted £8 10s. to £9 by makers of repute, and from this figure quotations varied to £10, £11, £12, and £15, according to quality. Charcoal plates were £7 10s., and best ditto £9 5s.

Merchant sections of iron are in steady output. Bars, hoops, and strips are in tolerably good inquiry for the colonies, and for other export markets. Hoops, in particular, continue in fair demand for America.

Common gas strip up to 6¾in. wide, and of the usual gauges, was to be had this afternoon at somewhat under £6 5s. per ton, while strip of from 7in. to 8½in. was quoted £6 15s., and from 8¾in. to 12in. £7 5s. per ton. Nail strip was abundant at £6 10s., whether 12in., 21in., or 24in. widths were required, and whether of 14, 13, or 12 w.g. Common angles of 1½in. to 4½in. were £6 10s., second qualities at £7, and best quality to 8 united inches £7 15s. to £8. Tees of ⅞in. to 2½in., of ordinary quality, were £7 10s. easy, while superior qualities were £8 to £8 5s. Ordinary horseshoe bars were £6 15s., while best sorts were £7 10s. and £8.

Pig-makers are quiet, but hopeful of the early future. Common native sorts are 42s. 6d. down to 40s., and part-mines 45s. to 50s. Northampton pigs are 45s. upwards, and Derbyshires 46s. 6d. to 47s. 6d., with only little business.

Ironstone and coke are in steady demand by the local pig makers. Large quantities of Northampton stone are coming into this district, and prices at date vary from 5s. 9d. and 6s. up to as high as 6s. 6d. per ton. Native stone of the "black ball" description is to be had at 14s. per ton, while "blue flats" are worth 16s. Pottery mine from North Staffordshire, for fettling the puddling furnaces, is quoted 17s. to 18s. per ton, delivered hereabouts. Best foundry coke is 24s. delivered from Durham, and best furnace coke 17s. 6d., delivered from North and South Wales. Good gas coke is 11s. 9d. to 12s. per ton.

This week "summer prices" have been declared by the Cannock Chase coalmasters. The new list is a reduction on that prevailing since Nov. 1st, of 1s. on coal, and 6d. on rough slack.

Certain of the constructive engineers report themselves tolerably busy on a variety of road bridges, some of large span; and also upon railway bridge work, alike for home and for foreign lines.

The open market quotation for iron roof-work is £12 per ton and upwards on trucks at makers' works, and iron-rivetted girders are £11 per ton and upwards. Galvanised shedding of improved design for hay barns, &c., is quoted £35 per 40ft. lengths, but advantageous contracts might be placed at less than these prices.

The workpeople in the forged horse-nail trade have received notice of a further reduction of 3d. per 1000. The masters state they are compelled to take this course in consequence of the competition of machine-made nails.

The South Staffordshire and East Worcestershire Trades Council have resolved, "That this Council considers that the proposals contained in the Government Patent Bill to enforce the making of a statement of claim in the provisional specification, and open it for public inspection before the grant of the patent, is an objectionable feature in the Bill, and should be amended before it becomes law; and that Mr. Hinde Palmer's proposals for a further reduction in the patent fees be favourably considered."

In North Staffordshire the colliers' strike shows no signs of breaking up, and it is calculated that some 8000 hands are still at play. The owners, of whom Earl Granville, and Mr. Robert Heath, ex-M.P. for Stoke on-Trent, are the principal, are so determined that they have drawn the horses up the pits, and most of the ironworks connected with the collieries are idle. Certain of the ironworks which are keeping on are obtaining some of their supplies of fuel from the Cannock Chase and Derbyshire coalfields. The ironworkers, having no union funds, are suffering.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The condition of the iron trade of this district remains practically unchanged. Business still comes forward very slowly, and there is nothing to indicate the possible existence in the background of anything likely to give an impetus to the market. For pig iron the inquiry is extremely limited, and to a large extent consumers appear to be still working on with deliveries on account of old contracts that have not yet run out, and one cause assigned for the very restricted buying which has characterised the market for some time back, is that an unusually large quantity of scrap iron has of late been offering for sale. There is unquestionably a great deal of old machinery being taken out to be replaced by plant of a more modern type, and this would bring a good deal of scrap into the market, of which founders appear to have availed themselves in preference to the raw material. Finished iron makers are kept going, and in some cases are busy, but the new orders given out are only small.

The iron market at Manchester on Tuesday was not very well attended, and the business done was very limited. Quoted prices were unchanged; but where offers for anything like quantities were submitted by buyers they were at figures under those asked by the makers. For Lancashire pig iron quotations remained on the basis of 45s. for forge, and 46s. for foundry, less 2½ per cent. delivered equal to Manchester. Makers, however, are unable to get orders at these figures, and they have been selling so little recently that stocks are now going down at the works. Offers for a fairly large quantity of iron were made on Tuesday at a little under the quoted rates; but local makers, although not absolutely firm at their list rates, seemed scarcely prepared to give way to the extent expected by buyers, and no orders of importance were booked. In district brands the business doing is only small; quotations remain on the basis of 44s. 4d. for forge and 45s. 10d. for foundry Lincolnshire, less 2½ delivered, with cheap lots of forge offering at under these figures; but buyers are not tempted to give out any large orders. A few expiring local contracts for Middlesbrough iron are being renewed, and the average quoted prices for foundry are about 47s. 10d. to 48s. 4d. net cash, delivered equal to Manchester.

In the finished iron trade prices are maintained on the basis of late quotations, but there is only a very small business doing. With the exception of one or two local makes that can be bought at £6 2s. 6d., good brands of bar iron are not offered at less than £6 5s., hoops average £6 10s. to £6 12s. 6d., and sheets £7 12s. 6d. to £8 per ton delivered into Manchester. Inquiries for shipment continue exceedingly poor, and where offers are made they are in most cases at extremely low prices, which sellers are not disposed to entertain.

The leading branches of the engineering trade continue well employed as a rule. I have referred several times to the exceptional activity prevailing in the locomotive building trade, and amongst manufacturers of railway plant generally, and there is no change to notice in this direction. The principal firms throughout the district who lay themselves out specially for heavy engine work of various descriptions have large orders in hand. Tool makers continue busy, and machinists appear to be getting better off for work. One section of the engineering trade is, however, only moderately employed. Makers of the lighter class of high-pressure engines are not, as a rule, very well off for orders; and there is no doubt that this branch of the engineering trade is suffering, and is likely to suffer still more seriously, from the competition of the gas engine, the manufacture of which has of late been very largely developed in this district. In fact, but for the difference in cost, it is questionable whether steam engines of under 20-horse power would, for any lengthened period, be able to hold their own at all against the gas engine, with its many advantages, where the driving power required is not large. Gas engines may, however, be even said to be now gradually passing beyond the stage of what is termed the light class of motor, and are being made capable of much more effective work than was at one time thought possible. The latest advance in this direction is a gas engine capable of developing 85-horse power, which is being manufactured by Messrs. Crossley Brothers, of Manchester.

Another class of motor which is becoming popular for light driving is the hot-air engine, and as an illustration of the purposes to which it may be applied, I may mention that Messrs. W. H. Bailey and Co., of Salford, have just completed a contract for Mr. J. H. Donaldson, of Harrowsby, Surrey, in which they have put down a one-horse power Lehmann hot-air engine, which is utilised for driving one of their double-cylinder "Challenger" pumps for raising water by separate suction pipes from a brook and a well, for laundry and wash-house purposes, as well as for the conservatory and stables, for driving wood-sawing and chaff-cutting machinery in the workshop, a washing machine in the wash-house, and a mangle in the laundry, the whole of which work, I understand, the engine does effectively.

The Fleuss breathing apparatus and lamp, which has been recommended by the Secretary of State for adoption in mining districts with the view of providing facilities for the exploration of mines after an explosion, was exhibited in working order at the meeting of the Manchester Geological Society on Tuesday, and its operations explained to the members by Mr. Brown, of Messrs. Fleuss, Duff, and Co., of London. A full description of the apparatus was given by Mr. Dickinson, H.M. Chief Inspector of Mines, at a previous meeting, and to this I have already referred in my "notes," and I need only here touch upon such points as were raised at the meeting on Tuesday relative to its adaptability for mine exploration purposes. The experiments at the meeting proved conclusively that the apparatus would enable the wearer to enter the most deadly gases with perfect safety, but beyond this are the questions as to whether the wearer, having entered the mine by means of the apparatus, would be able to render effective service in saving life, and also whether the cost of the apparatus would stand in the way of its general adoption. In the first place, I may state that the breathing apparatus weighs 28 lb. and the lamp 13 lb.; supposing men were to be brought out of a mine through deadly gases it would be necessary for the rescuers to take with them spare appliances beyond those in actual use, which would mean that two searchers would take a spare apparatus between them. The weight of the apparatus would, however, seem to stand in the way of its very effective employment in actually rescuing any large number of imprisoned miners, and it was suggested by Mr. Dickinson whether it would not be possible for the rescuers to carry with them some more portable appliances which could be supplied to the men to enable them to breathe whilst passing through the noxious gases. Mr. Hall, inspector of mines, thought the apparatus would be much more likely to be instrumental in saving property than in saving life, and this seems to put on a pretty accurate basis the really practical advantage which will be gained by its adoption. For restoring ventilation, getting near to a fire for the purpose of extinguishing it, or in the taking out of a stopping, the apparatus would be of the greatest possible service, but for the actual rescuing of miners out of a pit partially filled with gas there would be so many difficulties surrounding the operation that it is doubtful whether it would be attended with success except on a very small scale. To establish stations in various districts, as suggested by the Secretary of State, would, of course, necessitate a considerable number of apparatus being obtained, as from half-a-dozen to a dozen complete sets would be indispensable for each station, and this introduces the question of cost. This would be a serious item; each breathing apparatus with a bottle of oxygen gas for charging costs £25 and each lamp £13 10s.; the bottle of oxygen contains from four to five charges, which last four hours, and to re-fill the bottle costs 15s. It is a question whether the cost of fitting up stations as suggested will not be an obstacle which will stand in the way of any great adoption of the system as proposed by the Secretary of State; but for carrying out necessary but dangerous mining operations with

safety, there is little doubt the apparatus will be employed to a considerable extent.

The coal trade is naturally quieting down as the summer advances; pits are getting on to short time, and all round the demand is only moderate. There has been a little easing down in prices in some cases to secure present orders, but no difinite reduction, and as regards forward contracts colliery proprietors are very chary about quoting at all. At the pit mouth prices average about as under:—Best coal, 9s.; seconds, 7s. to 7s. 6d.; common round coal, 5s. 6d. to 6s. 3d.; burgy, 4s. 9d. to 5s.; best slack, 4s. to 4s. 6d.; and common, 3s. to 3s. 6d. per ton.

Shipping continues very dull, and Lancashire steam coal delivered at Liverpool or Garston can be bought at 7s. per ton.

The proposal to establish a Coal Exchange for Liverpool has met with only such partial support from the trade that it has been deemed advisable to abandon the scheme for the present.

Barrow.—So far as the business transacted in the hematite pig iron market is concerned there is no change to note. Business is very dull and buyers are few. This is not only the case with foreign consumers, but home buyers are scarce, and if it were not for the activity in the steel departments the trade would be in a very flat condition indeed. Prices are the same as quoted in my last week's notes, but notwithstanding this fact, smelters are making no preparations to reduce the output. On the contrary, they express their confidence in the future, and as they are pretty well sold forward, the occasion for immediately curtailing the output may not be so pressing as would appear. 50s. 6d. is the selling price of all-round samples of Bessemer. Stocks are on the increase. Steel rails are still quoted at £4 15s. to £5, and only a fair business is being done, and nothing like so much as a short time since. Makers are pretty largely sold forward. Iron shipbuilders are in a fair position, and there is a likelihood of another yard opening-up at Barrow before long. Iron ore quiet at unchanged prices. Coal and coke steady. Shipping fairly employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The coal trade continues very quiet, particularly in the classes of fuel ordered for the metropolitan markets. Manchester deliberations have ended in a resolution leaving the districts to enforce restriction separately on their own responsibility. This practically amounts to an abandonment of the effort to secure a universal restriction. I remember when the conference took place at Sheffield between the Coalowners' Committee and the miners' delegates, the latter distinctly promised that unless the movement was universal they would not persist with it. Their promise was taken, and on that basis the masters proceeded to reason the matter with them. Now that the idea of restriction on a national scale has been abandoned, the question may be regarded as shelved for a season. No one will dispute the wisdom of this decision, for in the present state of the market the prospects of colliers in any general strike would be hopeless. In fact, at this moment, very few collieries are being worked to a profit, and in the cases where large iron and steel companies have their own pits, the loss at the latter is so heavy as to form a serious drag on any profits made in iron and steel.

At Mexborough the first of a series of demonstrations, to be held in the district, was attended by nearly a thousand persons connected with the South Yorkshire and North Derbyshire Miners' Association. Mr. S. Hall, the chairman, while urging the advantages of trade unionism, strongly advocated the principle of a sliding scale, and condemned the restriction policy as "a wild, visionary, unprofitable, and unpracticable scheme." A resolution was passed in support of the efforts of Messrs. Burt and Broadhurst to secure the amendment of the Mines and Employers' Liability Acts. With regard to the "glut" in the coal market, the meeting expressed itself "in favour of any scheme for the regulation of the output of coal which is mutual between all parties concerned, and which places all miners on the system of working in one shaft only, eight hours from bank to bank, in every county, and keeping all unskilled men from the collieries." A resolution providing for mutual agreement between "all parties concerned" seems broad enough to admit of even consumers being considered from their own standpoint, and it is not likely that they would readily agree to any policy which would practically put a shilling or two per ton on the coal they consumed.

In the iron trade there are still severe complaints. In merchant iron, buyers are holding back in the hope of easier prices. Hoop iron is in fair request. At the Phœnix Bessemer Works, the Ickles, Rotherham, the contraction of the rail trade has necessitated the paying off of one half of the men in the Bessemer shops and rail and cogging mills; but the forge and rolling mills are well employed in the production of spring steel and special brands for cutlery and other Sheffield purposes. Large deliveries have also been made of steel for wire.

The wagon works in the Rotherham district have good orders in hand for Lancashire and Scotland, and also for wheels and axles, of which large shipments have been made to India, South America, and Australia. The home trade in wheels and axles has also been fairly satisfactory. Stove-grates are extensively made by the Rotherham firms, who have been so busy this season that overtime even had to be worked and the holidays cut short. The Rotherham brass trade is also in a satisfactory condition. Though progress is chiefly being made in the home markets, one energetic house has established itself in Australia, where a brisk business is being done.

The Sheffield file trade is still disturbed by the 10 per cent. dispute. About seventy men have returned to their employment at Messrs. Austin and Dodson's and Messrs. Beardshaw and Sons'. They are being paid according to the old scale. This incident, however, does not, on inquiry, hold out any hope of an immediate settlement of the difficulty. The two firms concerned have recently had some good orders, and find it advisable to re-engage the men on the old terms. Other employers state that their stocks had accumulated so largely that they have no difficulty in supplying their customers from the shelves.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

Notwithstanding the fact that the shipments for last month were exceedingly good, and that the ironmasters' returns of stocks are also of a satisfactory nature, the Cleveland pig iron trade is in a weaker condition than it was a week ago. At the market held at Middlesbrough on Tuesday, No. 3 g m.b. was offered by merchants at 39s. 3d. per ton, and it was reported that in some instances sales had been made at 39s. 1½d., and even as low as 39s. per ton. Makers' prices ranged from 39s. 6d. to 40s. per ton, but some of them who are fast completing their contracts have booked orders at less than 39s. 6d. The majority of producers are, however, in a fair position, and can afford to be firm for the present.

Warrants are still almost unsaleable, and 39s. per ton is the most that is offered for them.

The stock of Cleveland iron in Messrs. Connal's store at Middlesbrough was on Monday last 77,263 tons, being a reduction of 660 tons for the week. In their Glasgow store they have 578,490 tons of iron.

During the past month there have been shipped from the Tees 87,091 tons of pig iron and 29,725 tons of manufactured iron and steel. In April 87,830 tons of pig iron and 35,146 tons of manufactured iron and steel were exported. In May the bulk of the pig iron was disposed of as follows:—To Scotland, 26,021 tons; to Germany, 19,733 tons; to France, 8750 tons; to Holland, 5535 tons; to Belgium, 4350 tons; and to Norway and Sweden, 4232 tons. This month the shipments are progressing at a fairly satisfactory rate.

The Cleveland ironmasters' returns for May were issued on the 4th inst. They show that there are 118 furnaces in blast, against 120 at the end of April. One furnace at Consett and one at South Bank have been put out of blast, and one of the furnaces at Seaton has been changed from hematite to Cleveland iron. The total make of all kinds of iron was 236,829 tons, of which quantity 78,602 tons was hematite, basic, and spiegel iron. The output for the district was 7608 tons more that in April. The quantity of iron in stocks and stores on the 31st ult. shows a decline of 3139 tons, being then 287,807 tons.

There is very little buying and selling in finished iron, but all the works are fully occupied with old contracts. Prices remain unaltered, and are as follows:—Ship plates, £6 2s. 6d. to £6 5s.; shipbuilding angles, £5 12s. 6d. to £5 15s.; and bar iron, £5 17s. 6d. to £6 per ton, all less 2½ per cent. free on trucks at makers' works. Consumers are believed to be holding back in the hope that they will be able to do better shortly.

At meetings of blast furnace men, which have been held recently at Middlesbrough, Cargo Fleet, Port Clarence, Newport, North Ormesby, Consett, and Witton-park, a resolution has been passed, that six months' notice be given to the employers, to terminate the present sliding scale. The ground taken is that though it slides 2½ per cent from 40s. to 41s. per ton for No. 3 pig iron, and another 2½ per cent. from 41s. to 42s., it only slides 1¼ per cent. to every shilling at all other parts of the scale. The men also object to the wording of the clause referring disputes to the joint committee. It is intended to draw up an amended scale, which they hope will be adopted in place of the existing one.

The annual report of the Darlington Steel and Iron Company, Limited, was issued on Monday last. It shows that the directors have spent £3407 upon improvements in the works, such as additional boiler power, Gjers's soaking pits, &c. The amount of profit on the year's working is £10,813. This sum, less the amount spent over plant, leaves a balance of £7406, which the directors recommend should be disposed of as follows:—Dividend on 7 per cent. preference shares, £2752; reserve account, £3000; carried forward to next year, £1654. The nominal capital of the company, including £100,000 preference shares, is £275,000. Iron and steel goods to the value of £328,807 were manufactured during the year. The Springfield Works are still idle, and there is no likelihood of their being re-started at present.

Messrs. Bolckow, Vaughan and Company's men are still out on strike, and the large steelworks at Eston are idle. The men say they are determined not to return to work except at the old rates, and they do not seem disposed to submit the matter to an arbitrator. The masters show no signs of giving way; on the other hand, they say the men will have to accept the reduced rates, or the works will remain closed.

On Thursday and Friday last the North-Eastern Steel Company made an experimental trial of its converters, rolling mills, &c. About five tons of steel were made, containing only ·02 per cent. of phosphorus. The pig iron used contained over 3 per cent. The blooming and rail mills were tried, and the machinery was found to answer admirably. It is expected that the works will be in full operation shortly, and will give employment to upwards of 500 men. The output of rails, blooms, slabs, and wire billets will eventually be from 2000 to 3000 tons per week.

The Teesside Iron and Engine Works Company, Limited, is about to start in good earnest with its new iron shipyard at Middlesbrough. It has already engaged a practical manager for the new department. The site will be the same as that formerly occupied by the rolling mills and shipping wharf.

A petition has been drawn up and is being extensively signed in Middlesbrough and the neighbourhood to the Elder Brethren of Trinity House to erect a lighthouse on the Salt Sear, a reef of rocks one and a-half miles north of Redcar. On this reef many a good ship has been wrecked. An American clipper barque, of 1100 tons burden, laden with wheat, and bound for Hartlepool, struck upon it about ten days since, and will probably become a complete wreck. She is called the Stonewall Jackson. She left California five months since and was in sight of her port of destination, and in charge of a North Sea pilot, when she was towed on to the rocks by the steam tug to which she was attached. A Board of Trade inquiry will, no doubt, be held.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow warrant market was very quiet up till the close of last week, there being a small business with prices steadily declining until they touched the low figure of 46s. 5½d. per ton cash. Some rather extensive purchases of warrants have since taken place, with the result that prices exhibited a considerable improvement in the early days of the week. This upward movement, however, is not likely to be assisted by the resolution of several ironmasters to send pigs into store. Storing began on Tuesday, and it had the effect of arresting the steady reduction which has been going on for six or eight months in the stock in Messrs. Connal and Co.'s Glasgow stores. The shipments of the past week were again favourable, amounting to 11,609 tons, as compared with 9867 in the corresponding week of 1882. At home the demand continues very good, and the production large.

Business was done in the warrant market on Friday forenoon at 46s. 6½d. to 46s. 8d. cash and 46s. 8½d. to 46s. 10½d. one month, the quotations in the afternoon being 46s. 8d. to 46s. 10d. cash and 46s. 10½d. to 46s. 11½d. one month. On Monday transactions were effected at 46s. 10d. to 46s. 8d. cash and 47s. to 46s. 11½d. one month. The market was strong on Tuesday, with business at 46s. 10½d. cash and 47s. 1d. one month. On Wednesday business was done between 46s. 11d. and 46s. 9d. cash, and 47s. 2d. and 46s. 10d. one month. To-day — Thursday — transactions were effected at 46s. 8½d., 46s. 8d., and 46s. 9½d. cash, and 46s. 10d. to 46s. 11½d. one month.

The higher-priced brands of makers' iron are reduced this week, the quotations being as follow:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 57s. 6d.; No. 3, 53s. 6d.; Coltness, 61s. and 54s.; Langloan, 61s. 6d. and 54s.; Summerlee, 59s. 6d. and 50s. 6d.; Chapelhall, 57s. 6d. and 53s. 6d.; Calder, 59s. and 50s. 6d.; Carnbroe, 51s. 6d. and 49s.; Clyde, 50s. 6d. and 48s. 6d.; Monkland, 48s. and 46s.; Quarter, 47s. 6d. and 45s. 6d.; Govan, at Broomielaw, 48s. and 46s.; Shotts, at Leith, 61s. and 56s.; Carron, at Grangemouth, 50s. and 48s.; Kinneil, at Bo'ness, 48s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 54s. and 47s. 6d.; Eglinton, 47s. 6d. and 45s. 9d.; Dalmellington, 49s. and 48s.

The malleable iron trade continues busy. A beginning is being made at the Coates Ironworks, recently purchased by Messrs. Jardine and Goodwin, who have let the adjoining tube works, and also contemplate eventually introducing the manufacture of steel. There is very little change in the prices of malleable iron. Shipbuilding specifications are offering in large numbers. The engineering and boiler-making departments are actively employed, and the hardware trades are also in a satisfactory condition.

The coal trade is very active all over the Scotch mining districts, and it is now certain that the present year's business will be among the largest on record. At Glasgow the shipments are heavy, and it is difficult to obtain vessels to carry away the coals ordered. Plenty of steamers could be got, but they are unsuitable for carrying coals long distances, owing to their own consumption of fuel. There is great activity in Fife, where, however, prices are low. The coal exported at Grangemouth during the week amounted to 4800 tons, while 5000 tons were despatched at Bo'ness and a fair quantity at Leith. The quotations are everywhere without material change.

Miners' demonstrations have been unfrequent of late, but a few meetings of some importance have been held this week. The largest of these took place on Monday at Stirling, when there was a gathering of Fife and Clackmannan miners and their friends, variously estimated at from 6000 to 10,000 persons. They were addressed at length by Mr. Burt, M.P., who said that had the miners done nothing else than maintain the shortened hours of labour, that was worth ten times the trouble that had been expended in connection with them. He trusted that, come what might, the miners of Fife and Clackmannan would adhere as strictly as they had hitherto done to the eight hours. He trusted they would be able to arrange with their employers some scheme for regulating the rate of their wages. The secretary of the Employers' Association, it may be said, has written to the secretary of the Fife and Clackmannan miners, stating that as soon as prices improve to warrant an advance of wages, that will be given. He states that at present the prices are not better than they were when the last reduction was made in the wages of the miners. The colliers in Kilmarnock district of Ayrshire are threatened with a reduction of 6d. a day in their wages, to take effect a fortnight hence. A largely attended meeting of delegates took place on Saturday at Kilmarnock, when a unanimous expression of feeling was given that the reduction was not warranted by the condition of trade. It was agreed to have further meetings on the subject.

WALES AND ADJOINING COUNTIES

(*From our own Correspondent.*)

Speculation is rife still as to the Barry Dock and Railway Bill, and the question is whether the whole or a part of the scheme will be carried out. The railway over thirty-seven miles of country is regarded in good quarters with less favour than the dock, and residents at Sully and along the coast say that with the prevailing wind, S.W., it will be difficult to enter. The local papers still teem with the discussion, and the latest is an effort to show that the project which has cost £20,000 to win, will entail a cost of three millions, and take seven years to complete, and another seven to develope. Its good feature, that of developing a distant coal-field, is of less account when carefully considered, as there is nothing to prevent branches being formed either by the Taff, the Great Western, or the Swansea Bay.

The condition of the iron, coal, and tin-plate industries of Wales is very satisfactory; 220,000 tons of coal and 10,000 tons of iron were despatched last week from the various ports, and in addition a great variety of promising speculations are coming to the front, or are in actual operation. Swansea is going in for a dry dock. Messrs. Nixon contemplate sinking two new pits in the Aberdare Valley, and are moving to construct a line from near Aberdare; also to have powers for direct connection with Cardiff, independent of the Taff. Messrs. D. Davies and Co. are sinking a pit at Cwmpark, Rhondda. Mr. Wm. Crawshay will enter upon working the Newbridge Rhondda Colliery forthwith. He gave it a personal inspection this week. Two excellent seams of coal have been struck at Wernddu, Caerphilly. Cwmglo Colliery, under a new company, is pushing on well, and the Ogmore Steamship Company has been floated, principally by Cardiff men. These are substantial indications of existing prosperity.

The labour disputes remain unsettled; Dowlais Colliery dispute at Bedlinog is to be referred to arbitration, and Mr. Bailey, of the Plymouth Collieries, has offered to do the same with the dispute at his place. Ynysfeis men continue out. The dispute is as to which medical officer shall be retained.

Coal is firm in price, both house and steam, and the tendency is upwards. Rhondda No. 3, rigid at 9s. 6d.; Rhymney Works and Bargner samples advanced 3d. per ton. With respect to steam, many owners have closed their books against any more June business.

In the matter of the locked lamp question at Cwmtillery, which was settled by arbitration in favour of Mr. W. T. Lewis's recommendation, the colliers have held a meeting to object to the substitution of locked lamps instead of naked lights. This, however, is a point upon which there should be no wavering. It is to be expected that men who have been accustomed to work with a naked light will feel aggrieved at having to work with a diminished light; but security of life and limb should more than outweigh the difference. Though on the broad principle I have always contended that where a naked candle will not burn with safety, no man should work, unfortunately, or in the opinion of the coal world, fortunately, the exigencies of the trade would not allow of this. Everything is at high-pressure, double relays of men, double carriages from the pit, and a thousand tons a day from a colliery is now of common occurrence.

The tin-plate trade improvement continues, and best brands are in good request.

A start is about to be made with the tin mills at Lydbrook, and those at Lydney are already re-started. Prices are firm, even for wasters, and good cokes are fetching 16s. to 16s. 6d.—ordinary not less than 15s. 9d.

One of the leading subjects of discussion amongst the Cardiff coalowners and shippers at present is the tip question. Mr. W. T. Lewis, with a view to remedy existing monopolies and delays, has invited suggestions; and the result, I imagine, will be the adoption of a uniform system, giving the small owner the same privileges as the bigger one.

The Leeds Forge Company.—A series of official trials of the strength of Fox's corrugated flues have been conducted for several days in succession at the Leeds Forge Company's works under the direction of Mr. T. W. Traill, chief engineer surveyor to the Board of Trade, and Mr. Peter Samson, assistant chief engineer surveyor to the Board of Trade, for the purpose of establishing new Government rules for the pressures to be carried in the boilers of passenger steamers obtaining the Board's certificate. A great many former tests of the different constructions of boiler furnace flues, including Fox's patent corrugated flue, have been made at the works, but those of Fox's patent tested last showed that very great advances as to their powers of resistance and other qualities have resulted from the methods of manufacture now being carried out entirely by the new and specially patented machinery laid down during last year. The advantages of machine-made flues are, it is claimed, such that it is considered a new rule should be at once laid down by the Board of Trade to their surveyors and shipbuilders showing the extension of pressure these flues are entitled to carry according to the exhaustive series of trials which have been made. On Saturday week the completion and starting of the company's new Siemens steel works was made, and the Mayor of Leeds—Mr. Woodhouse—was invited to take part in the operations of tapping the molten steel from the ladle, which was done in good style, and the same gentleman worked the steam travelling crane which lifted the first ingot from its bed in the casting pit amid the cheers of the forge workmen, numbering some 800 or 900, as well as a number of gentlemen whose names are well known in engineering circles. After these several operations had been successfully accomplished an adjournment was made for refreshment, when Mr. Samson Fox, the managing director, in suitable terms proposed the health of the Mayor, at the same time asking him to accept as a memento of the occasion a case containing a set of silver serviette rings made in the form of small corrugated flues. The toast having been enthusiastically drunk by the company, his Worship thanked those present and proposed "Prosperity to the Leeds Forge," coupling with his proposition the name of Mr. Samson Fox, whom he said he had had the pleasure of knowing more intimately lately, and to whom he felt sure the district of Armley owed much for the trade his invention had brought to it; also that Leeds required many more such works and workers as those of the Leeds Forge Company in order to keep up its advance and to progress with other towns. Mr. Fox replied, and proposed "The health of Mr. Traill, of the Board of Trade," who coupled with his response the name of Mr. Wm. Fox as his brother's able assistant; and also spoke of the courteous manner in which the Government officials of the Board of Trade were always received by the company's staff. The Forge band much enlivened matters by playing a choice selection of popular music. The Mayor, along with the Town Clerk, Mr. Morrison, was conducted over the extensive works by Mr. Samson Fox, and the proceedings were brought to a close.—*Leeds Mercury.*

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

29*th May*, 1883.

2651. LAYING ELECTRICAL CONDUCTING WIRES in the GROUND, H. J. Allison.—(*J. Greives & J. Bleoo, U.S.*)
2652. STRETCHING WOVEN FABRICS, J. Strang, Ramsbottom.
2653. PLOUGHS, E. Edwards.—(*S. Boreau, France.*)
2654. BURNERS for COOKING, S. Leoni, London.
2655. SINKING SHAFTS, &c., C. D. Abel.—*F. H. Poetsch, Germany.*)
2656. CARTRIDGE HOLDER, P. W. D'Alton, London, and F. W. Durham, Barnet.
2657. ELASTIC WATERPROOF COMPOUNDS, W. Burnham, Chicago, U.S.
2658. RING SPINNING FRAMES, W. T. Emmott.—(*C. Verenet and E. Appenzeller, Mulhouse.*)
2659. HARNESS SHAFT-TUGS, S. E. Davies. Liverpool.
2660. CULINARY UTENSILS, P. Björling, Heath Town.
2661. ELECTRIC ARC LAMPS, J. Brockie, Brixton.
2662. TABLES, &c., H. Kinsey, Swansea.
2663. ROTARY SCREENS, H. Shield and W. N. Crockett, Nottingham.
2664. PURIFYING HAY, C. Perkin, Northernden.
2665. SCREW STOCKS, &c., W. McCormack, Paignton.
2666. PERAMBULATOR BODIES, G. P. Lee, Manchester.
2667. TELEPHONIC TRANSMITTING APPARATUS, J. Graham, London.
2668. DYEING SILK, T. Holliday.—(*E. Rau, U.S.*)
2669. AMMONIA, W. J. Cooper, London.
2670. DYNAMO-ELECTRIC MACHINES, W. Hochhausen, New York, U.S.
2671. TRAMWAYS, &c., W. P. Hope, Edinburgh.
2672. CARDING ENGINES, A. Clark.—(*H. Woodman, U.S.*)
2673. GALVANIC BATTERIES, A. Clark.—(*G. Velloni, Paris.*)
2674. RAILWAY BUFFERS, H. H. Lake.—(*G. Turton, London.*)

30*th May*, 1883.

2675. ELECTRICAL METERS, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
2676. NUMBERING, &c., TICKETS, J. M. Black, London.
2677. CHANGING PHOTOGRAPHERS' BACKGROUNDS, A. M. Clark.—(*W. E. Lindop, Canada.*)
2678. PLATE SPRINGS, G. W. Willford, Sheffield.
2679. CREEL PEGS, P. Coonan, Rishton.
2680. EXTRACTING FAT from BONES, &c., C. D. Ekman, Sweden.
2681. HORSENAILS, E. Brydges.—(*A. Gross, Berlin.*)
2682. PULVERISING SUBSTANCES, H. C. Bull, Liverpool.
2683. BELT FASTENERS, R. L. Kirlew, Manchester.
2684. REAPING, &c., MACHINES, J. Wild, Tetney.
2685. COMBINED BUTTON and FASTENER, T. W. Taylor, Birmingham.
2686. OIL PAINTS, &c., A. F. Link.—(*E. Fischer and M. E. Cohn, Berlin.*)
2687. SECURING TIRES to WHEELS, J. Spence.—(*A. C. Brown and R. Lindsley, South Africa.*)
2688. STEAM BOILERS, H. Johnson, Burgess Hill.
2689. VELOCIPEDE SADDLES, J. White and J. Asbury, Coventry.
2690. OIL CANS, G. A. J. Schott, Bradford, and G. Robinson, Sheffield.
2691. ARTIFICIAL FERTILISERS, J. Young, jun., Norfolk.
2692. GOVERNORS, W. P. Thompson.—(*H. Chapin, U.S.*)
2693. GRAINING SURFACES, J. A. Meginn, Liverpool.
2694. RAILWAY TRUCKS, A. J. Boult.—(*P. Dietrich, Berlin.*)
2695. COVERS for ARTICLES for TRANSMISSION by POST, &c., J. Hertz, London.
2696. STAITHS, G. Taylor, Penarth.
2697. LACING GLOVES, A. M. Clark.—(*W. Foster, U.S.*)
2698. CHIMNEY TOPS, J. Waple, Brixton.
2699. COKE OVENS, F. Wirth.—(*F. Brunck, Germany.*)
2700. BANJOS, &c., W. R. Lake.—(*H. McCord, U.S.*)

31*st May*, 1883.

2701. PUNCHING MACHINE, A. Higginson, Liverpool.
2702. GAS MOTORS, C. Pieper.—(*E. Körting and G. Lieckfeld, Hanover.*)
2703. STARCH, J. Polson and J. M. Harley, Paisley.
2704. TROUSERS, &c., J. H. Clibran, Altrincham.
2705. SEATS, J. A Boxer, Folkestone.
2706. GAS CALORIC MOTIVE ENGINES, E. and E. Crowe, Manchester, and H. Crowe, Middlesbrough.
2707. SOAP, E. A. Brydges.—(*F. O. Spielhagen, Berlin.*)
2708. LATHE BACK HEADSTOCKS, T. B. Barker and J. A. Ewins, Birmingham.
2709. PRODUCING STEAM POWER, S. J. Fear, Redland, and G. C. S. Hill, Bedminster.
2710. PREVENTING RUST on CAST IRON, &c., L. A. Groth.—(*E. Nicolaus, Saxony.*)
2711. SCISSORS, &c., L. A. Groth.—(*B. Cunze, Berlin.*)
2712. COCKS or TAPS, J. Ohren, Rio de Janeiro.
2713. CARAMELS, H. Roberts, Greenwich.
2714. LAGER BEER, &c., J. P. Jackson, Liverpool.
2715. WEDGE-SHAPED AIR BALLOON, G. Wellner, Brünn.
2716. SHIPS' BERTHS, H. J. Haddan.—(*G. Smith, U.S.*)
2717. PLAY CARDS, H. J. Haddan.—(*A. Dougherty, U.S.*)
2718. MINERS' SAFETY LAMPS, D. Dodd, Intake.
2719. TOOTHED WHEELS, &c., H. Shaw, Sheffield.
2720. WATER METERS, H. Frost, Manchester.
2721. STEAM BOILERS, E. Binns, Halifax.
2722. DEVICES for INDICATING SPEED, &c., R. P. Sellon, Surbiton.
2723. INDEXING of BOOKS, J. H. Johnson.—(*H. A. de Silvera, New York, U.S.*)
2724. CONVERTING RECIPROCATING MOTION into ROTARY MOTION, W. R. Lake.—(*F. Zassenhaus, Cleve.*)

1*st June*, 1883.

2725. FLOATING VESSELS, W. Johnston, Liverpool.
2726. SAFETY CORN CUTTER, H. W. Sharpin, Bedford.
2727. DISCHARGING NIGHT SOIL, A. M. Clark.—(*La Compagnie Générale de Salubrité, Paris.*)
2728. LADIES' HAT RESTS, A. Buckler, Coventry.
2729. STEAM ENGINES, W. C. Nicholson and J. Dixon, Kingston-upon-Hull.
2730. SHOT, G. Lampen, Gateshead-on-Tyne.
2731. MOTOR, R. Anderson, Bermondsey.
2732. STEAM BOILERS, E. H. Nicholson and W. Mather, Newark-upon-Trent.
2733. WATER-CLOSETS, J. Smith, Blackburn.
2734. PURIFYING ALKALINE SOLUTIONS, T. Glover, Runcorn.
2735. POTTERY KILN, J. Broadhurst, Fenton.
2736. SURGICAL FABRICS, S. Gamgee, Birmingham.
2737. RAILWAY VEHICLES, W. R. Lake.—(*J. W. H. Hullett, Port Augusta.*)
2738. COAL STAITH, G. Taylor, Penarth.
2739. GENERATING ELECTRIC ENERGY, A. J. Boult.—(*B. Faquant, Springfield, U.S.*)
2740. BOOTS, &c., W. P. Thompson.—(*W. Rogers, U.S.*)
2741. ELECTRO-MAGNETIC ENGINES, &c., R. W. M. Fraser.—(*J. R. Fraser, Gibraltar.*)

2*nd June*, 1883.

2742. TOOTHED WHEELS, J. Whittaker, Oldham.
2743. ELECTRIC ARC LAMPS, F. L. Willard, London.
2744. WOOD SCREWS, F. C. Glaser.—(*H. Boesner and F. Baumgarten, Germany.*)
2745. REMOVING INCRUSTATION from VESSELS, R. de Martino, Milan.
2746. LUBRICATOR, J. Imray.—(*H. Zweiffel, Kalk.*)
2747. PREVENTING INCRUSTATION in STEAM BOILERS, S. Lattuada, Milan.
2748. TREATING ORES, P. C. Bunn, Norwich.
2749. SHEET DELIVERY APPARATUS, W. Conquest.—(*Messrs. R. Hoe and Company, New York, U.S.*)
2750. REFINED SUGAR, J. Allen, Stepney.
2751. CUTTING SLATE ROLLS, O. Thomas, Bangor, and R. G. Thomas, Menai Bridge.
2752. STEAM ENGINES, W. Watson, Leeds.
2753. FIRING GUNPOWDER, C. W. Curtis, London.
2754. COPPER PYRITES, S. Pitt.—(*A. Gray, Edinburgh*)
2755. CONSTRUCTING ROADS, H. F. Williams, London.
2756. GLASS SYRINGES, E. C. Williams, London.

4*th June*, 1883.

2757. MOULDING METALS, S. E. Seanor, J. Hill, and J. Butler, Yorkshire.
2758. CAR COUPLERS, E. T. Hughes—(*G. A. Cage, R. F. Shreuder, and B. F. Read, Minvea, U.S.*)
2759. ENABLING OBSERVERS to READ THERMOMETERS, &c., J. Enright, London.
2760. FLUID ISINGLASS, L. A. Groth.—(*C. A. Sahlström, Jönköping.*)
2761. COMBING MACHINES, E. de Pass.—(*J. Imbs, Paris.*)
2762. SAILS for SHIPS, J. Capper, Liverpool.
2763. GENERATING, &c., ELECTRICITY, W. H. Scott, Wimbledon.
2764. PLAITING MACHINES, J. and R. J. Foot, London.
2765. FIREPLACES, P. Jensen.—(*F. von Callenberg and E. Fischer, Teplitz.*)
2766. REVOLVING BACK COLLARS, &c., E. Partridge, Smethwick.
2767. TREATING COAL, H. Symons, Totnes.
2768. GENERATING ELECTRIC CURRENTS, H. H. Lake.—(*R. E. Ball, New York, U.S.*)
2769. ELECTRIC LAMPS, W. Lake.—(*C. Menges, Hague.*)
2770. ELECTRIC-MOTORS, J. Imray.—(*H. T. Hillischer, Vienna.*)
2771. LIGNEOUS COMPOUNDS, C. D. Abel.—(*B. Harrass, Germany.*)
2772. SHIRTS, G. Charlton, Newcastle-on-Tyne.

Inventions Protected for Six Months on Deposit of Complete Specifications.

2651. LAYING ELECTRICAL CONDUCTING WIRES in the GROUND, H. J. Allison, London.—A communication from J. Greives and J. H. Bless, Paterson, U.S.—29*th May*, 1883.
2700. BANJOS, &c., W. R. Lake, London.—A communication from H. McCord, St. Louis, U.S.—30*th May*, 1883.
2715. WEDGE-SHAPED AIR BALLOON, G. Wellner, Brünn.—31*st May*, 1883.

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

2179. HOLLOW GLASS REFLECTORS, A. Specht, Hamburg.—28*th May*, 1880.
2182. FACILITATING TORPEDO BOATS, W. R. Lake, London.—28*th May*, 1880.
2183. RAILWAY SIGNALLING APPARATUS, C. E. Spagnoletti, London.—28*th May*, 1880.
2184. BANKERS' CHEQUES, A. A. Nesbit, London.—28*th May*, 1880.
2189. PRESERVING MEAT, W. C. Marshall, New York.—29*th May*, 1880.
2204. CHROMATIC PRINTING MACHINES, W. R. Lake, London.—29*th May*, 1880.
2203. WATER-CLOSETS, W. R. Lake, London.—29*th May*, 1880.
2230. LOOMS for WEAVING, J. H. Brierley, London.—1*st June*, 1880.
2233. RULES, &c., L. Appleton, London.—1*st June*, 1880.
2392. MARINERS' COMPASS, D. McGregor, Liverpool.—12*th June*, 1880.
2229. LIGHTING GAS, C. L. Clarke and J. Leigh, Manchester.—1*st June*, 1880.
2247. MANUFACTURING FELT, W. Bywater, Leeds.—2*nd June*, 1880.
2248. SIZING YARNS, W. Bywater, Leeds.—2*nd June*, 1880.
2493. KEY for RAILWAY CHAIRS, J. Gillings, Great Yarmouth.—15*th June*, 1876.
2552. KNITTING MACHINERY, S. Lowe and J. W. Lamb, Nottingham.—23*rd June*, 1880.
2222. KILNS for BURNING BRICKS, J. P. Cramp, Northampton.—1*st June*, 1880.
2280. INCUBATING APPARATUS, M. Arnold, Acton.—4*th June*, 1880.
2288. WATER PIPE JOINTS, J. Robbins, London.—5*th June*, 1880.
2418. TRANSMITTERS, R. M. Lockwood and S. H. Bartlett, New York.—15*th June*, 1880.
2419. TELEPHONE RECEIVERS, R. M. Lockwood and S. H. Bartlett, New York.—15*th June*, 1880.
2253. INLAID ARTICLES, G. Hirst, Whitby.—2*nd June*, 1880.
2298. STEERING SHIPS, &c, T. B. Heathorn, London.—7*th June*, 1880.

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

2254. PACKING for STUFFING BOXES, A. Beldam, London.—29*th May*, 1876.
2320. TOILET SERVICES, J. Vernon, Scotland.—1*st June*, 1876.
2301. WOOD PAVING, C. H. Green, New York—31*st May*, 1876.
2352. INTERLOCKING RAILWAY POINTS, &c., F. W. Webb, Crewe.—6*th June*, 1876.
2363. RAILWAY CARRIAGE LAMP GLASSES, H. Defries, London.—6*th June*, 1876.
2380. DRYING ANIMAL SUBSTANCES, H. S. Firman, London.—7*th June*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 22*nd June*, 1883.)

20. BOOTS and SHOES, H. H. Lake, London.—A communication from E. H. Buckley.—1*st January*, 1883.
309. FACTORY CHIMNEY SHAFTS, S. Hart, Hull.—18*th January*, 1883.
426. PRESERVING MILK, E. A. Brydges, Upton.—A communication from E. Scherff.—26*th January*, 1883.
430. STRINGING and TUNING PIANOS, C. F. Southack, London.—26*th January*, 1883.
442. COOKING FOOD, A. F. Link, London.—A communication from F. Desplas.—27*th January*, 1883.
456. KILNS for DRYING MALT, &c., P. Norton, Dublin.—27*th January*, 1883.
473. PORCELAIN FIRE-CLAY BATHS, J. Hall, Stourbridge.—29*th January*, 1883.
476. LOOMS for WEAVING, T. Lonsdale, Blackburn.—29*th January*, 1883.
478. ROPE DRIVING and HAULAGE, M. Smith, Halifax.—29*th January*, 1883.
481. HOISTING STONE, &c., R. Stone, New York.—29*th January*, 1883.
489. HEATING and COOKING STOVES, J. A. B. Bennett, King's Heath, J. Herd and B. P. Walker, Edgbaston.—30*th January*, 1883.
505. ATTACHMENTS for BRACKETS, &c., J. H. Norrington, Harlesden.—30*th January*, 1883.
511. RADIATORS, L. W. Leeds, London.—30*th January*, 1883.
520. ELECTRIC ARC LAMPS, A. Kryszat, Moscow.—31*st January*, 1883.
523. FOLDING BEDSTEADS, A. Hodson, London.—31*st January*, 1883.
527. SHUTTLES for SEWING MACHINES, H. J. Haddan, London.—A communication from E. Capitaine.—31*st January*, 1883.
550. SPRING HASP or CLIP, C. Mohr, Birmingham.—1*st February*, 1883.
558. MARINE BOILERS, C. H. Ziese, Elbing.—1*st February*, 1883.
573. SHARPENING PICKS, &c., R. Walton and F. A. Stansfield, Rawtenstall.—2*nd February*, 1883.
582. COUPLING for CHAINS, &c., J. H. Vidal, Sunderland.—2*nd February*, 1883.
585. STAMPING, &c., CIGARETTE PAPERS, W. H. Beck, London.—Com. from E. Abadie.—2*nd February*, 1883.
601. INDICATORS for ENGINES, A. Budenberg, Manchester.—A communication from C. F. Budenberg.—3*rd February*, 1883.
602. HOLDING NECKTIES in POSITION, E. C. Wise, Belvedere.—3*rd February*, 1883.
623. REGULATING, &c., CURRENTS of ELECTRICITY, P. Cardew, Chatham.—5*th February*, 1883.
653. SPINNING WOOL, J. T. Nelson, Leeds.—6*th February*, 1883.
824. EXTENSIBLE FIRE-ESCAPE LADDERS, A. M. Clark, London.—Com. from D. Hayes.—14*th February*, 1883.
842. WORKING GRABS, BUCKETS, &c., J. H. Wild, Leeds.—15*th February*, 1883.
867. GENERATING and UTILISING ELECTRICITY, F. M. Newton, Belfast.—16*th February*, 1883.
967. EXTRACTING SUGAR from MOLASSES, &c., C. Steffen, Vienna.—22*nd February*, 1883.
978. EFFECTING ILLUMINATION by LIQUID HYDROCARBONS, C. D. Abel, London.—A communication from J. Pintsch.—22*nd February*, 1883.
1018. DAMPING FABRICS, J. B. Jackson and G. Bentley, Bury.—24*th February*, 1883.
1403. TELEPHONIC APPARATUS, W. Moseley, London.—16*th March*, 1883.
2166. LUBRICATORS, C. H. Andrew, Stockport.—23*th April*, 1883.
2556. SEPARATING, FEEDING, &c., SHOE-LACE STUDS, H. H. Lake, London.—A communication from W. C. Bray.—22*nd May*, 1883.

(*Last day for filing opposition*, 26*th June*, 1883.)

496. GRADUAL REDUCTION of GRAIN, W. P. Thompson, Liverpool.—A communication from W. D. Gray and E. P. Allis.—30*th January*, 1883.
506. OPERATING PROPELLING APPLIANCES, &c., E. P. Alexander, London.—A communication from J. Frazier.—30*th January*, 1883.
518. AERIAL NAVIGATION, W. R. Lake, London.—A com. from E. F. Falconnet.—31*st January*, 1883.
519. MANUFACTURING GAS from OILS, A. Jay and C. Hook, Kingswood Hill.—31*st January*, 1883.
525. EXHIBITING GOODS, F. McIlvenna, Manchester.—31*st January*, 1883.
539. DRIVING VEHICLES by ELECTRICITY, &c., M. R. Ward, London.—31*st January*, 1883.
543. EMBOSSING PLATES, D. Appleton, Manchester.—1*st February*, 1883.
551. ARTIFICIAL INDIA-RUBBER and GUTTA-PERCHA, W. Harrison, London.—1*st February*, 1883.
553. OBTAINING PRODUCTS from COAL, &c., H. Pattinson, jun., Felling.—1*st February*, 1883.
555. ELECTRICAL CONDUCTORS, J. Imray, London.—A communication from the Société Anonyme des Cables Electriques.—1*st February*, 1883.
576. WINDOW SASHES, D. F. W. Quale, Isle of Man.—2*nd February*, 1883.
579. FLOATS of PADDLE-WHEELS, J. Stewart, London.—2*nd February*, 1883.
598. GALVANIC BATTERIES, H. Thame, London.—3*rd February*, 1883.
625. SUBSTITUTE for LEATHER, &c., W. Wise, London.—A com. from E. Bauer.—5*th February*, 1883.
697. ETCHING UPON GLASS, J. G. Sowerby, Gateshead-on-Tyne.—8*th February*, 1883.
708. STEERING GEAR for SHIPS, G. D. Davis, London.—9*th February*, 1883.
725. LAMPS, T. E. Bladon, Birmingham.—9*th February*, 1883.
728. HAND RAKES, W. R. Lake, London.—A communication from T. Carlsson.—9*th February*, 1883.
750. WHITE PIGMENT, T. Griffiths, Oxton.—10*th February*, 1883.
756. GUN CARRIAGES, A. Noble, Newcastle-upon-Tyne.—10*th February*, 1883.
757. REDUCING GRAIN, C. Pieper, Berlin.—A communication from A. C. Nagel, R. H. Kaemp, and A. Linnenbrügge.—12*th February*, 1883.
758. PRESSING GLASS, J. G. Sowerby, Gateshead-on-Tyne.—12*th February*, 1883.
790. CORRUGATED BOX IRONS, J. Gautherin, Paris.—13*th February*, 1883.
801. SEWING MACHINES, W. Morgan-Brown, London.—Com. from O. R. van Vechten.—14*th February*, 1883.
1087. DISTILLATION of COAL, &c., J. Barrow, Clayton.—28*th February*, 1883.
1131. BALANCING, &c., WINDOW SASHES, J. B. Adams and J. Telford.—2*nd March*, 1883.
1170. STITCHING BOOKS, G. W. von Nawrocki, Berlin.—Com. from G. Haunhorst.—5*th March*, 1883.
1422. CURE for FOOT-AND-MOUTH DISEASE, G. Jeanes, London.—17*th March*, 1883.
1600. GLOVE FASTENINGS, F. J. Martin, London.—29*th March*, 1883.
2053. STEAM GENERATORS, H. F. Phillips, London.—23*rd April*, 1883.
2155. BALING PRESSES, J. Watson, London.—28*th April*, 1883.
2193. RAILROAD BRAKE APPARATUS, B. Mills, London.—A communication from D. Torrey.—1*st May*, 1883.
2194. RAILROAD BRAKE APPARATUS, B. Mills, London.—A communication from D. Torrey.—1*st May*, 1883.
2201. KNITTING MACHINES, J. Higham, Newton Heath.—1*st May*, 1883.
2202. UMBRELLA FRAMES, J. Willis, Bournemoth.—1*st May*, 1883.
2217. DETERMINING the RATE of WATER CONSUMPTION, H. E. Newton, London.—A communication from B. Church.—1*st May*, 1883.
2270. ACTIONS of PIANOFORTES, J. Herrburger, Paris.—4*th May*, 1883.
2274. PROPELLING SEA-GOING VESSELS, H. Gerner, New York.—4*th May*, 1883.
2275. WATER-WHEELS, G. W. von Nawrocki, Berlin.—A communication from H. Baumotte and R. Noggerath.—4*th May*, 1883.
2616. CORSET, W. R. Lake, London.—A communication from I. Strouse.—25*th May*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 1*st June*, 1883.)

5767. SECONDARY BATTERIES, W. A. Barlow, London.—4*th December*, 1882.
5777. ATTACHMENTS for PERAMBULATORS, A. Lloyd, London.—5*th December*, 1882.
5780. CORRUGATING METAL SHEETS, G. M. Edwards, London.—5*th December*, 1882.
5781. SUSPENDING SWING LOOKING-GLASSES, &c., G. Crofts and G. F. Assinder, Birmingham.—5*th December*, 1882.
5782. GAS ENGINES, W. Watson, Leeds.—5*th December*, 1882.
5803. DRAW-OFF APPARATUS, T. Collingwood, London.—5*th December*, 1882.
5834. PIPE COUPLINGS, D. Drummond, Lenzie, N.B.—7*th December*, 1882.
5838. PANELS, NAME-PLATES, &c., C. L. H. Lammers, Gosforth.—7*th December*, 1882.
5844. SUSPENDED LIGHTS, J. J. Royle, Manchester.—7*th December*, 1882.
5847. INDICATING and RECORDING TIME, C. H. and C. W. Thompson. London.—7*th December*, 1882.
5849. CONNECTING DRAUGHT ANIMALS to VEHICLES, &c., J. Rexford, Edmonton.—7*th December*, 1882.
5965. SLIDE VALVES, C. Pieper, Berlin.—14*th December*, 1882.
427. MANUFACTURE of FIBROUS MATERIAL, C. Weygang, London.—26*th January*, 1883.
432. WEFT FORKS and HOLDERS, W. B. White, Colne.—26*th January*, 1883.
963. GUARD for CARVING FORKS, A. M. Clark, London.—21*st February*, 1883.
1144. TREATING SEWAGE, &c., W. C. Sillar, Blackheath, and J. W. Slater, London.—3*rd March*, 1883.
1433. VENTILATED TAP, T. Peacock, London, and J. S. Sworder, Loughton.—19*th March*, 1883.

(*List of Letters Patent which passed the Great Seal on the* 5*th June*, 1883.)

5804. CRUET FRAMES, J. F. Homer, Birmingham.—5*th December*, 1882.
5822. BOTTLES and STOPPERS, J. T. Creasy, London.—6*th December*, 1882.
5839. LOADING SILK, &c., G. W. von Nawrocki, Berlin.—7*th December*, 1882.
5840. SEWING MACHINE, T. J. Denne, Red Hill.—7*th December*, 1882.
5841. REDUCING FRICTION between WATER and SUBMERGED BODIES, F. H. F. Engel, Hamburg.—7*th December*, 1882.
5854. METALLIC ALLOYS, W. Keep, Cornwall.—8*th December*, 1882.
5860. STAYS or CORSETS, W. H. Symington, Market Harborough.—8*th December*, 1882.
5862. BUCKET DREDGERS, G. Klug, Hamburg.—8*th December*, 1882.
5863. WATCH or CLOCK, J. Pallweber, Salzburg.—8*th December*, 1882.
5864. CAOUTCHOUC, &c., GUMS, W. C. Horne, Old Charlton.—8*th December*, 1882.
5869. BEVERAGES, J. Armstrong, London.—8*th December*, 1882.
5880. CONSUMING SMOKE, &c., H. C. Paterson, Glasgow.—9*th December*, 1882.
4891. POCKET KNIVES, A. J. Boult, London.—9*th December*, 1882.
5893. BILLIARD CLOTHS, J. and G. E. Stead, Leeds.—9*th December*, 1882.
5903. CANS or VESSELS, T. S. Marriage, Reigate.—11*th December*, 1882.
5908. TOBACCO PIPES and CLEANERS, A. Barr, Glasgow.—11*th December*, 1882.
5917. PLANING and MILLING MACHINES, W. F. Smith and A. Coventry, Salford.—12*th December*, 1882.
5926. APPLYING ELECTRIC CURRENTS to ORGANIC BODIES, H. Haug, Westphalia, and A. Wienand, Baden.—12*th December*, 1882.
5934. SAWING WOOD, W. R. Lake, London.—12*th December*, 1882.
5969. VALVES, W. Hargreaves and W. Inglis, Bolton.—14*th December*, 1882.
5974. LOOMS for WEAVING, D. Eastwood, Luddenden Foot.—14*th December*, 1882.
5977. GALVANIC BATTERIES, J. Rapieff, London.—14*th December*, 1882.
6012. EXCAVATING MACHINERY, J. Imray, London.—16*th December*, 1882.
6044. SPINNING FIBRES, E. Tweedale, Accrington.—18*th December*, 1882.
6086. BANJOS, &c., W. R. Lake, London.—20*th December*, 1882.
6092. VESSELS for PRESERVING LIQUIDS, W. R. Lake, London.—20*th December*, 1882.
6124. COLOUR BOXES, T. Foxall, London.—22*nd December*, 1882.
6126. WARMING BUILDINGS, E. Hopgood, Ryde, and E. Jenner, London.—22*nd December*, 1882.
6131. METALLISED GLASS, &c., A. M. Clark, London.—22*nd December*, 1882.
6176. GLUCOSE SYRUP and GRAPE SUGAR, H. Haddan, London.—27*th December*, 1882.
208. COLOUR BOXES, T. Foxall, London.—13*th January*, 1883.
785. FEED-WATER PURIFIERS for BOILERS, W. Thompson, Liverpool.—13*th February*, 1883.
833. BEATING, &c., CARPETS, C. Hinksman, London.—15*th February*, 1883.
1255. ELECTRIC LAMPS and FITTINGS, J. G. Statter, Wakefield.—8*th March*, 1883.
1270. LIFE-SAVING APPARATUS, R. E. Pinhey, Oxton.—9*th March*, 1883.
1304. DYNAMO and MAGNETO-ELECTRIC MACHINES, C. W. Vincent, London.—12*th March*, 1883.
1320. GENERATING and CONDENSING STEAM, J. Hodgart, Paisley.—13*th March*, 1883.
1763. HORSESHOE BLANK ROLLS, H. J. Haddan, London.—7*th April*, 1883.

List of Specifications published during the week ending June 2nd, 1883.

737*, 4d.; 1749*, 4d.; 1984*, 4d.; 2238*, 4d.; 2369, 4d.; 4572, 6d.; 4691, 6d.; 4714, 6d.; 4718, 6d; 4722, 6d; 4725, 2d; 4735, 4d.; 4746, 6d.; 4749, 2d.; 4753, 6d.; 4754, 2d; 4755, 4d.; 4761, 2d.; 4762, 8d; 4763, 2d.; 4764, 2d.; 4765, 6d.; 4767, 2d.; 4768, 6d.; 4771, 6d; 4772, 2d.; 4773, 2d.; 4776, 6d.; 4777, 6d.; 4778, 6d.; 4780, 6d.; 4782, 8d.; 4783, 6d.; 4784, 2d.; 4786, 2d.; 4787, 6d.; 4789, 4d.; 4790, 8d.; 4791, 6d.; 4792, 4d.; 4793, 6d.; 4794, 6d.; 4796, 2d.; 4797, 6d.; 4798, 4d.; 4799, 2d.; 4800, 2d; 4801, 2d.; 4803, 6d.; 4805, 6d.; 4805, 6d.; 4807, 6d.; 4808, 2d.; 4809, 4d.; 4810, 4d.; 4811, 6d.; 4812, 6d.; 4813, 10d.; 4814, 6d.; 4815, 8d.; 4816, 2d.; 4818, 2d.; 4819, 6d.; 4820, 2d; 4822, 8d.; 4823, 6d.; 4825, 2d.; 4826, 4d; 4828, 2d.; 4829, 2d.; 4830, 6d.; 4831, 8d.; 4833, 6d.; 4834, 4d.; 4836, 2d.; 4837, 6d.; 4838, 6d; 4839, 2d.; 4840, 2d.; 4842, 2d.; 4843, 6d.; 4844, 6d.; 4846, 4d.; 4847, 6d.; 4848, 6d.; 4849, 2d.; 4851, 4d.; 4852, 2d.; 4853, 2d.; 4854, 8d.; 4855, 6d.; 4856, 2d.; 4858, 2d.; 4859, 6d.; 4860, 2d.; 4861, 2d.; 4862, 2d.; 4863, 8d.; 4864, 6d.; 4865, 2d.; 4866, 2d.; 4867, 6d.; 4868, 6d.; 4869, 6d.; 4870, 6d.; 4871, 6d.; 4872, 6d.; 4873, 2d.; 4874, 4d.; 4875, 6d.; 4876, 6d.; 4877, 6d; 4878, 2d.; 4879, 2d.; 4881, 6d; 4882, 6d.; 4883, 6d.; 4884, 6d.; 4885, 2d.; 4886, 2d.; 4887, 2d.; 4883, 2d.; 4889, 4d.; 4891, 6d.; 4892, 6d.; 4893, 2d.; 4894, 2d; 4895, 6d.; 4896, 2d.; 4898, 6d; 4899, 6d.; 4900, 2d.; 4901, 6d.; 4903, 2d.; 4904, 6d.; 4905, 6d.; 4907, 6d.; 4909, 4d.; 4912, 6d.; 4914, 6d.; 4915, 6d.; 4918, 6d; 4919, 8d.; 4920, 6d.; 4921, 2d.; 4922, 6d.; 4924, 6d.; 4925, 2d.; 4926, 6d.; 4927, 4d.; 4928, 2d.; 4929, 8d.; 4931, 4d.; 4932, 6d.; 4933, 4d.; 4934, 2d.; 4935, 2d.; 4936, 2d.; 4937, 2d.; 4938, 2d.; 4939, 10d.; 4940, 4d; 4941, 2d.; 4943, 4d; 4944, 2d.; 4945, 6d.; 4946, 2d.; 4947, 6d.; 4948, 6d.; 4949, 4d.; 4951, 6d.; 4952, 2d.; 4954, 4d.; 4956, 6d.; 4958, 6d.; 4960, 2d.; 4962, 4d.; 4963, 8d.; 4964, 2d.; 4965, 2d.; 4969, 6d.; 4970, 2d.; 4972, 6d.; 4974, 8d.; 4975, 4d.; 4976, 2d.; 4977, 8d.; 4980, 4d.; 4981, 6d.; 4982, 6d.; 4983, 2d.; 4984, 2d.; 4985, 2d; 4998, 6d.; 4999, 6d.; 5000, 6d.; 5014, 4d.; 5022, 6d.; 5036, 6d.; 5044, 4d.; 5052, 6d.; 5129, 4d.; 5168, 6d.; 5297, 6d.; 5420, 6d.; 5467, 4d.; 5546, 6d.; 5835, 4d.; 516, 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.*

4943. WRITING SLATES, *J. and W. Williams, North Wales.*—17*th October*, 1882. 4*d.*

To strengthen the frame a groove is formed along the top and bottom edge, and in it a wire is placed, the two ends then being passed into diagonal holes across the corners, and the extreme ends turned down into the wood.

2369. BULGE BARREL MACHINES, *E. G. Brewer, London.*—19*th May*, 1882.—(*A communication from R. Hinchliffe, Hamilton, Canada.*)—(*Not proceeded with.*) 4*d.*

This relates to the general construction of these machines so as to render them more compact, convenient, and durable.

4572. MANUFACTURE OF GAS, *S. Chandler, Newington-causeway.*—26*th September*, 1882. 6*d.*

This relates more particularly to improvements in apparatus for scrubbing or washing gas, such as that described in patent No. 4928, A.D. 1877, in which segments of iron are arranged in clusters, with spaces for the passage of gas. The two outside plates are joined by a strap, so as to form a basket of just the width to contain a given number of sheets, and having

a support at bottom to receive the sheets. Other cross straps secure the sheets at top. The iron segments being smaller at the bottom than at top can readily be removed for cleaning.

4691. GENERATION AND DISTRIBUTION OF ELECTRIC ENERGY, *F. C. Phillips, Cannon-street.—2nd October*, 1882. 6*d.*

When generators are feeding a system they will, if self-regulating, automatically adapt themselves to the demands of the system. But it is not economical to work machines greatly below their full capacity; the inventor therefore provides an apparatus which cuts the machines successively out of circuit as the demand decreases, and puts them into it again when more current is required. The apparatus consists of a movable contact piece inserted between the terminal of the machine and the main, and an electro-magnet in the main circuit having a fixed contact piece, against which the movable one is held. The movable contact piece is loaded in opposition to the attraction of the magnet, and will fall when the current decreases.

4714. MANUFACTURE OF ALKALIES, *E. W. Parnell, Widnes, and J. Simpson, Liverpool.—4th October*, 1882. 6*d.*

The inventors claim, First, the method of treating caustic salts with steam, while subjecting them to mechanical pressure; Secondly, the furnace for the purpose of manufacturing soda ash from caustic salts from which the liquor has been removed.

4718. ELECTRIC RAILWAYS, *J. Hopkinson, F.R.S., Westminster-chambers.—4th October*, 1882. 6*d.*

The object of this invention is to prevent leakage of current on electric railways. The rail or rails are divided into lengths which are insulated from each other. The conductor is carried along the track and insulated from it, and branches are led to each length. In each branch a switch is provided by which communication with the conductor is maintained, whilst sufficient current flows by an electro-magnet through which the current passes. Connection is started by making use of the rise of potential caused by the running car coming on the section. This is done by connecting the two rails of the pair through a high resistance electro-magnet, which serves to make the contact for the main circuit, which contact is then maintained by the current which flows from the main. The circuit of the high resistance magnet is broken when the current from the main conductor flows, by means of a third electro-magnet. When the car leaves the section of rail the current fails, and the section becomes disconnected from the main conductor; subsequently the high resistance circuit is made where it was broken when the current began to flow, ready for the next car which may come upon the section. The functions of the three electro-magnets may be accomplished by a single one suitably wound.

4722. MACHINERY FOR TREATING FIBROUS PLANTS AND TEXTILE MATERIALS, *E. G. Brewer, London.—4th October*, 1882.—(*A communication from La Compagnie Générale des Fibres Cosmos, Brussels.*) 6*d.*

The inventors claim, First, the successive and several operations consisting in the employment of alkalies, earthy alkalies, manures, and alkaline sulphurets, employed in varying doses either pure or mixed, the whole completed by a prolonged boiling in a ley; Secondly, the employment of cylinders or rollers in machinery provided with some elastic material so acting that the fibres are not injured, and assisted in separating the one from the other in combination with a special arrangement of a rotary and to-and-fro alternate rectilinear motion.

4725. BICYCLE SEATS OR SADDLES, *W. R. Lake, London.—4th October*, 1882.—(*A communication from J. L. Wilson, Waltham.*)—(*Not proceeded with.*) 2*d.*

This relates to the mode of attaching the seat or saddle to the bicycle.

4735. SECONDARY BATTERIES, *C. T. Kingzett, Tottenham.—5th October*, 1882. 4*d.*

This relates to the use of caustic potash or soda, or the sulphate of sodium in solution, in place of the dilute sulphuric acid hitherto usually employed as the electrolyte in secondary batteries. By this means the inventor is enabled to use iron in the construction of the supports of his plates, without the said supports being attached. The plates he makes as described in his patent No. 3802, 9th August, 1882.

4746. APPARATUS FOR STARTING, STOPPING, AND REVERSING ROTARY MOTION, *C. D. Abel, London.—5th October*, 1882.—(*A communication from F. Reuleaux, Berlin.*) 6*d.*

The invention consists mainly in combining with the shaft to be driven a continuously-revolving driving wheel, loose thereon, or two such wheels revolving in opposite directions, a clutch sliding upon but carried round by the shaft, and screw gear carried by the shaft for putting the clutch in or out of gear with the wheel or wheels, the parts being so arranged that by turning the screw gear in one direction the shaft is made to revolve in one direction, while by turning it in the contrary direction the motion of the shaft is reversed, and by stopping the motion of the screw gear the motion of the shaft is also stopped.

4749. ZINC PLATES OR BLOCKS FOR PRINTING, &c., *J. H. Johnson, London.—5th October*, 1882.—(*A communication from J. A. Silvestre, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to improvements in the preparation of zinc plates or blocks for printing, gilding, decorating, and other purposes, and it consists in plating or covering the surface of such plates or blocks with a coating of nickel after the design or drawing has been engraved on the said plates.

4753. AIR COMPRESSING AND WATER PUMPS FOR DIVING APPARATUS, &c., *J. H. Davis, London.—6th October*, 1882. 6*d.*

This relates partly to improvements for guiding the outer ends of the pump piston-rods, whereby extreme simplicity and economy of construction is obtained; and partly to an improved arrangement of the valve boxes and valves, whereby access to the latter is materially facilitated, and they can be easily removed and replaced.

4754. CENTRE CHANGE VALVES OF GAS PURIFIERS, *R. Blakeborough, Brighouse.—6th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is the construction of the valves, so that the whole of the purifiers connected therewith may be in use and operation, or that any one or more of such purifiers may be shut off or disconnected at will.

4755. GAS ENGINES, *E. G. Wastfield, Liverpool.—6th October*, 1882.—(*Not proceeded with.*) 4*d.*

This relates to several improvements in the general construction of the engine.

4761. MACHINERY AND APPARATUS TO PREVENT WASTE, *F. and A. Craven and W. Allan, Bradford.* 6*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to fitting to spinning frames an apparatus for stopping the progress of the roving towards the delivery rollers on the slackening or breakage of the spun thread, preventing waste, doubles, snarls, and roller lapping.

4762. REVOLVING LAMPS FOR LIGHTHOUSES, &c., *J. Trotter, London.—6th October*, 1882.—(*A communication from L. F. Lindberg, Stockholm.*) 8*d.*

This consists in occulting apparatus set in motion by means of a combination of propellers, by the heat of the lamp flame.

4764. ELECTRICAL APPARATUS FOR THE PROPULSION OF BOATS, *A. Reckenzaun, Leytonstone.—6th October*, 1882.—(*Void.*) 2*d.*

This relates to means for reducing the speed of propellers when driven by dynamo machines.

4763 BURNERS FOR GAS FIRES, *F. R. Mosley, London.—6th October*, 1882.—(*Not proceeded with.*) 2*d.*

The burner consists of a flat case of iron of trilateral form, and made in two parts secured one above the other, their inner sides having channels which, when the two are put together, form passages for a mixture of gas and air from a pipe at the under part, near the junction of two sides, to an aperture near the other side of the case. The passages are arranged radially.

4765. BUSHING MATERIAL, &c., *W. R. Lake, London.—6th October*, 1882.—(*A communication from G. F. Lenter, New York.*) 6*d.*

This relates to a bearing for a shaft or spindle formed of a rough metallic shell or casting, having an internal cavity or cavities for receiving a bush or lining, which bush or lining is formed of a plastic anti-friction material, and is passed into the said cavity or cavities.

4767. APPARATUS FOR FACILITATING THE TAPPING OF BARRELS, &c., *H. D. English, Birmingham.—6th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the employment of an india-rubber flanged tube.

4768 APPARATUS FOR COVERING WIRE FOR ELECTRICAL PURPOSES, *J. J. C. Smith, College Point, New York.—7th October*, 1882. 6*d.*

This relates to means for covering wire so that a good joint shall be made and air excluded. Any suitable waterproof insulating compound in a plastic state is laid in a thin sheet on a woven or other fabric, and these are pressed together by calendering. Out of the sheet is than cut a long strip, sufficient to reach round the wire longitudinally, leaving a surplus for a joining flange. It is then drawn tightly round the wire, and the faces of the compound brought together with pressure, so that the rubber, or whatever it is, is inseparably united around the wire. The projecting flange is then cut off, after which the covering is vulcanised. The patent also relates to machinery for carrying the invention out.

4771. PRODUCTION OF THE ELECTRIC LIGHT, *O. G. Pritchard, Penge.—7th October*, 1882. 6*d.*

This relates to an arc lamp in which the upper carbon is fed by gravity subject to the retarding influence of a vacuum formed in the tube, comprising the carbon holder. The lower carbon is carried by guide rods attached to the armature of an electro-magnet in a shunt circuit, which armature also makes and breaks contact rapidly, whereby a reciprocating motion is imparted to the lower carbon in the direction of the upper one. The action of make and break between the carbons is very rapid, and the intermittence of the arc imperceptible.

4772. COMPOUND FOR DYEING, *W. E. Aykroyd, Bradford.—7th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to facilitate the dyeing of fibre and fabrics and to increase the lustre and improve the handle and appearance of silk fibre and fabrics, and it consists in adding to the dye bath a mixture of gelatine, albumen, and soap, by which an acid can be used with soap without decomposing it.

4773. GAS ENGINES, *E. S. Wastfield, Liverpool.—7th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the general construction.

4776. ORGANS, *T. Casson, Denbigh.—7th October*, 1882. 6*d.*

This relates to organs having besides the manual keyboards a set of pedals for bass and couplers for connecting them to and disconnecting them from the keys, and it consists in the combination with each set of manuals of a subsidiary coupling action, with a special slide, push, stop, pedal, or key, the movement of which brings into action the pedal organ, and also, if desired, the couplers in its own set, and throws out of action the pedal organs and couplers of the other sets.

4777. MECHANISM OR APPARATUS FOR ELECTRICAL COMMUNICATION ON RAILWAYS, *R. Tatham, Rochdale.—7th October*, 1882. 6*d.*

This relates to means and apparatus for affording electrical communication between trains on the same line of railway, or between trains and signal boxes, &c. The invention is carried out by means of an insulated rail laid between the ordinary rails, on which runs a contact wheel connected to the guard's van and telegraphic or telephonic apparatus therein. The rail is also in communication with signal boxes, &c. Earth is obtained by the ordinary rails or other means.

4778. TELEPHONES, *H. B. T. Strangeways, Temple.—7th October*, 1882. 6*d.*

This relates to means for increasing the strength of telephones. A small magnet is fixed to the diaphragm and surrounded with a small helix. It is arranged in juxtaposition to the large magnet of the telephone, round which is another helix. Instead of sending currents in opposite directions through these helices, as is done by some, the inventor causes a current to traverse both of them in one and the same direction, whereby he claims to obtain greater electrical effect and louder sounds than hitherto.

4780. ELECTRIC LAMPS, *S. F. Walker and F. G. Olliver, Cardiff.—7th October*, 1882. 6*d.*

This relates to improved means for regulating the feed of arc lamps by employing a rotating disc, with projections or depressions on its surface, operated by a motor, in combination with a lever connected with a clutch, which regulates the feed of the electrode, to which it is applied in proportion to the rate of consumption of both electrodes.

4782. ELEVATORS FOR TRANSSHIPPING OR ELEVATING GRAIN, &c., *W. S. Brice, Liverpool.—7th October*, 1882. 8*d.*

The inventor claims, First, a cradle or jib pivotted on a column or support, fixed to a floating or travelling base, to which cradle an elevator is pivotted or hung, so as to be capable of being stowed away so as to lie in said cradle without disconnecting the driving gear; Secondly, the elevator proper, capable of partial rotation in its axis, and of being raised or lowered while its pivot remains stationary, and its elevating action continues; Thirdly, also the arrangements for driving and delivering without impediment to its free descent in relation to the driving shaft.

4783. WINDOW SASHES, &c., *G. Hurdle, Southampton.—7th October*, 1882. 6*d.*

The object is to dispense with sash weights; and it consists in the use of racks gearing with a wheel containing a spring, which is wound up as the window is opened.

4784. CARDING ENGINES, *E. Edwards, London.—7th October*, 1882.—(*A communication from P. Poucin, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction of carding machinery so that two slivers may be obtained from the carding cylinder. Two doffing cylinders are arranged to revolve one above the other in contact with the main carding cylinder, the surface of the lower one being divided by grooves, so as to take part of the fibre from the cylinder by dividing the fibres into strips, and taking each alternate one, those left being removed by the upper cylinder.

4786. APPARATUS FOR PRODUCING LIMELIGHT, *E. G. Wood, London.—7th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to provide means whereby the lime cylinder may be protected against contact with air of low temperature, and whereby the particles of lime which would otherwise become diffused within the lantern are carried away through the ventilator of the lantern, and whereby the beating of erratic deflected flames against the condenser is prevented.

4787. MACHINES FOR MOULDING PIPES OR TUBES FROM PLASTIC MATERIAL, &c., *J. H. Johnson, London.—7th October*, 1882.—(*A communication from G. F. Lufbery, Paris.*) 6*d.*

This consists in the employment for feeding forward the material of two or more pairs of screws, engaging together and turning in cavities, into which the plastic material is introduced, the said screws acting conjointly to feed the said material into and force it through the moulding orifice.

4789 TYPEFOUNDING, &c., *A. J. Boult, London.—7th October*, 1882.—(*A communication from H. J. Kolk, C. A. J. Gursch, and C. H. J. Klemn, Berlin.*) 4*d.*

The object is to prevent the corrosion and deterioration of the copper matrices used in typefounding; and it consists in extracting from the molten type metal the impurities—pyrogenic matters and arsenic—which it contains whilst in the melting pot by the use of finely-divided iron, and at the same time use for the mould a metal which will bear a higher temperature of the type metal, whereby a part of the injurious matters will be partly burnt. The moulds are made from platinum, pure or alloyed with the platinic metals or with zirconia.

4790. VELOCIPEDES, *G. W. Quatremaine, Stratford-on-Avon.—7th October*, 1882. 8*d.*

The main object is to combine in the same machine the advantages of driving both driving wheels at once with either foot by means of treadles, which are disconnected with each other, and which may, when desired, be both depressed together.

4791. APPARATUS FOR PLAYING A NEW GAME OF SKILL, *E. Boizet, Paris.—7th October*, 1882.—(*Not proceeded with.*) 6*d.*

This consists in an apparatus for playing a new game, in which balls are projected for striking the lower ends of any number of suspended rods and oscillating the same.

4792 TREATMENT OF HIDES AND SKINS, *W. Maynard, New York.—7th October*, 1882. 4*d.*

This relates to improvements in the operations of "soaking," "liming," and "tanning" hides and skins, and consists essentially in the employment of sulphurous acid in a certain manner and proportions, and in certain of the operations in combination with other substances.

4793. MANUFACTURE OF ENVELOPES, &c., *E. Sturge, Walworth.—9th October*, 1882. 6*d.*

This relates to several improvements in the general construction of the machinery employed.

4794. FILTERING APPARATUS, *E. Edwards, London.—9th October*, 1882.—(*A communication from N. A. B. Chevallot, Paris.*) 6*d.*

The inventor claims the method of arranging cotton wool or other fibrous filtering material between two gratings. Also, in combination with such filtering apparatus, the employment of a strainer in the upper vessel.

4796. BURNERS, *Sir J. N. Douglass, Dulwich.—9th October*, 1882.—(*Not proceeded with.*) 2*d.*

The invention consists of an Argand ring or circular flame burner constructed similarly to that described in patent No. 84, dated 7th January, 1881, but preferably of not more than one ring or ring chamber for gas.

4797. STEAM AND OTHER FLUID PRESSURE ENGINES, *C. A. and R. C. Parsons and J. H. Kitson, Leeds.—9th October*, 1882. 6*d.*

This relates to four-cylinder engines of the kind described in patent No. 2344, dated 15th June, 1877, and of the modified kind provided with rotating slide valve described in patent No. 4266, dated 24th October, 1878. The improvements in engines of this type relate chiefly to the application thereto of an excentrically rotating slide valve; to the construction and arrangement of the pistons, cylinders, and framing of the engine; to means of packing and lubricating the joints and working parts, and arrangements for varying the cut-off in such engines, and for working them as compound engines.

4798. MACHINE FOR TOUSING OR OPENING HORSE-HAIR, *M. G. Daughters, Old Kent-road.—9th October*, 1882. 4*d.*

The machine has in its upper part two fluted rollers, through which the hair or fibre is fed. It passes from these rollers down between two revolving cylinders having a number of hook teeth projecting from them. These teeth are arranged in circular rows on each cylinder, so that the teeth of the one pass through the spaces between the teeth of the other. Below the gap of these cylinders are fixed combs which serve to draw or comb out the hair or fibre as it is carried past them by the teeth of the cylinders. Immediately below each cylinder is a set of rapidly revolving combs, each comb being mounted on a radial arm. These as they revolve, sweep the hair or fibre off the teeth of the cylinders, and discharge it at each end of the machine in a toused or open condition.

4799. MACHINES FOR CUTTING OUT CLOTH, &c., *J. M. Sellers, Keighley.—9th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to cut cloth or other materials to any desired pattern, such as clothes, shirts, or other articles it is desired to give shape before making up.

4800. APPARATUS FOR GOVERNING THE FLOW OF WATER UNDER PRESSURE, *G. Wightman, Retford.—9th October*, 1882.—(*Not proceeded with.*) 2*d.*

The apparatus either allows the water to enter with a flow sufficient to actuate the meter, or shut it off altogether, collecting into brief intermittent periods of full flow the water which usually dribbles through the meter without actuating the index. It also cuts off the water under high pressure from the service pipes and outlet fittings, except when considerable quantities of water are being drawn off, thus reducing the waste by leakage to a minimum.

4801. SPINNING MACHINERY, *C. G. Bracewell and Pilkington, Yorkshire.—9th October*, 1882.—(*Not proceeded with.*) 2*d.*

The improvements consist of an adjustable projection or overlap, outwardly applied in such manner as to be readily turned on or off a flange or rim, formed on the loose tube, whereby the said tube may be easily removed from or secured steadily in position on the fixed tube.

4803. GEARING FOR BICYCLES, TRICYCLES, &c., *W. Britain, jun., Hornsey-rise.—9th October*, 1882. 6*d.*

This consists in combining or arranging parts forming differential speed gearing for bicycles, tricycles, and similar vehicles adapted for use in altering the speed relatively to the driving and driven parts thereof at will.

4805. MANUFACTURE OF TERRY WEB, *J. Swann-Senior, Nottingham.—9th October*, 1882. 6*d.*

This relates to the manufacture of elastic fabrics with the face warps or back warps made to lap round or partly around the rubber threads of elastic terry web.

4806. HARVESTING MACHINES, *J. Hornsby, J. Innocent, and G. T. Rutter, Grantham.—9th October*, 1882. 6*d.*

The principal object is to prevent the animals working the sheaf binder treading on the sheaves that lay at the corners of the crop they are cutting.

4807. SELF-LEVELLING SLEEPING BERTHS FOR SHIPS, &c., *W. R. Lake, London.—9th October*, 1882.—(*A communication from J. H. Milligan, Boston, U.S.*) 6*d.*

A berth is pivotted or hung upon bearings at its sides in a frame that is also pivotted at its ends upon the framework of the vessel, or the partition of the state room, and the invention has for one of its objects to increase the strength and delicacy of action of the said bearings, the working parts of which are wholly enclosed and protected in the woodwork of the berth.

4808. SOLUTIONS FOR TREATMENT AND UTILISATION OF ISINGLASS FOR CLARIFYING BEER, &c , *C. Vaux, Doncaster.—9th October*, 1882. 2*d.*

This relates, First, to a solvent to be used for dissolving isinglass to enable it to be used as a clarifying agent; and, Secondly, to the use of a solution formed by dissolving isinglass in such solvent, as a clarifier. Quicklime and soda ash are boiled in water, and the isinglass dissolved in the solution.

4809. SECONDARY BATTERIES, *R. Tatham, Rochdale, and A Hollings, Salford.—10th October*, 1882. 4*d.*

This relates to the construction of plates for secondary batteries by mixing vegetable fibre with finely divided metal. According to one method, paper pulp is mixed moist with twelve times its volume of peroxide of lead for the positive element, and a similar quantity of suboxide of lead for the negative element, so that the mixture contains about 93 per cent. by volume of metallic agent. After mixing, the compound is spread on a thin lead or other plate on both sides, so as to be about ¼in. thick. The patent also describes processes for obtaining finely divided lead and oxide of lead.

4810. DYNAMO-ELECTRIC MACHINES, *R. E. B. Crompton, Queen Victoria-street, and G. Kapp, Chelmsford.—10th October*, 1882. 4*d.*

This relates to means for providing a constant electro-motive force at the terminals of dynamos, when there are extreme variations in the external resistance. One method of carrying the invention out is to take a dynamo having an armature resistance of, say, ·1 ohm, and wind on to its field magnets next to the core sufficient turns of No. 5 B.W.G. wire to give a resistance equal to that of the armature, or ·1 ohm, and couple these coils in series with the armature in the ordinary manner. Outside these coils is wound sufficient ·057in. wire to give a resistance of 20 ohms, or from that to 30 ohms. This second winding of fine wire is coupled up from brush to brush. This armature should be driven at such a speed as to give 65 volts, when the external resistance is infinite, and will be found to give that electro-motive force constantly with varying resistances.

4811. DOOR STOPS OR CHECKS, *A. J. Boult, London.—10th October*, 1882.—(*A communication from G. R. Elliott, J. M. Winslow, and T. E. Clary, Massachusetts, U.S.*) 6*d.*

This relates to door stops and devices for retaining the door in any position, and it consists in the use of a spring and piston combined with an outer spring, so that when opened the door closes automatically and without slamming. The locking devices consist of a lever stop and a toothed rack supporting the piston, and which is pivotted to the door jamb. An air cylinder serves as a cushion to prevent slamming.

4812. INCUBATOR, *T. Christy, Fenchurch-street.—10th October*, 1882. 6*d.*

An iron water tank is kept hot by a small boiler connected to it by pipes and heated by a lamp, the heat from such tank being radiated downwards on to the eggs in a drawer below. The bottom of the tank converges upwards and is pierced by an air shaft, fitted with a valve regulated by a thermostatic band subjected to the heat of the apparatus, so as to maintain a regular temperature. Moisture is supplied to the eggs from a water vessel beneath the drawer, from which it is drawn up by coarse canvas and absorbed by the entering air.

4813. LIGHTING BY GAS, *W. T. Sugg, Westminster.—10th October*, 1882. 10*d.*

This relates more particularly to apparatus for lighting by gas in which a high illuminating power is required. Two, three, or more argand burners, known as "Sugg's London argand burners," are placed concentrically one within the other. The gas issues from a steatite chamber at an almost inappreciable pressure. Each burner is connected by two or more tubes with a gas box fitted with regulators to regulate the flow of gas to the upper part, and below them and above the inlet a piece of flannel is placed to act as a filter. A dome directs the air required into the middle of and between the burner, and over it is a second perforated dome to direct air on to the outer flame near the top of the burner. A short glass chimney is used with a porcelain above it of smaller diameter.

4814. MOULDERS' NAILS AND CHAPLETS, *W. Motherwell, Glasgow.—10th October*, 1882. 6*d.*

This consists in striking the nail or stud in a die to form a bearing shoulder and a rivet part, by which the plate of the chaplet is rivetted to the nail or stud.

4815. TOOL AND CUTTERS FOR BORING TAPER HOLES, *J. G. Perkin and J. Scott, near Wakefield.—10th October*, 1882. 8*d.*

The object is to bore holes with the inner diameter larger than the outer diameter. A circular tool-box is mounted on a spindle, and is recessed to receive any number of cutters held therein by circular springs embracing them, all endway movement being prevented by retaining the tool-box in position by end plates on the spindle. The springs hold the cutters and allow to expand at one end to suit the required taper. To expand the cutters a screw has a taper piece at its upper end, which enters between the cutters when moved up.

4816. VOLTAIC BATTERIES, *E. J. Wimshurst, Anerley.—10th October*, 1882.—(*Not proceeded with.*) 2*d.*

Relates to a cheap carbon zinc battery, in which the plates can be lowered into the liquid according to the current required.

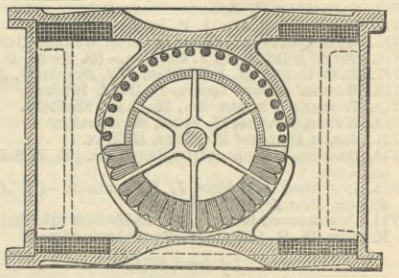
4818. REFRIGERATING ROOMS OR CHAMBERS FOR CURING AND PRESERVING PROVISIONS, *M. J. Power, Waterford.—10th October*, 1882.—(*Not proceeded with.*) 2*d.*

The top of the room is covered at top by an ice chamber with an iron floor on which the ice is placed, and the moisture which condenses on the underside of the floor and in the atmosphere is collected by means of an openwork covering made up of grooved zinc or corrugated iron, the parts of which overlap, leaving air passages.

4819. DYNAMO OR MAGNETO-ELECTRIC MACHINES, *W. R. Lake, London.—10th October*, 1882.—(*A communication from J. Wenstrom, Orebro, Sweden.*) 6*d.*

This relates to improvements, whereby the inventor is enabled to utilise the magnetism excited in dynamos more completely than has been done before. Instead of forming his electro-magnets of iron cores with wire

4819



wound round, he reverses this order, and winds his wire inside iron envelopes or frames. The armature is composed of an iron core with cylindrical or other channels cut in it, in which the wire is wound as shown in the illustration herewith.

4820. STOPPING LEAKS IN TUBES OR PIPES, *A. M. Clark, London.—10th October*, 1882.—(*A communication from W. F. Thompson, San Francisco.*)—(*Not proceeded with.*) 2*d.*

The object is to enable leaks in tubes of boilers or other pipes to be readily stopped without interfering with the draft, and it consists of a short tube with a wedge to expand it, such wedge being actuated by a lever connected to a screw rod, and used with a yoke to force it endwise of the short tube, and extend it after being placed in position.

4822. PRINTING MACHINES OR PRESSES, *J. E. Dawson, London Wall.—10th October*, 1882.—(*A communication from W. P. Kidder, Boston, U.S.*) 8*d.*

The formes of type or the platens are placed vertically instead of horizontally, so that less space is occupied than hitherto. The formes or platens are carried by a frame, the longest side of the chase—when type formes are employed—being horizontal. According to one arrangement two impression cylinders are arranged to roll across two formes of type, the cylinders being actuated by a crank and connecting-rod, and supported in a frame, the impression being adjusted by screws and wedge blocks. The cylinders can be moved and retained a short distance from the formes by excentrics. The forme rollers and distributing mechanism are connected to the frame and move with

the cylinders. The feed rolls and cutter are at the top of the machine. An oiled surface tympan sheet is provided for preventing the impression of one cylinder being blurred by the other during the feed.

4823. DRYING WOOL, &c., *D. P. Smith, Glasgow.*—11*th October*, 1882.—(*A communication from J. Scott, Cape of Good Hope.*) 6*d.*

A horizontal cylindrical chamber is fitted with a central shaft carrying screw blades, by means of which the wood or other material is caused to pass slowly from one end of the chamber to the other. Hot air is drawn through the chamber.

4825. EXTRACTING METALS FROM SILICIOUS, ALUMINOUS, AND OTHER SUBSTANCES, *J. B. Hagenbusch, Finsbury-circus.*—11*th October*, 1882.—(*Not proceeded with.*) 2*d.*

For obtaining precious metals from such substances they are pulverised and roasted with charcoal, after which they are thrown red-hot into water and washed clean. The substances are next dried and mixed with the following fluxes for smelting, viz.:—Soda ash, carbonate of soda, potash, or carbonate of potash, borax, or other suitable fluxes. The substances are then smelted, after which zinc and copper are added for the purpose of generating electricity, and so facilitate and complete the preparation of the metals.

4826. VAPORISERS, *P. Chapelain, Paris.*—11*th October*, 1882. 4*d.*

This relates to a vaporiser in the form of a revolver, by actuating the trigger of which an india-rubber ball is caused to draw in and expel the air necessary for distributing scented liquid in a spray from the muzzle.

4828. PROPELLING TRICYCLES, &c, *J. T. B. Bennett, Aston, near Birmingham.*—11*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The seat is arranged to oscillate on a centre or hinge and its motion utilised to actuate the vehicle.

4829. ELECTRICAL SWITCH FOR ELECTRICAL LAMPS, &c., *G. W. Bayley, Walsall.*—11*th October*, 1882.—(*Not proceeded with.*) 2*d.*

Relates to an improved switch for making and breaking an electric circuit.

4830. FUZES FOR PROJECTILES, *A. Noble, Newcastle, upon-Tyne.*—11*th October*, 1882. 6*d.*

The object is to enable shrapnel shells which are fired from a gun to be used instead of "case," which breaks up in the gun at the time of firing, and which is now used when firing against troops at close quarters, and consists in providing shrapnel shells with a fuse which explodes the shell immediately that it leaves the muzzle of the gun, by reason of a hammer or striker being liberated by the firing and thrown forward by a spring when the shell, leaving the muzzle, ceases to be accelerated.

4831. MACHINE GUNS AND GUN CARRIAGES, *A. Noble, Newcastle-upon-Tyne.*—11*th October*, 1882. 8*d.*

The gun is especially intended for throwing projectiles of several pounds' weight with great velocity and in rapid succession. In rear of the ordinary trunnions, and near the breech end, are other trunnions, on which excentrics are mounted. The excentrics on the two sides are connected by a lever frame, serving as a handle to work the gun. The breech block is fixed to the excentric straps. A metallic capsule cartridge of large dimensions is used. The breech block has a grooved lip, which, when the cartridge is in position, engages with the base flange around its upper half. When the handle is raised, the breech block recedes, drawing back the cartridge case with it. The further movement of the handle causes the breech block excentrics and the handles all to move upwards, leaving the cartridge partly withdrawn lying loosely in the breech. The gun is cocked as the breech is closed. The carriage is a gun-metal casting with a circular base and central pivot, and has a recoil press cylinder extending forward on each side in line with the trunnions. It also carries on the right side a pivot for an elevating lever crutch concentric with the trunnions. A piston-rod is connected with each trunnion block, and extends through the recoil press cylinder, the piston having a loaded valve to allow water to pass from one side to the other.

4834. UTILISING DISTILLED OR BURNED SHALE OR "BLAES," &c., *T. L. Paterson and T. J. Scott, Glasgow.*—11*th October*, 1882. 4*d.*

This relates to the utilisation of distilled or burned shale for the production of bricks, blocks, tiles, or pipes, and also for the manufacture of pottery and cement. The shale is ground and mixed with cement and water, when it can be run into moulds of the desired form.

4836. STACKS OR WALLS OF CUPOLA, BLAST, CASTING POT, AND OTHER LIKE FURNACES, *J. Toussaint, near Birmingham.*—11*th October*, 1882. 2*d.*

This consists in constructing the walls of such furnaces with a chamber between the outer and the inner or lining walls in combination with openings in the latter at suitable distances apart, for the distribution of air or heat into and amongst the material under treatment.

4837. VEHICLES PROPELLED BY HUMAN FORCE, *C. Truman, Birmingham.*—11*th October*, 1882. 6*d.*

The object is to enable vehicles to be driven without the use of a rotating crank, and it consists in substituting clutch motions for the same.

4838. EMPLOYING THE MUSCULAR FORCE OF MAN, *B. J. B. Mills, London.*—11*th October*, 1882.—(*A communication from L. Bellefonds, Lyons.*) 6*d.*

The man is placed in a seat suspended from a swinging frame, and he pushes the seat to and fro by pressing on fixed bars, the motion obtained being conveyed by a suitable rod to a crank shaft.

4839. SASH BALANCES, *A. J. Boult, London.*—11*th October*, 1882.—(*A communication from C. E. Bogle, Pennsylvania, U S.*)—(*Not proceeded with.*) 2*d.*

A single weight box on each side of the window contains a single weight. A double cord connected to the window sash by means of a pulley passes from the point of attachment down and around a lower pulley and then up over a stationary pulley. The weight is connected to the end of the cord inside the stationary pulley.

4840. SUPPLYING FEED WATER TO BOILERS, &c., *W. Teague, jun., Pool, Cornwall.*—11*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The top of the boiler has a tank of water supplied from a large reservoir, the supply being controlled by a cock. The tank communicates with the boiler by pipes, one connected in the steam space, the other to supply, each pipe being fitted with a cock.

4842. LOCKS OR DOOR FASTENINGS, *J. Garon, Southend.*—11*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The end of spindle to fit the hollow neck of the handle is formed with transversely-arranged recesses and projections, and in the wall of the hollow neck is a slot to receive a block or locking device. The rose is also formed with a slot for the passage of the block.

4843. LOOMS, *J. W. Holmes, Preston.*—11*th October*, 1882. 6*d.*

This relates, First, to means for producing a selvage upon the inner edges of cloth when weaving two or more widths in one loom. Each inner edge of the cloth is provided with a temple operating as usual, and above them is fixed a platform, below which is a cutting arrangement to divide the weft thread at each pick. On the upper side of the platform are a pair of curved hooks mounted on shafts and caused to partially rotate to and fro by the action of the slay, such hooks serving to pass through several upper threads of the shed near the adjacent edges, and on the return movement lift up the weft thread, which is then cut. A second improvement relates to the crank arm which connects the crank with the slay, and consists in the use of a flat spring to press down the central cotter used to keep the bushes at each end of the arm up to the bearings; and a third improvement consists in making the end studs which receive the extremities of the picker rod or spindle with hollow cavities to receive hard, dried buffalo hide.

4844. ROTARY PRINTING MACHINERY, *J. Dobson, London.*—11*th October*, 1882. 6*d.*

The object is to provide a machine that will print paper bags or sheets from stereotyped plates with economy and despatch, and it consists in the application to rotary printing machines of a "feeding-in" arrangement, composed of adjustable reciprocating markers or equivalent propellers, in combination with the feed board, and with specially formed and adjustable guide bars or pieces.

4846. EXPLOSIVES FOR FIRE-ARMS, BLASTING, &c., *R. Hannan, Glasgow.*—12*th October*, 1882. 4*d.*

This relates to explosives capable of being safely handled, and which are not liable to injury from atmospheric changes, and it consists in the combination of prussiate of potash, nitrate of potash, chlorate of potash, and vegetable or animal charcoal. To bind the ingredients together they are mixed with paraffine or other oleaginous or fatty substances.

4847. VELOCIPEDES, *J. Rettie, Hatton-garden.*—12*th October*, 1882. 6*d.*

This relates to a novel description of multiplying gear.

4848. BOTTLES OR RECEPTACLES FOR MUCILAGE, LIQUID BLACKING, &c., *E. P. Hawkins, London.*—12*th October*, 1882. 6*d.*

The neck of the bottle is fitted with a cover, to which bristles are secured so as to form a brush, which when the bottle is inverted becomes charged with a certain quantity of the mucilage or other liquid.

4849. LOOMS, *J. Almond, Blackburn.*—12*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates, First, to an improved construction of taking-up lever used in connection with the taking-up motion of looms; Secondly, to a shuttle guide and springs acting as shuttle guide and swell; Thirdly, to a temple roller adjustable to varying widths of cloth; Fourthly, to improved apparatus for taking up the cloth as woven without the aid of the cloth beam ordinarily used.

4851. FIGURED OR PATTERNED HEARTH AND FOOT RUGS, *W. W. Smith, Kingsland.*—12*th October*, 1882. 4*d.*

The rugs consist of a suitable backing, into which a pattern is woven by jacquard or other mechanism in woollen yarns of various colours, the wool forming a separate warp governed by the jacquard and woven over grooved rods, so as to form a loosed pile, which is then cut.

4852. RAISING AND LOWERING CAGES IN MINES, &c., *T. Jones and J. Griffiths, Glamorgan.*—12*th October*, 1882.—(*Not proceeded with.*) 2*d.*

Pinion wheels are carried at intervals in a framing in the shaft and gear with the racks on one side of the cage, so that when rotated the cage will be raised or lowered, two or three of such pinions always being in gear with the rack. On each end of the pinion spindles are cranks, those at one end being at right angles to those at the other end. Each crank is connected by a rod to the cranks immediately above and below it. An engine drives the pinions, and the arrangement is such that one cage ascends on one side and another descends on the other side of the pinions.

4853. COMPOUND FOR MAKING TIGHT JOINTS IN MACHINERY, &c., *A. J. Scollick, London.*—12*th October*, 1882.—(*A communication from H. Simons, Cologne.*) 2*d.*

The compound consists of a sulphate of baryta, peroxide of manganese, and suitable oil, which are mixed and passed through rollers, and afterwards beaten with hammers or equivalent means.

4854. APPARATUS FOR TRANSMITTING HEAT TO FLUIDS, *W. L. Wise, London.*—12*th October*, 1882.—(*A communication from B. Röber, Dresden.*) 8*d.*

This relates to improvements on patent No. 4516, A.D. 1880, and consists in placing a centre pipe into the heat transmitting pipe, the space between the two having partitions to guide or promote circulation of the fluids in order to transmit the heat, and the inner tube forming a channel for circulation or escape of products of combustion. The heat transmitting pipes may be enlarged at the part exposed to the fire, and such parts form walls, channels, or passages in the combustion chambers.

4855. HYDROGEN GAS, *S. Pitt, Sutton.*—12*th October*, 1882.—(*A communication from W. H. Bradley, New York.*) 6*d.*

When steam is decomposed in the presence of hydrocarbon at a high temperature, the resultant gases are a mixture of carbonic acid and hydrogen with a small percentage of carbonic oxide and marsh gas. The object of this invention is to eliminate the carbonic oxide and carbonic acid gases, and for this purpose two generators are filled with lump lime, which is heated by the burning of carbonic oxide and air. Steam charged with hydrocarbon vapour is then admitted, and the lime in the second generator serves to extract the carbonic acid generated at the same time with the hydrogen by the decomposition of the steam and hydrocarbon in the first generator. The operation of the chambers is then reversed, by which means the lime in the second generator is revivified.

4856. PRODUCING LINT FROM NEW FLAX FIBRES, *G. W. von Nawrocki, Berlin.*—12*th October*, 1882.—(*A communication from M. Salomonson, Germany.*) 2*d.*

The flax is dried and broken, winnowed and carded, so as to free it from woody parts. It is then treated in a closed boiler by two or three atmospheres pressure in a lye containing 6 per cent. of 95 deg. calcined soda as well as 5 per cent. of a composition consisting of one-third potash and two-thirds of equal parts pure oleine, tallow, and olive oil. After three hours the fibres are rinsed and put into a chlor bath heated to from 60 to 68 deg. Fah., then again rinsed and wrung out, after which they are placed in a solution of muriatic acid. After being again rinsed and wrung out they are softened by boiling in the above-named saponified fatty compositions, again rinsed and converted into wool by a carding engine.

4858. MAKING AND FIXING ROUND AND MOVABLE HEELS TO BOOTS AND SHOES, *C. Mole, London.*—12*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The heel consists of a movable piece of metal which is secured to a round piece of leather nailed to the boot or shoe by means of a central screw, the head of which enters a countersunk hole in the metal piece.

4859. BICYCLES, &c., *G. W. von Nawrocki, Berlin.*—12*th October*, 1882.—(*A communication from L. Schmetzer, Germany.*) 6*d.*

This relates to means for adjusting the spring which supports the seat of bicycles, so as to enable people of different sizes to use the same machine; and also in covering the seat with perforated india-rubber, so as to keep the same cool. The seat may also be formed of a hollow india-rubber plate filled with water or air.

4860. CARRIAGES, *W. P. Thompson, Liverpool.*—12*th October*, 1882.—(*A communication from G. E. Bartholomew and E. Armant, Montreal.*—(*Not proceeded with.*) 2*d.*

The invention relates, First, to that class of carriage gear in which the perch connecting the front and rear axles is abolished and the spring gear is braced to the carriage body without the use of a platform, and it consists in bracing the spring firmly to prevent back roll; to properly support the fifth wheel and ensure its easy and accurate movement; to afford strong resistance to unnatural draught, and to allow the front wheels to turn completely under the arch without interfering with the easy working of the parts. The invention further relates to the construction of the fifth wheel and to carriage seats which spring out from the rear of the vehicle.

4861. OMNIBUSES AND OTHER CARRIAGES, *S. Andrews, Cardiff.*—12*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to enable omnibuses to run with greater ease and comfort than those now in use. Six or more wheels are employed and arranged on two or more different gauges, the central wheels being largest.

4862. UNDER CARRIAGES FOR OMNIBUSES, &c., *S. Andrews, Cardiff.*—12*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates especially to the form of omnibus described in patent No. 2511, A.D. 1882, the object being to enable the wheels to project upward under the seats of the carriage, and it consists in forming the frame with a wheel plate inside the wheels, and both under carriage and frame are cut away where they would come in contact with the wheels.

4863. REFLECTORS FOR GAS GLOBES, &c., *A. M. Clark, London.*—12*th October*, 1882.—(*A communication from P. Costes, France.*) 8*d.*

The object is to provide globes with a reflector, also serving as a "top" to prevent the blackening of the ceiling, and it consists of a loose expanding ring or crown fitting on the top of the globe, and of a reflector connected to the ring by pins or hinged thereto, and resting either close down upon or at a short distance above the ring or crown.

4864. CLIPS OR HOLDERS FOR MACHINES FOR STRETCHING OR FINISHING WOVEN FABRICS, *D. P. Smith, Glasgow.*—13*th October*, 1882. 6*d.*

The clip as applied to endless chains consists of a lower jaw fixed to a double bracket or pair of arms projecting laterally from the body of the link, and the upper jaw is jointed to the lower parts of the double bracket by arms projecting down inside the lower jaw. A lug projects up from the middle of the upper jaw, and serves to open the clip by hand or by fixed inclines with which the motion of the chain brings it in contact at the proper times. The upper jaw is closed by a spring or springs of special construction.

4865. SPRING MATTRESSES, *D. R. Gardner, Glasgow.*—13*th October*, 1882.—(*Not proceeded with.*) 2*d.*

A wooden strip is placed at the head and foot of the bedstead, and to them are secured spiral springs, on to which is fixed a surface of parallel spring wooden laths.

4866. BRAKE FOR TRICYCLES, &c., *J. D. Hankey, Newington.*—13*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The brake consists of two arms suitably situated, and actuated so as to cause their ends to grasp between them the hub of the wheel.

4867. MACHINERY FOR WASHING WOOL, &c., *W. H. Greenwood, Bradford, and C. Hoyle, Keighley.*—13*th October*, 1882. 6*d.*

This relates to means for giving with the cleansing liquids in an ordinary washing trough an extra cleaning or scouring to the wool or fibres, which cleansing liquids permeate and penetrate the mass of fibres before they pass through the squeezing rollers. For this purpose a pump is used to draw the liquid out of the trough, and then force it back through perforated pipes arranged therein, so as to drive it in a shower through the fibres.

4868. LOUNGE, *A. J. Wilkinson, Sydney, New South Wales.*—13*th October*, 1882. 6*d.*

The object is to form a lounge which can be readily taken to pieces and packed together in a small space for transport.

4869. ELECTRIC LIGHTING, *W. Strickland, Essex.*—13*th October*, 1882. 6*d.*

The object of this invention is to produce a steady arc without the use of regulating mechanism. The inventor employs four carbon pencils placed in suitable holders so as to form two parallel lines, the points of each pair being in contact with one another and maintained so while in action by gravity or other means. The distance apart of the two lines of pencils is regulated according to the length of arc required, the four points forming the two poles of the arc. In order to start the lamp the poles of the pencils are enlarged so as to bring the two lines into contact when placed in position. Alternating currents are preferably used.

4870. FACING POINTS FOR TRAMWAYS, *H. Scott, Liverpool.*—13*th October*, 1882. 6*d.*

A pivotted trailing point is used, and has a square end, and is of the same section as the rail. The point is pivotted at the rear end to a plate, so that it comes flush with the rail, and the front square end faces the feather end of the facing point, the two points being connected by a lever fulcrummed on the base-plate. The driver of a car causing the horses to pull to the right or left moves the trailing point in one direction, and the facing points in the opposite direction. The parts of the tramway about the points are formed with open grids so as to free them from dirt.

4871. APPARATUS FOR RANGE FINDING, *C. Mc. G. Bate, Woolwich.*—13*th October*, 1882. 6*d.*

This relates to an apparatus in which the distance of a remote object is approximately ascertained by triangulating or measuring the angles between the observer, the remote object, and a third object at right angles, more or less, from two points at different distances from such third object. On a base a binocular field glass or telescope is fixed, and in front of it a mirror is placed, so as to turn on a vertical centre for adjusting it in any position, within sufficient limits, from an angle of 45 deg. with the line of sight of the glass. The lower edge of the mirror does not descend below the centre of the glass, so that the distant object can be seen directly, and above it the reflected image of the object at about right angles can be seen simultaneously, and, by turning the mirror, vertical lines through the centres of the two objects can be made to coincide. Above the plate on the axis of the mirror is a horizontal arm, and on a centre, a short distance from such axis, are pivotted graduated arms, which can be separated at any desired angle. Above the bars, at right angles to their graduated edges, is a transverse bar, on which slides an indicator.

4872. BRIDLES FOR HORSES, &c., *J. G. Heinisch, Germany.*—13*th October*, 1882. 6*d.*

The head gear has no curb, but the curb strap of the tether serves in place of same, and is connected with the nose piece or head latch by a square eye on each side, each eye having a slot at its lower end. Cheek pieces, capable of a rotary movement, are provided on the upper ends of the two cheek bars, and fit into the slots in the eyes.

4873. VENTILATED WATERPROOF GARMENTS, *J. Frankenburg, Salford.*—13*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This is particularly applicable to garments made of an outer part of fabric, and an inner part of waterproof lining; and it consists in removing a portion of the latter, and covering the open space with a patch, leaving the top open, and inserting therein a number of short tubes to allow air to pass inside the garment.

4874. PRODUCTION OF YEAST FROM THE SACCHARINE JUICES OF GRAIN, MOLASSES, &c., *A. M. Clark, London.*—13*th October*, 1882.—(*A communication from G. Claudon and C. Vigreux, Paris.*) 4*d.*

A wort is prepared from molasses, to which juice of grain is added. A portion of the yeast generally used is diluted in a portion of the mixed wort and brought to 25 deg. Cent., the vat being then gradually filled with the mixed wort. When the fermentation has become fully active, the temperature is reduced to 18 deg. Cent. while the vat is being filled. This temperature is maintained until the whole of the yeast has been collected by skimming. The temperature is then raised to 26 deg. or 27 deg. Cent. to stimulate the fermentation, and the fermentation completed under ordinary conditions.

4875. PREVENTING THE SURREPTITIOUS OPENING OF DOORS AND WINDOWS, *E. Guattari, Paddington.*—13*th November*, 1882. 6*d.*

This relates to a portable fastener, and consists of a stem with teeth at opposite parts, and a cross bar at top for rotating it. The stem is inserted between the two parts to be secured, and turned so that the teeth enter the woodwork.

4876. GUN CARRIAGES, *J. Vavasseur, Southwark.*—13*th October*, 1882. 6*d.*

This consists in mounting guns required to be fired from either side, or from any intermediate point between the sides of a ship, on a central pivot which can be traversed by gear carried on the mounting in a straight or curved line along rack racerr laid across the deck from port to starboard, suitable gear being provided for traversing the gun, and also for turning the pivotting carriage, so training the gun

4877. STALL DIVISIONS AND FITTINGS FOR STABLES, COWHOUSES, &c., *J. A. Hanna and T. F. Shillington, Belfast.*—13*th October*, 1882. 6*d.*

The sills to receive the partition boards are formed so that air may have free access to the grooves therein and any liquid may escape therefrom, the grooves being formed so that the ends of the boards do not entirely fill up the same. The invention further relates to the construction of a feeding trough, which can be revolved for filling and cleaning the same; and also to means for balancing hinged sashes of ventilators and windows.

4878. GALVANIC BATTERIES, *G. C. V. Holmes, Sussex-place, and S. H. Emmens, Argyll-street.*—13*th October*, 1882. 2*d.*

The object of this invention is to diminish the internal resistance of batteries, and increase the electro-motive force. The electrodes are composed of rods or wires of whatever substance is employed, with their ends bound together, thus affording a large surface for action. The exciting liquid is composed of a mixture of nitric and chromic acids partly combined with alkaline bases, and further acidified, if required, by sulphuric acid. The electrodes are also coated, electrolytically or otherwise, with an oxide of chromium, iron, cobalt, or nickel.

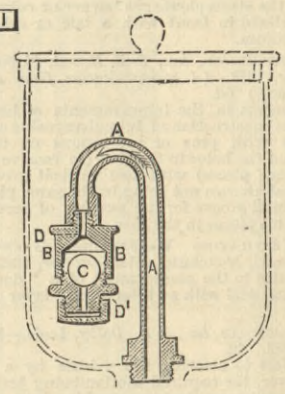
4879. PIGMENT, *J. B. Freeman, Tottenham.*—13*th October*, 1882. 2*d.*

This consists of a volute pigment, made by mixing together lead sulphate and zinc oxide or zinc white, and submitting the mixture to great pressure and friction.

4881. APPARATUS FOR LUBRICATING STEAM ENGINES, *G. Varley and W. Gregory, Over Darwen.*—14*th October*, 1882. 6*d.*

This invention consists principally in an addition to an oil cup of the ordinary form—either open or closed, the latter by preference—of a syphon pipe, provided with a double-acting ball or other valve. Into the central opening, at the lower side of the interior of the cup, is screwed the longer leg of a syphon pipe A, which extends upwards towards the top of the interior, and is then bent downwards again until its lower end nearly reaches the bottom, its extreme end being provided with a small valve-box B, in which works a ball valve C, acting between two seatings D D1. It will be

4881



evident that when the pressure of steam is in the engine cylinder or valve box, the ball valve C will remain closed against the lower seating D1 as shown, and no oil will pass through, but when the vacuum occurs the ball C will be drawn up close to the upper seating D, and a certain definite amount of oil will be sucked through the valve whilst the ball C is passing from one seating to the other; no steam, however, will be able to pass.

4882. LOOMS FOR WEAVING CARPETS, &c., *W. Youngjohns, Kidderminster.*—14*th October*, 1882. 6*d.*

This relates to "Moxon" looms, the object being to simplify and improve the wire motion, and it consists in the use of a vertical arm with a fork or beak at its lower end, and arranged to be reciprocated by suitable mechanism for the purpose of moving the free ends of the wires, after they have been withdrawn from the fabric, into position to be inserted in the shed.

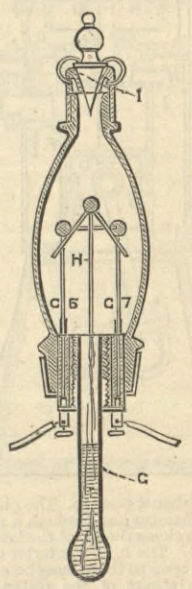
4883. COATING TIN AND TERNE PLATES, &c., *T. H. Johns, Hackney.*—11*th October*, 1882. 6*d.*

The sheets are placed in a chamber containing a solution of metals, so that while in preparation they are slightly coated with zinc or tin by electro-deposition. They are then either passed through heated grease, so as to remelt the coating, or they are coated with a further coating of metal in a bath of special construction.

4883. ELECTRIC LAMPS, *P. R. de. F. d'Humy, Clapham Rise.*—14*th October*, 1882. 6*d.*

This relates to incandescent lamps. Referring to the illustration herewith, G is a glass vessel filled with some hydrocarbon fluid; a wick dips into this which is attached to a wire H. The burner is constructed of wire sticks C^6 C^7, of metal or other

4883



material, connected at their upper ends by a cross-piece, and having small globes of carbon, mixed with graphite, resting on them, and so arranged that as the upper ends of C^6 C^7 become consumed, the globes gradually sink by gravity. When the current is turned on heat is conveyed to the hydrocarbon liquid by the stick H, and vapour is given off, which will drive the atmospheric air out at the hole at the top of

the globe, the stopper I having been first removed. This hole is then closed, and the vapour becomes deposited on the incandescent wires and globes, thereby aiding in preventing their destruction.

4885. EXTRACTING OR REMOVING SEDIMENTS OR PRECIPITATES DURING AND WITHOUT INTERRUPTING THE SEDIMENTARY, PRECIPITATING, OR CLARIFYING PROCESSES, &c, *G. Bacher, Kladno, Austria.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The chief novel feature consists in the employment of a movable and transportable bottom, which is at a distance slightly above the bottom of the vessel, conducted through the vessel, and afterwards led out of the vessel up the side of the same in a slanting or inclined direction.

4886. GAS ENGINES, *T. Baldwin, Cheetham.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates principally to the arrangement of the valves.

4887. DENSE STEEL CASTINGS, &c., *C. M. Pielsticker, Kilburn.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the apparatus used for the purpose.

4888. COMPOUND TO PRESERVE ROPE, YARNS, &c., FROM DECAY, AND INCREASE THEIR SOLIDITY AND FLEXIBILITY, *J. H. Evens and H. Lowenfeld, London.*—(*A communication from F. de P. Weber, Austria.*)—(*Not proceeded with.*) 2*d.*

This consists of odourless petroleum 80 parts by weight, olive oil 1 part, clear French colophony 1 part, solid paraffine ½ part, soft water 240 to 300 parts.

4891. GAS STOVES, *G. E. Webster, Nottingham.*—14*th October*, 1882. 6*d.*

This consists in the use of coloured glass to give gas stoves known as "Coseya" a more cheerful appearance. The glass is also placed in connection with a circular stove in which an atmospheric burner is used, and consists of a cast metal top with holes, through which the gas passes. On this stove asbestos is placed. A governor is described for regulating the supply of gas. Other improvements are also described.

4892. GAUGE FOR MEASURING THE CIRCUMFERENCE OF THE WRIST OR ARM, *B. H. Joseph, Birmingham.*—14*th October*, 1882. 6*d.*

This relates to the employment of a thin flexible metal band.

4893. OBTAINING AND APPLYING MOTIVE POWER, *W. Wade, Crewe.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means of obtaining and applying motive power from the operation of a screw or screws.

4894. APPARATUS FOR COOKING, HEATING, AND VENTILATING, &c., *J. Wadsworth, Manchester.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

One form of the stove consists of a small space enclosing the atmospheric gas burner or coke fire, and which is glazed in front with a talc or other transparent medium.

4895. HORSESHOES, &c., *E. E. Hewett, Sheffield.*—14*th October*, 1882.—(*A communication from A. Gauer, Hamburg.*) 6*d.*

This consists in the improvements of horseshoes, &c., by the construction of interchangeable calks, and toe pieces with pins or projections on the stems thereof, and the holes in the shoe (to receive the said calks and toe pieces) with two vertical grooves (the two vertical grooves not being in the same plane), and one horizontal groove for the purpose of securing the calks and toe pieces in the shoe.

4896. VENTILATING WATERPROOF GARMENTS *J. Trapowski, Manchester.*—14*th October*, 1882. 2*d.*

This relates to the employment of a "double texture" or material with an intervening layer of india-rubber.

4898. TRICYCLES, &c., *J. P. Dalby, Leeds.*—14*th October*, 1882. 6*d.*

This refers to steering the vehicle by a hand or moving lever, the required motion being transmitted through a pinion on the lever working into a rack in connection with the steering apparatus.

4899. MACHINE GUNS, *T. Nordenfelt, Westminster.*—14*th October*, 1882. 6*d.*

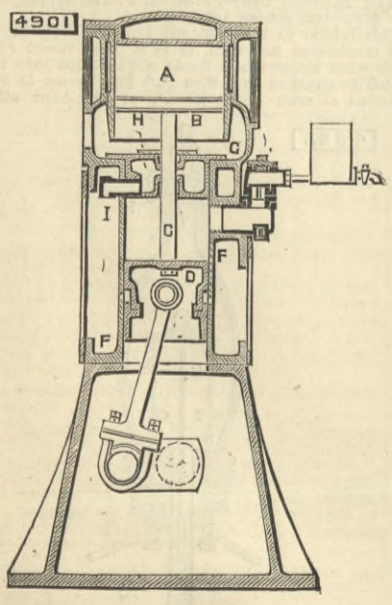
This relates especially to simplification of the construction and improvements of the details of that class of gun now well known as the Nordenfelt gun, and which have the barrels arranged side by side in a horizontal plane in the fore part of a rectangular frame.

4900. FIRE-ARMS, *T. Nordenfelt, Westminster.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to reduce the recoil of a rifle or gun, and the effect of such recoil against the man's shoulder or against the gun carriage.

4901. HIGH-SPEED ENGINES, *P. W. Willans, Thames Ditton, and M. H. Robinson, Hampton Wick.*—14*th October*, 1882. 6*d.*

In the drawing A is the steam cylinder, B the piston, C the piston-rod, having at its end a second piston or plunger D, to which is jointed a connecting rod, that works on to a crank on the crank shaft. The second piston D works to and fro in a cylinder F, which not only serves as a guide for it, but also as an air-compressing cylinder to serve as a buffer for checking the momentum of the piston at the end of its backward or return stroke. The lower end of the cylinder A opens into a chamber G, which communicates with the



condenser or exhaust passage. The piston-rod C passes through this chamber and through a stuffing-box in a cover H, which closes the top of the lower cylinder from the chamber G. The hollow interior of the cover H is by a passage I open to the atmosphere, in order that if on the return stroke of the piston any air under pressure should leak past the lower stuffing-box into the hollow interior of the cover, it may not force its way past the upper stuffing-box and so find its way to the condenser.

4903. GALLERIES OR BRACKETS FOR HOLDING GLOBES OR LAMP BOWLS, *C. Ferranti, Liverpool.*—14*th October*, 1882.—(*Not proceeded with.*) 2*d.*

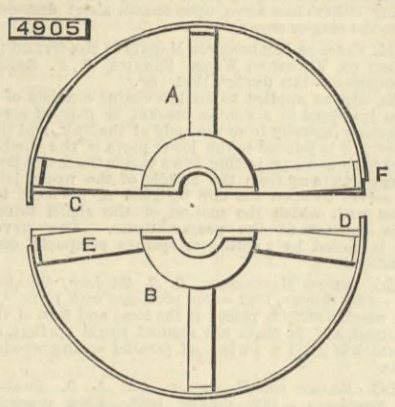
This consists in so contriving the gallery that one part only shall be rigidly connected with the burner support, the other part being movable and hinged to the fixed part.

4904. MACHINE FOR WASHING, RINSING, AND DRAINING BOTTLES, JARS, &c., *W. W. Horner, Dulwich.*—14*th October*, 1882. 6*d.*

This relates to improvements in the general construction of the machine.

4905. DRIVING AND OTHER PULLEYS AND WHEELS, *G. E. Sherwin, near Birmingham.*—14*th October*, 1882. 6*d.*

The drawing represents in front elevation a wrought iron split or divided pulley, made according to one part of the invention. A is one-half of the pulley, and B is the other half. Instead of connecting all parts of the two halves A B in the same plane as usual, the inventor makes the rim or periphery of the half A at one side of the said half project at C beyond the plane in which the pulley is split divided, and similarly he makes the rim or periphery of the half B project at D



at the side opposite that at which the rim or periphery of the half A projects. A recess is left at E in the half B for the projecting arm or periphery C on the half A to take in or overlap, and a similar recess F is left in the half A for the projecting arm or periphery on the half B to take in or overlap. The two halves A B of the pulley when brought together are joined by rivetting or otherwise connecting the parts C, E and D, F.

4907. MACHINERY AND APPARATUS APPLICABLE TO HOSIERY STITCHING MACHINES, *H. Clarke, Leicester.*—16*th October*, 1882. 6*d.*

The inventor claims a grooved and notched wheel for holding the stitched fabric in position, while the superfluous portion is cut off.

4909. SCREW-NECK BOTTLES OR JARS, AND STOPPERS FOR SAME, *F. Foster, Hoxton.*—16*th October*, 1882. 4*d.*

This relates to improvements on patent No. 466, A.D. 1871. It consists in improving the form of the neck of the bottle or jar by making a ledge within the neck (but above the screw thread) in such manner that the joints may be made here, instead of on the top of the neck as heretofore.

4912. PERAMBULATORS, *T. F. Simmons, Croydon.*—16*th October*, 1882. 6*d.*

The handles are in rear of the perambulator in lines parallel to the line of motion, instead of at right angles thereto, and are so placed as to be grasped by the hands with the palms facing each other. The steering is effected by one of the handles, which is movable, and connected to a pivotted axle carrying the front wheel or wheels.

4913. BOILERS FOR HEATING WATER, &c., *W. H. Thompson, L. Hardaker, and J. M. Porter, Leeds.*—16*th October*, 1882. 4*d.*

The boiler is cylindrical, and has concentric cylindrical flues, each complete boiler consisting of two, three, or more annular portions placed one within the other. One or more portions may be divided into segmental portions which when fixed become portions of the annular formations. A number of small flues are formed by thus placing the annular parts one within the other, and serve to distribute, break up, and absorb the heat from the gases.

4914. UMBRELLAS AND PARASOLS, *J. B. Seel, Urmston, Lancashire.*—16*th October*, 1882. 6*d.*

This consists in attaching the cover to the ribs by inserting the seams of the gores, or cords or wires sewn to such seams, into tubular cavities formed in the ribs.

4918. MACHINES FOR DISINTEGRATING WOOLLEN OR OTHER WOVEN FABRICS, *J. C. Watson, Leeds.*—16*th October*, 1882. 6*d.*

The object is to disintegrate or separate the fibres of woven fabrics so that they may be respun into thread, and this is effected by means of a cylinder covered with carding or filleting, having hooked or curved teeth. The cylinder revolves and the teeth enter and remove the fibres from the fabric, which is fed to it by fluted rollers. A rapidly revolving brush removes the fibres from the teeth of the cylinder.

4920. FASTENINGS FOR NECKTIES, &c., *P. A. Comte de Sparre, Paris.*—16*th October*, 1882. 6*d.*

This relates to a flat hinged clasp formed of two parts jointed together, and formed of wire or sheet metal shaped to the required form.

4922. APPLIANCES FOR SETTING, TIGHTENING, REPAIRING, AND RENEWING THE SPOKES OF VELOCIPEDE WHEELS, &c., *R. Adams, Southwark.*—16*th October*, 1882. 6*d.*

Screw-threaded nuts fit into holes in the hub or felloe of the wheel, one end of the spoke being formed with a head, and the other with a screw thread to fit the nut. By turning the spoke it may be tightened or loosened as required.

4924. FOUNTAIN PENS, *R. Enright, Kingsland.*—16*th October*, 1882. 6*d.*

A hollow tube has a vent at the end and screws on to the barrel of the pen, the nib being the valve for supplying ink, for which purpose it is formed with a conical projection entering a hole near the end of the tube, and the pressure when writing opens such hole, and allows the ink to flow.

4925. VELOCIPEDES, *W. Jeans, Christchurch, Hants.*—16*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The wheels are driven by clutches actuated from the treadles by cords, the return motion of one treadle being effected by the downward movement of the other treadle by means of suitable gearing. Other improvements are described.

4926. RANGE-FINDERS, *F. H. Poore, Portsmouth.*—16*th October*, 1882. 6*d.*

On a base line of known length an imaginary triangle is constructed with the object whose range is to be found as the apex. A second triangle similar to the first is constructed, and having its base a determined proportion of that of the first triangle. The sides of the large triangle can be read off directly from those of the small one. These operations are effected by means of two instruments, one placed at each end of the base. Each instrument is marked with lines equally spaced, radiating from a centre and cutting a circular arc. One has a sight bar that can radiate about the axis of the arc. The points where the radial lines cut the arc are connected with an electrical conductor, and the radial bar completes the circuit when the line of sight along it is parallel with any one of such radial lines. The other instrument is similarly marked with lines and an arc, but the point about which its sight bar radiates is adjustable, so that its distance from the axis of the arc may be made to represent the length of the base.

4927. APPARATUS FOR TREATING SILK YARNS OR THREADS, *A. M. Clark, London.*—16*th October*, 1882.—(*A communication from G. Teissonnière and J. Auroy-Deslongchamps, France.*)—(*Not proceeded with.*) 4*d.*

The object is to treat waste silk worked with the gum in it, so that the stitches made with it will be more sightly, and consists in a process whereby it may be dampened to any desired extent in a uniform and self-acting manner. Steam is used for this purpose, and brought into contact with the silk by suitable apparatus.

4929. FRICTION CLUTCHES, &c., *D. Frisbie, New Haven, U.S.*—17*th October*, 1882. 8*d.*

This relates to improvements on American patent No. 148,165, and consists in so forming the parts that bearing pieces or friction blocks connected with one wheel, and which traverse around in an annular groove in the other wheel when the clutch is disengaged, induce the required friction when the clutch is engaged, by acting on inclined surfaces. A sleeve adapted to slide on the shaft is connected with the ends of the clutch levers by links acting as toggle levers. The train of connections between each clutch lever and its bearing piece can be adjusted to regulate the force. Guide bolts are employed in the radial levers which communicate motion from the clutch levers to the friction blocks. The friction blocks and the groove they run in are of V-shape. Other improvements are described.

4932 CLOGS OR FOOT COVERINGS, *D. Pickles, Halifax.*—17*th October*, 1882. 6*d.*

This consists of a foot covering, the upper of which is of usual form, the heel and sole being of wood, and the waist of leather, the irons being secured to the face of the wood, or let into grooves formed therein.

4933. BUCKLES, *F. J. Candy, Cambridge.*—17*th October*, 1882. 4*d.*

This consists of a double buckle, the tongues being on the same spindle, but placed back to back to work in opposite directions.

4934. TRUSSES, *H. J. Haddan, Kensington.*—17*th October*, 1882.—(*A communication from L. Barrère, France.*)—(*Not proceeded with.*) 2*d.*

The truss consists of a double pad, an elastic belt, a pair of elastic thigh straps, attached with one end to a screw or pin, which also connects one end of the belt to the pad. The other end of the thigh strap has a row of holes, and is attached to the belt.

4935. MANUFACTURE OF PAPER PULP, TEXTILE FABRICS, &c., *H. A. Dufrené, Paris.*—17*th October*, 1882.—(*A communication from H. da C. C. Leite, Paris*) 2*d.*

This relates to the manufacture of paper pulp, paper, textile fabrics, cordage, and the like from Galega Orientalis and Galega Officinalis.

4936. WATER OR STENCH TRAP CONNECTIONS, *P. M. Justice, London.*—17*th October*, 1882.—(*A communication from C. Lightbody, Brooklyn, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to sewer traps having a water tank connecting with the sealing bend of the trap, the tank being supplied with a water pipe discharging therein, under the control of a float valve.

4937. CLIPPING HORSES AND SHEEP, *W. H. Greenwood, near Huddersfield.*—17*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a rotary cutter working on a pivot, in conjunction with an under plate, with a comb-like edge a little in advance of the cutter, so as to lift and support the hair while being cut.

4938. APPARATUS EMPLOYED IN PRINTING, *J. F. Haskins, London.*—17*th October*, 1882.—(*Not proceeded with.*) 2*d.*

This relates, First, to a special arrangement of forme rollers and distributing or vibrating rollers for improving the distribution of ink; Secondly, to means for securing the printing surfaces or plates to the type or main cylinder; Thirdly, to means for holding the sheets to be printed, and delivering them when printed from the impression cylinder on to the fly or tapes; Fourthly, to means for preventing the impression cylinder taking ink from the main cylinder except where desired; and Fifthly, to means of driving the distributing rollers.

4939. SEWING MACHINES AND BUTTON FEEDING DEVICES, *W. P. Thompson, Liverpool.*—17*th October*, 1882.—(*A communication from the Morley Sewing Machine Company, Boston, U.S.*) 10*d.*

This relates to details of construction of the button feeding and carrying devices of machines for sewing on buttons, and of mechanism for operating the presser-foot, the cast off bar, and of counting devices therefor, the object being to feed and carry buttons more expeditiously to the sewing devices of the machine, and with less liability to obstruction from buttons of varying sizes to operate the presser-foot independently of the vertical needle bar, and to provide with machines of this class suitable means for determining the number of buttons sewn on by the machine in a given period.

4940. MILLSTONE BALANCES, *A. J. Boult, London.*—17*th October*, 1882.—(*A communication from J. C. E. Thierrion, Paris.*) 4*d.*

On the mill spindle is placed a cockhead with three radiating arms. The eye of the runner is fitted with a bush, on which are cast three lugs corresponding with the arms of the cockhead. Through the lugs pass screws which bear upon the radial arms, and which serve to level the stone as required.

4941. WICK TRIMMERS, *A. J. Boult, London.*—17*th October*, 1882.—(*A communication from W. C. Seaton, Quebec.*—(*Not proceeded with.*) 2*d.*

A spiral brush is mounted in a case with slots, through which the wick is passed, and by revolving the brush the wick is trimmed.

4946. FURNACES AND MECHANICAL STOKERS, *J. C. Brentnall, Timperley, Chester.*—18*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The coal passes from a hopper to a box containing a toothed roller revolving with its shaft, and acting in conjunction with a series of separate curved bars actuated by excentrics, and serving to break up the coal, which then enters the combustion chamber. The furnace bars are actuated by excentrics to cause the coal to travel along them.

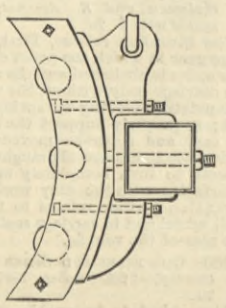
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

277,098. BRAKE SHOE, *Warren M. Abbott, Chicago, Ill.*—*Filed March* 12*th*, 1883.

Claim.—A brake shoe constructed of any suitable

277.098

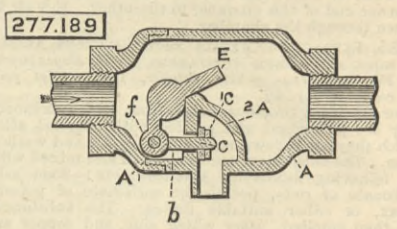


material, having set into its acting or pressure face friction rollers of any suitable material, inserted in slots or openings in the face of the shoe, and arranged, acting, and secured in the manner and for the purposes substantially as set forth.

277.189. RELIEF VALVE FOR STEAM FIRE ENGINES, *Richard H. Attwell, Baltimore, Md.*—*Filed September* 20*th*, 1881.

Claim.—The relief valve consisting of the cylindrical case A A^1, made in two parts with peripheral joint, and having its section A cast with a hollow internal

277.189

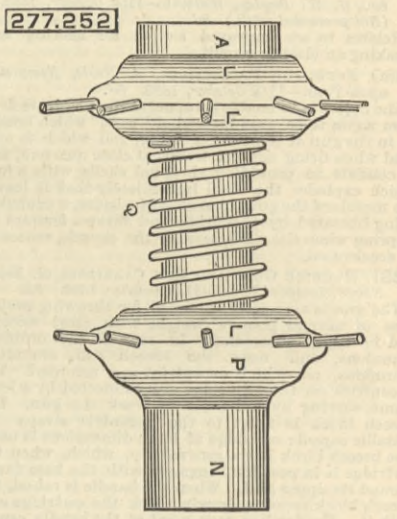


chamber A^2, with opening *b*, in combination with the wing E, fulcrumed on the internal chamber, and having extension *f*, with valve rod *c* and c^1, arranged substantially as shown and described.

277,252, VEHICLE WHEEL, *Edward G. Ferguson, Macon, Ga.*—*Filed January* 27*th*, 1883.

Claim.—(1) The combination of the hollow box D, having enlarged portion A and provided with screw threads on its periphery, the detachable spokes, two sets of discs, L L and L P N, clamped upon opposite sides of the two sets of spokes, the axle *f*, and the nut R, screwed upon the axle, inside the sleeve N, substantially as shown and described. (2) The combina-

277.252



tion of the hollow box D, having enlarged portion A, screw threaded portion I, and plain portion J, of the detachable spokes, the two sets of discs L L and L P N, clamped upon opposite sides of the spokes, and the intermediate spiral rings Q placed between the two sets of discs and wound about the plain portion J, substantially as shown and described.

CONTENTS.

THE ENGINEER, June 8th, 1883. PAGE

THE Brooklyn Bridge trustees have fixed the toll for foot passengers at 1c. The disbursements thus far on account of the construction of the bridge amount to 14,689,905 dols.

THERE are in Pennsylvania 277 blast furnaces, 149 rolling mills, 7 Bessemer steel works, 15 open-hearth steel works, 17 crucible steel works, 5 miscellaneous steel works, and 31 bloom forges.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 2nd, 1883:—On Monday, Tuesday, and Saturday, free from 10 a.m. to 10 p.m., Museum, 11,935; mercantile marine, Indian section, and other collections, 3747. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 1992; mercantile marine, Indian section, and other collections, 1062. Total, 18,736. Average of corresponding week in former years, 16,729. Total from the opening of the Museum, 22,074,673.