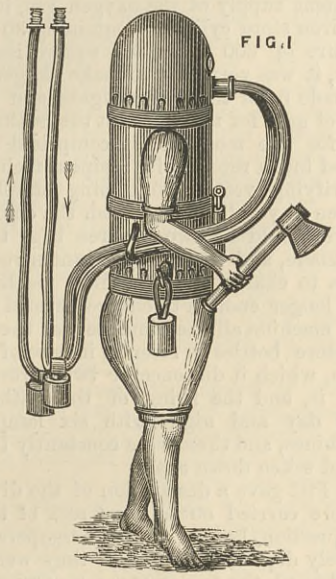
INSTITUTION OF MECHANICAL ENGINEERS.

OF the papers read at the recent meeting of the Institution, we have already given abstracts of the first and third. We now give a full abstract of the second, which was by Mr. W. A. Gorman, on

APPLIANCES FOR WORKING UNDER WATER, OR IN IRRESPIRABLE GASES.

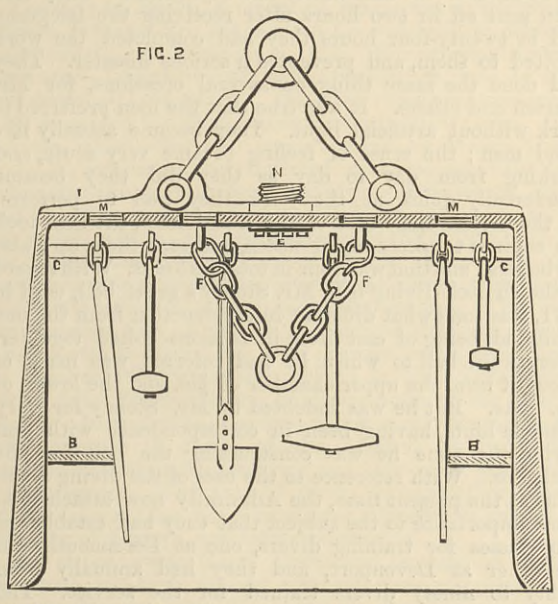
This paper opens with a brief history of diving by artificial help. The first account of the use of the diving bell in Europe is that of Tasnier, who relates that in 1538, at Toledo in Spain, he saw two Greeks, in the presence of Charles V., let themselves down under water in a large inverted kettle without being wet. Lord Bacon—A.D. 1600—describes the primitive method adopted in his time. In 1632 Richard Norwood took out a patent for a special means to dive into the sea. Borelli, in 1669, constructed a copper vessel 2ft. in diameter, with glass fixed before the face of the diver; this he termed a "Vesica." It was worn as a helmet, and securely attached to a dress of goat-skin. Within the "Vesica" were pipes, by means of which a circulation of air was contrived. About the year 1700 Dr. Edmund Halley devoted much time to sub-aqueous experiments, and in 1716 he read a paper before the Royal Society, entitled "The Art of Living under Water." He turned his attention to the diving bell. In 1721 he described to the Royal Society a method by which

FIG. 1



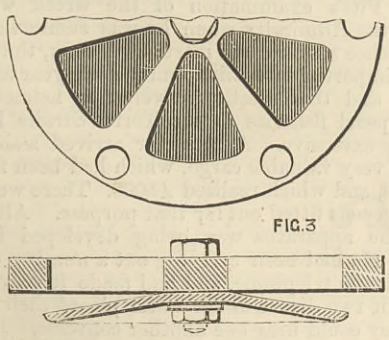
the diver could leave the bell. He used pipes, 40ft. in length, made with spiral brass wire inside; one end was fixed in the bell, and the other to a cock which opened into the diver's cap. This was made of lead, weighing 56 lb., and he also wore a girdle of the same weight, and clogs of lead weighing 12 lb. each. About 1716 John Lethbridge invented an air reservoir, made of wainscot, perfectly round and 6ft. long, 2ft. 6in. in diameter at the head, and 1ft. 6in. at the foot. He compressed air into this with a pair of bellows, and then lowered it with himself under water, where he remained 34 minutes. Numerous inventors fol-

FIG. 2



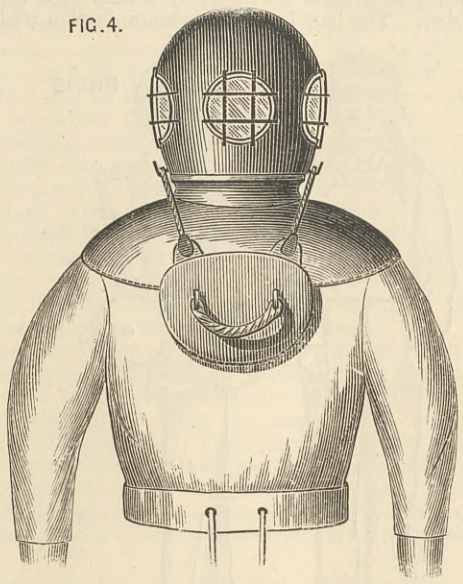
lowed in his track. Smeaton, in 1779, first employed the diving bell for civil engineering operations in repairing the bridge at Hexham, Northumberland. The apparatus was an oblong wooden box, 4ft. high, 2ft. wide, and 3ft. 6in. long. It was supplied with air by a pump fixed on surface. A diving dress was invented in 1798 by Kleingert, of Breslau, which consisted of strong tin-plate

FIG. 3



armour, Fig. 1, in the form of a cylinder encasing the diver's head and body, with a leather jacket and strong leather drawers. These were made waterproof, and joined by brass hoops around the metal armour, so that the diver was relieved from the pressure of the water except on the legs and arms. He inhaled the air from the surface through one pipe, and the vitiated air was carried to the surface by another. A diver could not with this apparatus descend to greater depths than 20ft. About the same date Messrs. John and William Braithwaite constructed a diving apparatus, with which they carried out several successful operations. Rennie, whilst occupied on the works of Ramsgate Harbour, 1813, made considerable improvements in the diving bell; he designed and constructed a diving bell of cast iron—Fig. 2—6ft. high, 4ft. 6in. wide, and 6ft. long, with one side a little heavier than the other, so that it should not float quite level, and thus more readily allow the vitiated air to escape. At the top of the bell six thick bull's-eyes of glass M M were fixed to admit light. In the centre of the top was a circular hole N, in which a brass lining was firmly fixed. To the under side of this was attached the air valve E, on a brass grating of the form shown in Fig. 3.

FIG. 4.



The valve itself was simply a disc of strong leather. A nozzle was fixed to the top of the bell above the valve, and to this was screwed a watertight leather hose 2½in. diameter, connected to the air pump, which was constantly worked by a sufficient number of men. Inside the top of the bell were strong lugs, to which were attached chains F F—Fig. 2—for suspending stones or other material. The bell was fitted with seats B B, and a rail C for hanging the various tools used by the men; it was slung by stout chains from a double-purchase crab fixed on a truck, which could travel along the gantry; the total weight was five tons. Rennie used this diving bell with great success in the numerous harbour and other works with which he was associated.

FIG. 5

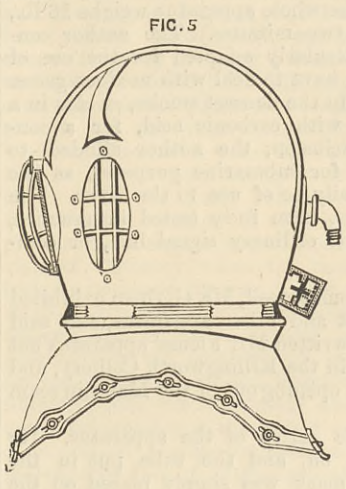


FIG. 8

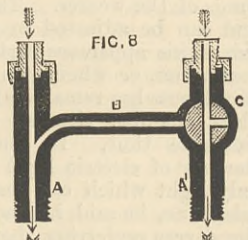
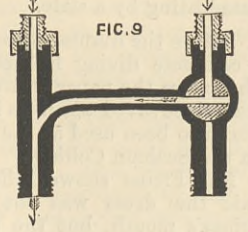


FIG. 9

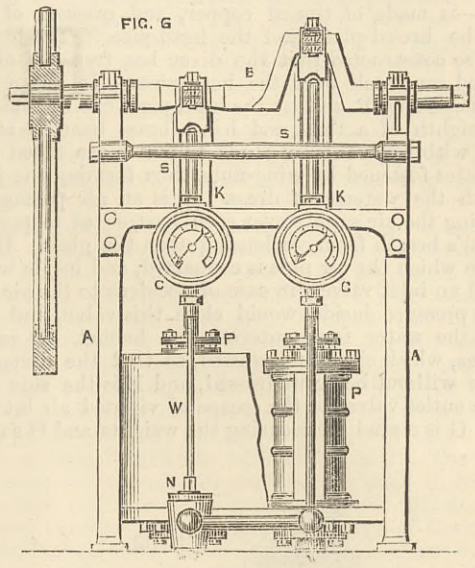


Open Diving Dress.—In 1828 or 1829 the late Mr. Augustus Siebe was employed in the construction of a diving dress, afterwards known as the open-helmet diving dress. The helmet was made of copper with a screw lens in front, Fig. 3, and a metal elbow rivetted on the back of the head-piece, to connect the air pipe with the pumps, the head-piece and breastplate being in one. To the breast-plate was attached a canvas jacket, which, with the aid of two lead weights, kept the helmet fixed upon the shoulders. Boots with lead soles, weighing 12 lb. each, were worn, and also a water-proof dress fastened round the neck, over which were placed the helmet and jacket. The air escaped into the water from underneath the outer canvas jacket, and the water reached within a few inches of the diver's mouth, so that he had to work in a vertical position. The air pumps had three cylinders, 3in. diameter, 9in. stroke. Even at the present day many of the coast divers use this form of dress.

Close Diving Dress.—About 1839 Mr. Siebe introduced the close helmet, Fig. 5, fitted with inlet and outlet valves, I and O, and with a segmental neck screw, to remove the head-piece by one-eighth of a turn. The waterproof dress was fastened to the metal collar by screws and brass bands.

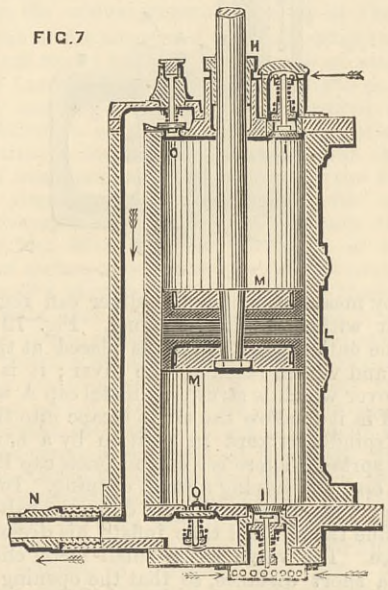
Modern Apparatus.—This apparatus, as illustrated in Figs. 6 and 7, is a very perfect one, combining a high degree of safety with comfort for the diver. The air pump, Fig. 6, is capable of compressing air to a pressure of 240 lb. per square inch, and consists of two vertical double-action gun-metal cylinders P P securely fixed to a bed-plate of gun-metal, which is bolted on the base of two side standards A A, forming an iron framing to carry the crank shaft B. Each piston, Fig. 7, is constructed of two inverted cups of leather L L with leather packing placed between, and the whole is secured by two cast iron piston plates M M fitted to the piston-rod inside the leather cups, and pressed together by a nut. Grooves are formed in the periphery of the piston plates to contain expanding springs, which, pressing against the inner side of the leather cups, keep them in close contact with the cylinders, and thus maintain the piston in a perfectly air-tight condition. Each cylinder cover has an oil tap for lubrication. The piston-rods pass through glands H packed with turned leather washers, and are extended so as to work in guides K K, Fig. 6. Double connecting slings S S, with gun-metal bearings, connect the piston-rods to the crank pins.

FIG. 6



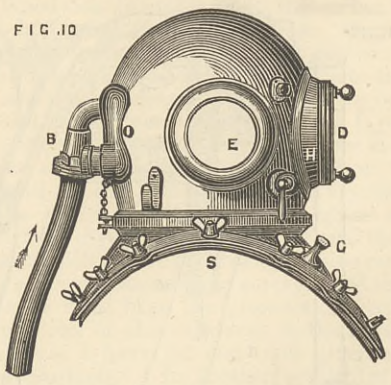
Inlet and outlet vales I and O, Fig. 7, are fixed in the covers of each cylinder, and also in the base plate. Spindle valves are used, faced with leather, and with gun-metal seatings, to which the valve is kept by a spiral spring. The top and bottom outlet valves are connected by passages cast on the cylinders, and leading to the air-delivery nozzle N. The cylinders are surrounded by a

FIG. 7



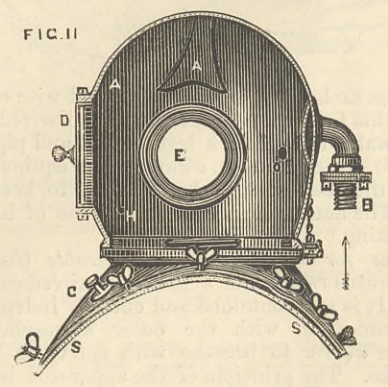
copper cooling cistern W, Fig. 6. Pressure gauges G G show the depth and pressure at which the diver is working, and are also used for testing the air pipes. Each gauge is marked off to represent the pressure in pounds per square inch, at given depths of water from 20ft.

FIG. 10



where the pressure is 8·68 lb., to 204ft. and a pressure of 88·54 lb., which is the greatest depth a diver has been known to descend—140ft. is given as the practical limit of diving, the pressure being 60·76 lb. The air-distributing arrangement, by which the air can be

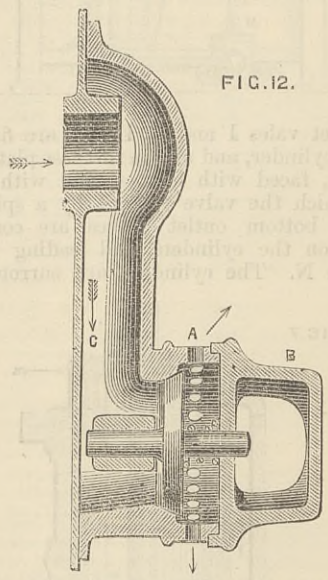
FIG. 11



transmitted to one or two divers as occasion may require, is as follows:—The two outlet nozzles, A A, Fig. 8, are connected by a cross branch pipe B, and a three-way cock C is fixed at the junction of the pipe B with the nozzle A.

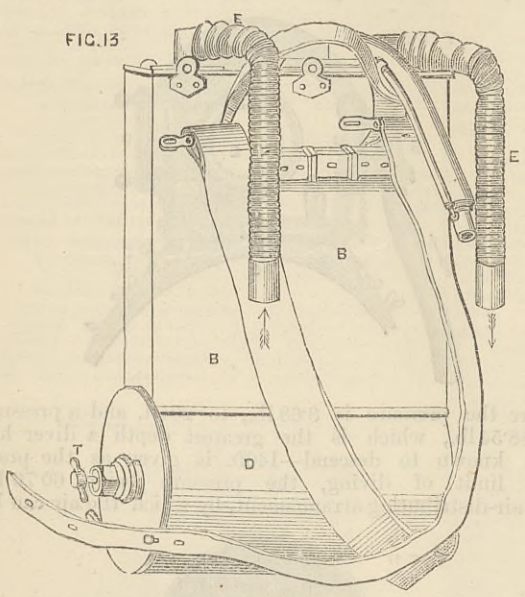
The position of this cock, when supplying air from both cylinders to one diver, is shown in Fig. 9, while Fig. 8 shows the position when two divers are to be supplied, each being in connection with one cylinder. If at any time the pump is supplying one diver, and it is necessary to send down the second diver to his assistance, it is only necessary to turn the lever of the cock C round to the position marked "two divers," and work the pump faster. Two divers can work from it to a depth of 90ft., or one diver to a much greater depth. The improved helmet—Figs. 10 and 11—is made of tinned copper, and consists of two parts, the breast-plate and the head-piece. The breast-plate is so constructed that the diver has free use of his arms, and can reach over the head-piece. It has a segmental neck ring R, so that the head-piece can be removed by one-eighth of a turn, and has a brass band S at the bottom, with twelve screw studs, to which are fitted four brass plates fastened by wing-nuts, thus forming the junction with the waterproof dress. A is an air passage for conducting the air supply over each lens, so as to prevent the diver's breath from condensing upon the glass. B is a nozzle to which the air pipe is connected, and inside which is placed an inlet valve ; in case of accident to the air pipe the air pressure inside would close this valve, and thus prevent the water from entering the helmet. D is the front lens, which can be unscrewed, so that the diver can converse without being undressed, and E is the side lens. O is the outlet valve for the escape of vitiated air into the water G is a stud for securing the weights, and H a regu-

FIG. 12.



lating tap, by means of which the diver can regulate his supply of air without giving a signal. Fig. 12 shows a section of the outlet valve, which is placed at the side of the helmet, and within reach of the diver ; it is a metal cone valve, over which is screwed a metal cap A with small holes drilled in it to allow the air to escape into the water. The valve spindle is kept in position by a hard-drawn copper wire spring. There is a second brass cap B screwed on the first one, and having a small opening. In this the diver can insert his finger and press down the valve spindle so as to confine the air, and thus inflate his dress and rise to the surface. The valve has a small metal chamber C, carried up a short distance, so that the opening into the helmet is 4in. above the valve. The waterproof dress is made of strong tanned twill, with an india-rubber lining between the thicknesses of the material. It has mineralised india-rubber collar and cuffs. The boots have lead soles weighing 14 lb. each. At the front and back are lead

FIG. 13

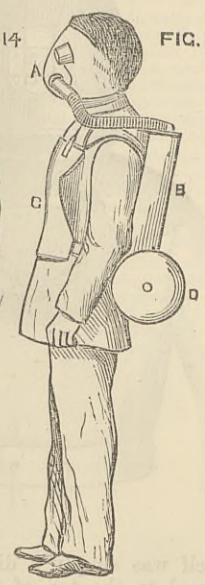


weights 40 lb. each. An air-pipe with spiral wire embedded in it and joints fitted to connect up to any desired lengths ; a knife, in water-tight case, a leather belt and pipe-holder, and a double suit of flannels, complete the equipment. For deep water the men wear a body guard to keep off the pressure. The author then described some of his experience in working.

Appliances for Working in Irrespirable Gases.—The Fleuss apparatus represents a great improvement in this direction. It is self-contained and entirely independent of any communication with the outer atmosphere, thus enabling the wearer to breathe with safety in the most noxious gases. The principle of the apparatus is that the wearer breathes the same air over and over again, the carbonic acid being absorbed from it after each expiration, and at the same time the requisite amount of oxygen restored ; thus rendering it pure, and fit to be again inhaled into the lungs. The apparatus, Fig. 13, consists of a strong copper cylinder D, 6½in. diameter, and 12in. long, with domed ends, and capable of containing 4 cubic feet of oxygen, at 16 atmospheres pressure ; this being sufficient for four hours' respiration. Above the cylinder D is attached a square metal box B, 12in. by 12in. by 4in. ; this contains the carbonic acid filter, which is a box of vulcanite divided into four compartments by vertical diaphragms, in such a manner that the exhaled breath of the wearer is made to pass twice up and down through the vessel, before it is in a position to be again inhaled. This box is fitted with small cubes of india-rubber sponge, saturated with a thick pasty solution of caustic soda. The exhaled air, being finely divided as it passes through the interstices of the sponge, and coming in contact with a very extended surface of caustic alkali, becomes thoroughly cleansed of all the objectionable products of respiration. As shown in Fig. 14, a flat bag G of vulcanised india-rubber, 12in. by 15in., is strapped on in front of the wearer ; into this the exhaled air passes from the filter, by means of a tube of india-rubber. The bag is also in communication with the

FIG. 14

FIG. 15



oxygen chamber D, and the supply of oxygen to the bag G is regulated by a jamb screw valve T, Fig. 13, under the control of the wearer. The mask A, Fig. 15, is made to fit air-tight to the face of the wearer, and is held in place by straps buckled at the back of the head. A band of rubber is made to cover the ears, and the eyes are protected by glass, when it is necessary to go into smoke or gases that would hurt them. The mask is provided with a pair of flexible tubes E, with valves, the one for exhaling being in communication with the filter, and the one for inhaling being connected to the air bag. The slightest effort of inspiration brings the revivified air freely to the lungs of the wearer. The whole apparatus weighs 26 lb., and can be adjusted in two minutes. The author considers this apparatus particularly adapted for the use of coal mines, or when men have to deal with noxious gases. Mr. Fleuss has remained in the densest smoke, as also in a glass chamber charged with carbonic acid, for a considerable time. In conclusion, the author alluded to the use of electric light for submarine purposes, as the only light which can really be of use to the diver. The telephone, he said, had not been fully tested in practice, the divers preferring their ordinary signal line, or communicating by a slate.

Before the discussion commenced, Mr. Gorman exhibited a complete diving helmet and other apparatus, and said that since the paper was written Mr. Fleuss' apparatus not long since saved ten lives in the Killingworth Colliery, and had also been used at the opening out of the Maudlin seam in the Seaham Colliery.

Mr. Fleuss showed the action of the apparatus. He said the dress was put on, and the tube put in the miner's mouth, but the mask was simply placed on the forehead, and he went into the pit in that position. The mask and breathing apparatus could be adjusted in a moment in case he came suddenly into foul gases. By putting his hand behind and turning the tap, he could at any time get more air ; and this had to be done every ten minutes. This air was pure oxygen admitted to the bag G, which was 300 or 400 cubic inches from the reservoir D. He could make the man if he chose breathe only the proper mixture of oxygen and air by first inflating the bag with breath. The arrangement explained was perfectly safe, because as long as any oxygen was there it would be supplied to the bag, and whenever the man found the volume was not sufficient—irrespective of purity—he could put his hand down and admit more. The carbonic acid remained of course in the filter, forming carbonate of soda, and the volume of gas thus abstracted was made up by the oxygen. He had made an improved filter, since the paper was written, in which, instead of india-rubber sponge, he was simply using tow mixed with caustic soda, and made in sticks. It made an efficient filter, and when the soda was completely carbonised, the whole could be thrown away. The sponge cost a sovereign, but a halfpenny worth of tow was sufficient for the same purpose.

Mr. Charles Cochrane bore testimony to the admirable and prompt way in which work could be carried out in mines, even when it was necessary to telegraph to London for apparatus.

Mr. Druit Halpin suggested that the glass shield in front which had to be taken off when necessary to speak to the man, and then put on again, might be improved. If the buttons for unscrewing were made like common winch-handles, and then milled, they would give a chance of doing what was wanted without dropping the shield overboard.

Mr. Charles Hawksley said that he had occasion to repair a pump which failed in a well of small diameter. In that confined situation one of the parts of the pump gave way, and the only means of getting at it to do the necessary repairs was by means of divers. A diver was sent down by the author's firm, and although the well was crowded with pump trees and their means of support, he descended to a depth of 130ft., and in that depth of water he successfully replaced the broken part ; so that the pump was able to be set to work again with comparatively little delay.

Referring to some remarks made by Mr. Cowper, Mr. Halpin said it was easy to get rid of any difficulty connected with fish getting in the way of the electric light, by injecting a small quantity of paraffine into the water round the lamp, which at once drove the fish away.

Mr. Fleuss said that in working in pits it was utterly impossible, although the apparatus was complete for breathing, to work without a light ; and where the gases were so dense that the men could not breathe them, it was necessary to have some special kind of light. He exhibited a lamp which he had designed for the purpose, and which he had frequently carried when working in the Maudlin seam at Seaham. The vessel could be kept charged for any length of time, by using common precautions in shutting off the valve. It could be easily seen at any time whether the valve was properly shut, by putting a film of moisture across the hole, when in an instant it would be seen if gas was leaking even to the smallest extent by bubbles appearing on the film. To ensure a sufficient supply of the oxygen gas, it might be carried in an iron store cylinder containing 30 cubic feet, under a pressure of 600 lb. to the square inch. Apart from that plan, it was very easy to make oxygen gas. All the theatres made it for their lime lights, and he had left a complete set of gear for making it at the Seaham colliery, after working for five months. It comprised a mercury bottle converted into a retort, with a pipe attached. There were two purifying vessels containing simply water—changed as often as you liked—to wash the chlorine out of the gas. There should be two or three bags to hold the gas as it was made, and in twenty minutes you could get off enough gas to charge one breathing machine, and in a few minutes longer enough to charge several more. He had used the machine all the time he was there, keeping two or three store bottles in reserve, in case of the pump breaking down, which it did once or twice from the extra strain put on it, and the firing of the leathers. They were working day and night with six lamps and six breathing machines, and these were constantly being taken up, refilled, and taken down again.

Lieut. Dean Pitt gave a description of the diving operations which were carried out at the wreck of the Doterel. In reply to a question, he said that the temperature inside the dress entirely depended upon how they were working. If they worked hard, the temperature rose very high, and they sometimes had to rest a few minutes to get cool. But what they suffered from chiefly was the intense cold to their hands. With regard to the light, the water was very clear indeed, and they could very fairly distinguish what a thing was at a distance of 7ft. or 8ft., though they could not see the parts distinctly.

Mr. Gorman, in reply to the discussion, thanked Mr. Halpin for the suggestion he had made, which would be of great assistance in screwing up the glass when the hand was cold. Mr. Cochrane had referred to his efforts in sending off some men for him about ten days back. They had been sent off in two hours after receiving the telegram, and in twenty-four hours they had completed the work allotted to them, and prevented a serious disaster. They had done the same thing on several occasions, for Mr. Marten and others. It was true that the men preferred to work without artificial light. They became actually like blind men ; the sense of feeling became very acute, and working from day to day as they did they became wonderfully quick at the work they had to perform. In the case of the wreck of the Caledonian, the men took the engines to pieces under water, and sent them up ; also the boilers ; and that was done in total darkness. With regard to the air-lock diving bell, Mr. Stoney's great bell, used in 1871, was somewhat different in construction from the one exhibited, being of cast iron, in sections bolted together, whereas the bell to which he had referred was made of wrought iron, the upper chamber of ⅜in. and the lower of ½in. plate. But he was indebted to Mr. Stoney for very valuable hints, having been in correspondence with him during the time he was constructing the bell for the Barbados. With reference to the uses of the diving apparatus at the present time, the Admiralty now attached so much importance to the subject that they had established two classes for training divers, one at Portsmouth and the other at Devonport, and they had annually from eighty to ninety divers trained for the service. The Royal Engineers also had classes formed at Chatham ; the men were trained in the Medway, and they also went down and dived off Sheerness, where they got into deep water. They also urged the Royal Engineer officers to dive. In the Navy the officers could also learn diving, if they chose to do so ; and they had just heard an instance of the value of that system, because Lieutenant Pitt's examination of the wreck was most valuable to the Admiralty when he was summoned home to give evidence at the court martial. Again, the value of the sponge imported into this country each year amounted to £90,000, and that mostly recovered by helmet divers. Lately the pearl fisheries in the Torres Straits had also become very extensive. A schooner arrived a short time ago with a very valuable cargo, which had been fished up in six weeks, and which realised £8000. There were now a number of vessels fitted out for that purpose. Altogether, therefore, the apparatus was being developed in other directions. He had been carrying out a number of experiments with the telephone, and had made it very perfect. At present, if two divers under water placed their helmets together, they could hear one another converse. But with the new instrument, if two divers placed their helmets together, they could hear at the surface what the men were talking about. He hoped to exhibit this on a future occasion.

MERCHANT STEAM VESSELS AT THE SHIPWRIGHTS' EXHIBITION.

No. II.

THE Alaska—model No. 287—the most recent addition to the well-known Guion line of passenger steamers trading between Liverpool and New York, was built last year by Messrs. John Elder and Co., of Fairfield, and has made the fastest passage on record between the Old and the New Worlds. Her launch, which took place in July last, was unfortunately not completed on the day proposed, as she stuck fast upon the ways, but she was subsequently launched without injury. Her principal dimensions, as registered by the Board of Trade, are :—Length, 500ft.; breadth, extreme, 50ft.; and depth of hold, 38ft.; and, with a gross tonnage of 6932 tons, she has a displacement exceeding 12,000 tons. The Alaska is built of iron on the transverse system of framing, to receive the highest class at Lloyds', and her bulkheads, which are nine in number, are so arranged as to qualify her for entry on the Admiralty list. Upon the upper deck she has a turtle back forecastle nearly 100ft. long, a bridge deck and promenade flat about 330ft. long covering the saloon skylight casing, officers' cabins, engine and boiler casing, galleys, &c., and a turtle-back poop about 55ft. in length. She has four masts, barquentine rigged, with a fair amount of sail power.

One peculiarity noticeable in this handsome model is the sharp cutting away of the fore-foot, a practice which we believe was first introduced by Messrs. Harland and Wolff, and now frequently followed by other builders with excellent results, both as regards speed and easy handling.

The engines of the Alaska were also manufactured by Messrs. Elder. They are of the compound inverted direct-acting type, with three cylinders, the high-pressure cylinder having a diameter of 68in., and the two low-pressure a diameter each of 100in. The length of the stroke is 72in., and the propeller, which is four-bladed, has a diameter of 23ft. 3in. and a pitch of 34ft. 6in. The boilers are built of steel, they are nine in number, they have each a diameter of 15ft., and are cylindrical double-ended with a working pressure of 100 lb. per square inch. Each boiler has six furnaces, with an aggregate grate surface of 138 square feet.

The estimated maximum speed of the Alaska is 18·5 knots with 11,000 indicated horse-power; but, as at the time of leaving the Clyde for Liverpool, prior to entering upon the passenger service, the fitments in connection with the whole of her boilers were not completed, no full powered measured mile trials, we believe, were made. The Alaska has large and luxurious passenger accommodation for over 300 first-class passengers and for a large number of second and third-class, and carries 4000 tons of dead-weight cargo.

The fastest passages on record across the Atlantic were made by the Alaska on her last voyage out and home, her average ocean speed outwards was 16·7 knots per hour, the distance between Queenstown and New York having been covered in seven days four hours thirty-two minutes, which is two hours eleven minutes less than she took on her previous homeward voyage, and four hours seven minutes less than the fastest passage made by her sister vessel the Arizona. She has just made the return passage in seven days one hour.

The City of Berlin, a model of which was exhibited by Messrs. Inman—No. 309, Section L—was built by Messrs. Caird and Co., of Greenock, in 1875. Her principal dimensions are :—Length over all, 520ft.; breadth, extreme, 44·2ft.; and depth of hold, 34·9ft. The gross registered tonnage is 5491 tons, and the displacement exceeds 10,000 tons. Her engines, which were also manufactured by Messrs. Caird and Co., are compound inverted direct-acting, with two cylinders, the high-pressure having a diameter of 72in., and the low-pressure a diameter of 120in. The length of the stroke is 66in., and the pressure in the boilers is 75 lb. per square inch. The City of Berlin attained on the measured mile a maximum speed of 14·825 knots per hour with 5200 indicated horse-power. At the time of her construction she beat all previous records on the voyage from Queenstown to New York. Her fastest passage was made in October, 1877, when she arrived at New York within seven days fourteen hours twelve minutes of the time of leaving Queenstown—a record which is only eleven hours forty minutes in excess of the Alaska's shortest. She carries 202 first-class passengers and 1500 other passengers and emigrants. The City of Berlin, like the other vessels of the Inman Line, has a handsome clipper bow similar to the City of Rome's, previously referred to.

The sister vessels, Garth Castle and Drummond Castle, to which we have already referred, were completed last year by Messrs. John Elder and Co., for Messrs. Donald Currie and Company's Cape Mail Line. The dimensions of these vessels are as follows :—Length over all, 376ft.; breadth, 43ft. 6in.; depth of hold, 31ft. 4in.; and the gross tonnage is about 3700 tons. They have compound inverted direct-acting two-cylinder engines, the high-pressure cylinder being 51in. in diameter, and the low-pressure 88in., with a length of stroke of 57in., and a steam pressure of 75 lb. per square inch. The indicated horse-power developed on the measured mile was 3325 with a maximum speed of 14·3 knots, the engines making sixty-six revolutions. These vessels, in addition to their large cargo-carrying capacity, have considerable passenger accommodation, including berths for 166 first-class passengers, eighty second-class, and 130 third-class. For greater safety at sea, and to qualify them for a place in the Admiralty list, they are subdivided into nine separate water-tight compartments, and they have provision for water ballast to the extent of nearly 400 tons. Special provision has been made in these vessels to secure adequate pumping power in the event of any compartment being injured, although the flooding of any one compartment would not of itself imperil the safety of the vessel.

The vessels represented in the Exhibition and belonging to the well-known Monarch Line, owned by the Royal Exchange Shipping Company, deserve more than a passing notice. Three of these vessels have been built by Messrs. McMillan, of Dumbarton, and two others by Messrs. Earle, of Hull. The Assyrian Monarch and the Lydian Monarch are constructed of mild steel, and the others of iron. They are all built on the cellular, longitudinal and bracket system, and have capacity for about 600 tons of water ballast between the inner and outer bottoms. With the exception of the Grecian Monarch, which has been made longer than the others, these vessels are all of the same size, their principal dimensions being :—Length over all, 371ft.; breadth, 43ft.; and depth of hold, 24ft. 10in. The gross tonnage, including the shelter deck, is nearly 4000 tons.

The engines with which they are fitted are compound inverted two-cylinder direct-acting, the high-pressure cylinder having a diameter of 46in., and the low-pressure 87in. The length of the stroke is 57in., and the steam pressure in the boilers is 80 lb. per square inch. They have a speed of from 12 to 13 knots with about 2500 indicated horse-power.

These vessels are engaged in the Atlantic trade between London and New York, and have a special arrangement of centre-line partitions, constructed of iron, for the carriage of grain in bulk in the lower hold, and between lower and middle decks, on the homeward voyages. These partitions serve to prevent the shifting of the loose grain from side to side of the vessel during heavy weather at sea, it having frequently been found that in grain-carrying vessels where no such provision has been made the loose cargo has shifted to such an extent as to produce a considerable list, and this, accompanied by a consequent diminution of stability, has been doubtless a fruitful source of loss of life and property. We may remark that the Board of Trade regulations require in grain-carrying vessels not so fitted that one-third of the cargo shall be stowed in bags.

These vessels are all fitted with a complete shelter deck for the purpose of carrying cattle on the return voyage from New York. They have limited first-class passenger accommodation, but they can carry in the 'tween decks nearly 1500 emigrants. They are each divided into seven water-tight compartments, so as to comply with the requirements for entry on the Admiralty list. The models show these vessels to be of comparatively full form, so that they are capable of carrying a large amount of deadweight cargo.

A very handsome model of the Grecian Monarch was exhibited by the builders, Messrs. Earle's Shipbuilding Company, of Hull. The model was shown for competition in Section B, Class 4, for Atlantic cattle and grain steamers, and her builders were awarded the first prize, a gold medal, as we intimated in our last issue.

Great as has been the improvement in the speed of our Transatlantic steamers, it has been at least equalled by the advances made in the vessels employed in the China tea trade, to which the Stirling Castle is the latest addition. This vessel, a model of which, No. 284, was exhibited in Section L, by the builders, Messrs. John Elder and Co., of Fairfield, has been built for Messrs. Skinner and Co. for the above service. As previously mentioned, this vessel on her trial trip in March last attained on the measured mile the very high speed of 18·4 knots with 8500 indicated horse-power. This speed, we believe, is equal to any attained even by the large transatlantic passenger steamers, and is far in excess of that hitherto obtained in purely cargo carrying vessels. That our readers may comprehend the reasons for the keen competition which has led to the building of so fast a vessel for cargo carrying, it is desirable that we should refer briefly to the progress and development of the tea trade between China and this country. Prior to the opening of the Suez Canal, and before the marine steam engine had attained anything like its present state of efficiency, when the passage to and from China had to be made by way of the Cape, the tea trade was carried on principally in sailing vessels, the excessive coal consumption of the machinery of that date acting as a deterrent to the employment of steam. The tea which arrived first commanded heavier prices than that which followed, and tea merchants were always ready to offer increased freights to the fastest vessels. This practice led, of course, to a keen competition as regards speed, and a magnificent fleet of clipper sailing vessels grew into existence. Every year a grand race from China home with the first of the season's teas took place, and the spectacle was not unfrequently witnessed of two vessels starting from China at about the same time and arriving in the Downs within a few hours of each other. But the gradual improvement which took place in the steam engine, accompanied by a diminution in coal consumption, led gradually to the introduction of steam vessels, and it was seen that at no far distant date sailing vessels would be driven out of this trade. Then came the opening of the Suez Canal, which dealt a final blow to sailing clipper tea vessels. Many of these fine vessels are still afloat, and find profitable employment in the Australian and other trades. The opening of the Suez Canal, and the consequent absorption of nearly the whole of the tea trade by steam vessels, did not, however, put an end to the competition. On the contrary, from that date up to the present the two lines in whose hands the tea trade between China and this country principally lies have been engaged in an honourable competition, which has resulted in the building of the Stirling Castle. Whether Messrs. McGregor, Gow, and Co., owners of the Glen line of steamers, Messrs. Skinner's formidable rivals, who have added two fine vessels—the Glenfruin and Glenavon—to their magnificent fleet during the past twelve months, and within the last few weeks a still larger vessel, the Glenogle, will be able to surpass even the Stirling Castle, remains to be seen.

The Stirling Castle is built of iron to receive Lloyd's highest class. Her model shows her to have considerably greater rise of floor than is usual in either cargo or passenger steamers, and her lines, which are very fine, present to the eye the appearance of being adapted for a very high rate of speed. Her length between perpendiculars is 420ft.; breadth, 50ft.; and depth of hold, 30ft. 10in. The gross register tonnage is about 4500 tons, and the displacement at the load draught exceeds 8000 tons. She is constructed on the ordinary system of framing; she has two complete iron decks and seven water-tight bulkheads, which divide her into eight independent water-tight compartments, by which the Admiralty's requirements for admission to their list of vessels suitable for service as a cruiser in time of war are complied with. Upon the upper deck she has a long bridge enclosing the engine and boiler casings, and a poop and forecastle.

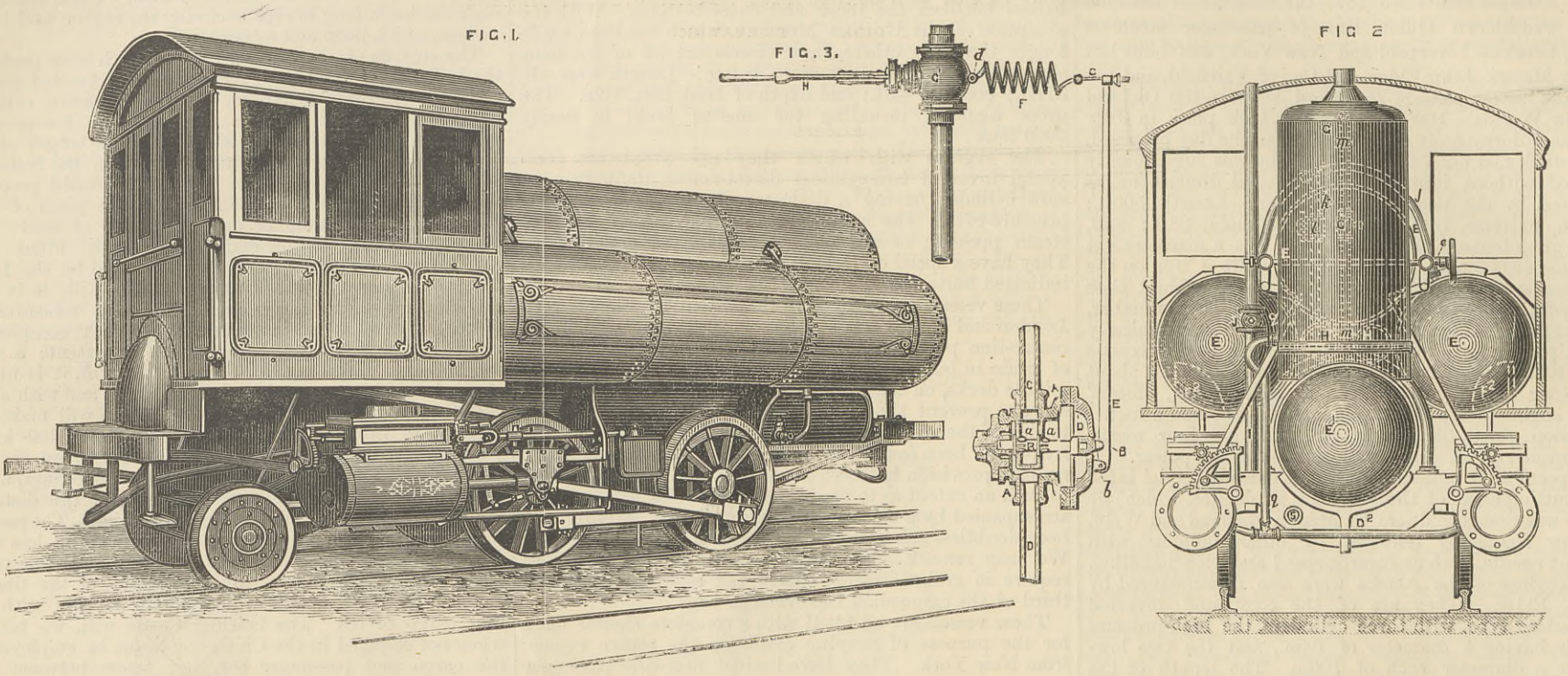
The engines of the Stirling Castle, which were made by the builders of the vessel, are compound inverted direct-acting, with three cylinders, the high-pressure cylinder having a diameter of 63in., and the two low-pressure cylinders a diameter each of 90in. The length of the stroke is 72in., and the steam pressure in the boilers is 100 lb. per square inch. She has a four-bladed propeller with a disc diameter of 22ft. 4in., and a pitch of 31ft. Her boilers, six in number, are constructed of steel; they are cylindrical, double-ended, are each fitted with six furnaces, Fox's patent, manufactured by the Leeds Forge Company. The Stirling Castle will, it is estimated, be able to carry over 5000 tons measurement of tea, and as a ton measurement of tea occupied 40 cubic feet and weighs 8 cwt., this represents a dead weight cargo exceeding 2000 tons. She will, it is understood, take her cargo on board at Hankow, and with about 800 tons of coal it is estimated that she will make the passage to Singapore, a distance of about 2400 knots, where she will recoal, in six days. At Singapore she will take on board sufficient coal for the passage to Suez, where she will recoal. She is expected to cover this distance, which is about 5000 knots, within a fortnight. The passage from Suez to England will probably be made in less than eight days, and thus if all goes well with this fine vessel we may presume that within four weeks of the time of her leaving Hankow she will arrive in London with her first cargo of tea. The Stirling Castle will, we believe, when not engaged in the China tea trade, be employed in the cargo and passenger carrying trade between this country and America.

THE IRON AND STEEL INSTITUTE.

IT will be remembered that, as we explained in our last impression, the annual general meeting of the Iron and Steel Institute was adjourned on Wednesday in order that the members might have an opportunity of attending the funeral of Lord F. Cavendish at Chatsworth on Thursday. On Friday morning proceedings recommenced in the hall of the Institution of Civil Engineers, the president, Mr. Josiah Smith, in the chair. He announced that a large number of members had been present at the funeral, and that the attention was appreciated by the members of Lord F. Cavendish's family. The secretary then read a paper by Mr. Woodcock, of Sheffield, on the mutual relations of carbon and iron in steel, which contained some statements of a very startling character. Thus Mr. Woodcock suggests that the hardness of steel is due to the presence of carbon crystals—in plain terms diamond dust—scattered through its substance. Mr. Woodcock starts by reasserting what is well known, viz., that the Eggertz colour test is not accurate, which he explains by the hypothesis that the carbon is not always in a condition to make its presence manifest in this way. He suggests his diamond dust theory by the following statement :—Raw cemented steel, as it comes from the furnace, is as soft and easy to work with a file or other tool as the wrought iron from which it is made, notwithstanding its increased content of carbon. On being heated and quenched, however, this steel becomes as hard as any other description of steel under the same conditions; and if broken, the fractured surface is found to be studded with innumerable small crystals, which, on inspection under a magnifying power, present physical features very much like small diamonds. These crystals can be attributed, says Mr. Woodcock, to nothing but the carbon; they are never to be found in wrought iron; they are more numerous in proportion as the original amount of carbon in the steel increases, and also in proportion to the resulting hardness, and if a sufficiently large piece or bar be used they will be found more numerous in the outer layers than in the inner, whilst the centre may have none at all; while the hardness of the bar will also decrease from the outside inwards, until at the centre, where no crystals are perceptible, the steel is as soft as in the original unhardened state. If these crystals, then, are carbon, there is only the diamond which we yet know as crystalline carbon; "and it seems to me more reasonable to suppose that the hardness of steel results more from the presence of a large number of small particles of this substance in the steel than from any other cause I have yet met with given as likely to cause such hardness." In another portion of his paper he asserted that the strength of a steel bar should be calculated in terms of the fractured area, not of the untouched bar, and that the ultimate strength of steel is very little affected by the quantity of carbon it contains.

The discussion which ensued was carried on entirely by chemists, Mr. Stead, Mr. Riley, Mr. Perry, of Ebbw Vale, Mr. Bauerman, and others taking part in it. It is to be regretted that Mr. Woodcock was not present, as in his absence the chemists demonstrated that his views were wrong from first to last. If, it was pointed out, the diamonds were there, they could not be touched by an acid, and it would suffice to dissolve the steel to obtain the diamonds free. But nothing of the kind could be done. A few interesting statements were made worth remarking; thus Mr. Riley said that he had ascertained that the maximum quantity of carbon that iron would take up was 4·75 per cent. Mr. Perry, of Ebbw Vale, who is, we need hardly say, one of the most able metallurgical chemists of the day, said that when steel was "burned,"—spoiled by overheating—the injury was not due to the loss of carbon, but to the loss of some volatile substance, probably hydrogen. Mr. Riley stated that iron containing 20 per cent. of silicon is so brittle that it may be powdered to dust in a mortar. Mr. I. L. Bell gave particulars of some experiments he had made by keeping iron at a high temperature for a long period, seven days in one case and fourteen days in another. The pig tested contained to begin with 3·694 per cent. carbon, of which 0·637 per cent. was

HARDIE LOCOMOTIVE, ELEVATED RAILROAD, NEW YORK.



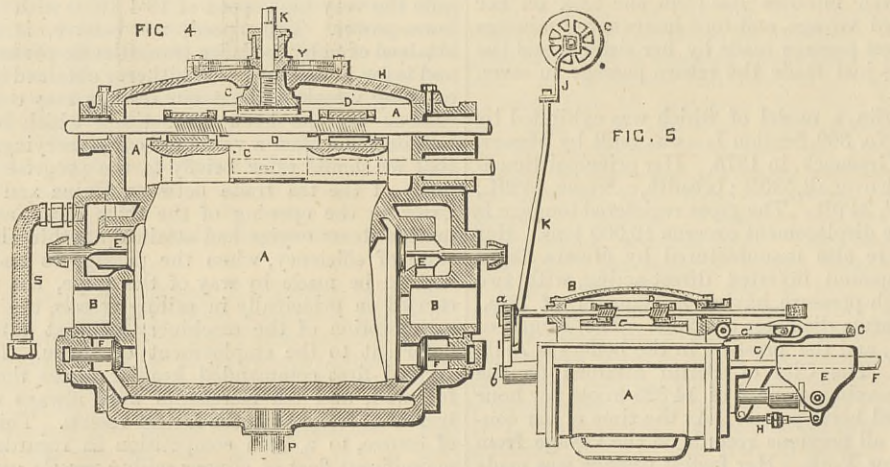
combined, the remainder graphitic. At the end of seven days there was a shell $\frac{1}{8}$in. thick on the iron which contained no combined carbon. Mr. Bauerman referred to a peculiar hematite ore, which contains 5 per cent. only of quartz; but it has none of the characteristics of a hematite, its physical properties being those of quartz. A vote of thanks was passed, and Mr. Jeans then read a statistical paper on the consumption of fuel in the iron and steel manufacture. It would be quite impossible to abstract this paper and do justice to its contents. It will prove a valuable addition to the proceedings of the Institute. The paper, consisting as it did mainly of a vast array of tables of figures, could not be discussed. Some exception was taken to Mr. Jeans' estimate that every ton of finished iron requires for its production 3 tons of coal. Most of those present held that $2\frac{1}{2}$ tons were nearer the mark. Some remarks were made on the value of compound condensing engines in steel mills, and something was said concerning the raising of steam in furnace boilers. The value of various kinds of hot blast stoves was also touched on, some holding that the common pipe stove was as good as the Whitwell or Cowper stove, while others disputed this assertion. A vote of thanks was passed to Mr. Jeans, and the most uninteresting meeting in, we believe, the annals of the Institute, came to an end at a comparatively early hour in the afternoon. A considerable number of papers in print were not read. It was stated that Mr. Annable's paper on the Whitworth system of compressing steel had been "withdrawn," yet we find it published in full in the pages of a contemporary. Such statements as those made by Mr. Annable ought to have been made the subject of the competent criticism of the Iron and Steel Institute, the paper having once been accepted by the council.

THE HARDIE AIR LOCOMOTIVE ON THE ELEVATED RAILROAD, NEW YORK.

A good deal of attention is being paid to the subject of traction by compressed air, and in view of this we illustrate herewith the Hardie locomotive, which has attracted considerable notice in the United States. Above will be found a general view of the engine, Fig. 1. Fig. 2 clearly shows the position of the four large air reservoirs E E E E^1, the lowest one E^1 running the entire length of the engine, its dished end being seen projecting beyond the cab frame. This reservoir is supported by the cylinder saddle D^2, to which the bar framing, after the usual American practice, is secured, while the other reservoirs are supported by brackets, bolted or rivetted to the lower reservoir and frame. The reservoirs are all connected by pipes *j k*, and the air passes from them through a reducing valve *l* into the bottom of a small boiler in the cab, the water of which is kept at boiling point, but the design is not to mix steam with the air, but to heat and moisten it by contact with hot water. The reservoirs E contain an aggregate of 460 cubic feet, to which air is originally supplied at 600 lb. per square inch. The working pressure in the cylinders is but 100 lb. to 130 lb., however, and it will thus be seen that this locomotive departs largely from the practice of Col. Beaumont, in which the loss of heat in the cylinders during expansion is compensated for by externally steam jacketting them. But it would seem that the amount of heat supplied to the air by the Hardie arrangement is yet too small, for in an article on this subject in a New York contemporary, *Science*, it is stated that "it has been found that when using the air expansively while running, *i.e.*, with a quick cut off, the expansion is sometimes so rapid that towards the end of the stroke the pressure in the cylinders is less than the external atmosphere; to obviate the loss of power which would be caused by the vacuum thus created, valves are placed in the exhaust passages, which prevent any vacuum being formed."

The air supply to the cylinders is taken from the top of boiler G through the throttle or stop valve G^1, shown in Fig. 3, which is connected by a lever E to the cylinder reducing valve, so that in moving the throttle lever H the reducing valve is made to "open earlier than it would otherwise do, and to close with a less pressure than is exerted by the difference in the pressure of air on the diaphragm and valve seat." The two cylinders are connected by a pipe, through which, and the pipe *q*, compressed air passes to the boiler G, thence to two small reservoirs H H, when the cylinders are used as air pumps, drawing their supply from the atmosphere, and making use in this way of part of the energy needed to retard the train going down hill or coming to a standstill. This arrangement is said to be so successful that no other brakes are required on the engine and none are made. The valve gear may be very clearly seen by Fig. 5 and in the general view; the wheel *e*, by levers J K, moving the geared segments I—see also Fig. 2—which rotates the small toothed wheels *a*, when the cut-off valves D^1 on the spindle are either drawn together or apart, they deriving their motion from a lever G coupled to a crosshead by link H. The cylinder saddle D^2, Fig. 2, is made hollow and forms an exhaust chest, from which extends the exhaust pipe I with check valve J, and it is also used as a vacuum chamber when the cylinders are used as air pumps and draw their air supply from it. A hose connected with the coupling S, Fig. 4, communicates with the vacuum brakes upon the train.

The main valve is held to its seat when the cylinders are used as compressors by the bridge-piece D, Fig. 4, connected by an adjusting screw K to a diaphragm L which just keeps it off the valve when in ordinary work. When compressing, the supply is drawn through valves E and delivered through valves F and pipe *p* into the small reservoirs previously mentioned. The admission of air to or production of a vacuum in the exhaust cavity of the saddle is controlled by a stop-cock within reach of the engineer.



At a trial in October last this engine started from 128th-street, with a pressure in the reservoirs of 580 lb. per square inch., and travelled as far as 42nd-street, about four and a-half miles, stopping at every station, and loaded with three cars containing fifty people. At 42nd-street some switching was done, and the train was returned to 128th-street with a remaining pressure of 115 lb. The weight of the engine is given as nearly that of an ordinary elevated railroad locomotive, weighing 18 tons.

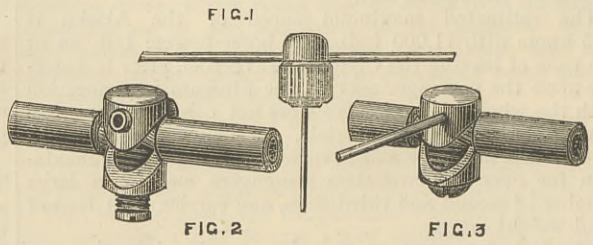
University College.—The Council of University College, Gower-street, have established a new professorship of civil engineering and surveying, in connection with the engineering department. The department has grown so much that it was absolutely necessary that Professor Kennedy should no longer be left to work alone. The special branches to be taken up by the new professor will be hydraulic engineering, railway, and road work. No appointment to the new Chair has yet been made; applications from candidates will be received up to May the 29th.

Railway Communication with Southampton.—The Didcot, Newbury, and Southampton Junction Railway Bill, the preamble of which has been proved, will bring Southampton into direct communication with Birmingham, *viâ* Newbury, Didcot, and Oxford, and with the entire Great Western system. The first portion, that between Didcot and Newbury, was opened for traffic a few weeks back. According to the decision of the committee there is to be a junction at Winchester. The news of the success of the Bill before the committee was received with great satisfaction at Southampton, and flags were hoisted and the church bells rung to celebrate it.

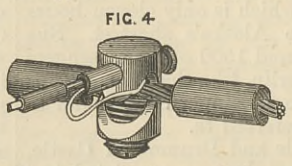
Public Scientific Analysts.—The president of the Royal College of Surgeons, Sir Erasmus Wilson, has nominated Dr. Charles Meymott Tidy to the post of scientific analyst, an appointment which the Secretary of State for the Home Department has confirmed. Dr. Tidy, who is the professor of chemistry and medical jurisprudence in the London Hospital, is deservedly well known to the profession and public generally by his numerous contributions to chemistry and toxicology. He is also well known by his investigations into the quality of water supplied by the different companies to the metropolis; and, in conjunction with Mr. Crookes and Dr. Odling, he has for some time conducted daily analyses of the London waters for the Local Government Board, analyses which show the Thames water to have a very high potable value and to be actually better than other waters which chemists—not medical men—also would condemn.

BREWTNALL'S PATENT COUPLINGS FOR ELECTRICAL PURPOSES.

The accompanying engravings illustrate a new and simple coupling, invented and patented in England and abroad by Mr. A. W. Brewtnall, for connecting branch wires with main electric light leads, which will be of especial use in fitting incandescent



lamps. The couplings consist of a small brass cylinder, one end of which is solid and the other fitted with a broad screw or nut, as shown in Figs. 1 and 3. A slot is cut in the side at an angle of about 45 deg. to the length to receive the main wire or cable. Intersecting this a hole is drilled, either longitudinally or transversely, to receive the branch wire. When the wires are put in their respective positions, and the screw or nut is tightened up, the main wire or cable is jammed forcibly against the branch wire and against the solid end of the slot. This gives a very firm and enduring contact between the two wires or conductors, and the surface contact is large, thus ensuring perfect electrical conductivity. A fusible portion can also very easily be combined with this form of connector, as shown in Fig. 4, which is an obvious advantage.



These couplings furnish a rapid, easy, and absolutely reliable means of connecting up wires, and entirely supersedes the old method of soldering. No tool or material of any kind is required, save a screwdriver and the usual knife or instrument

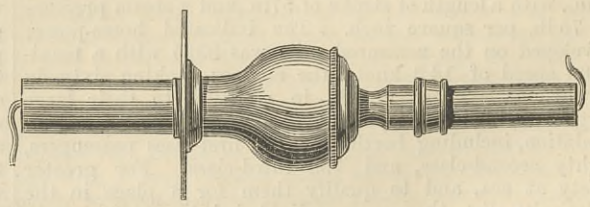


Fig. 5.

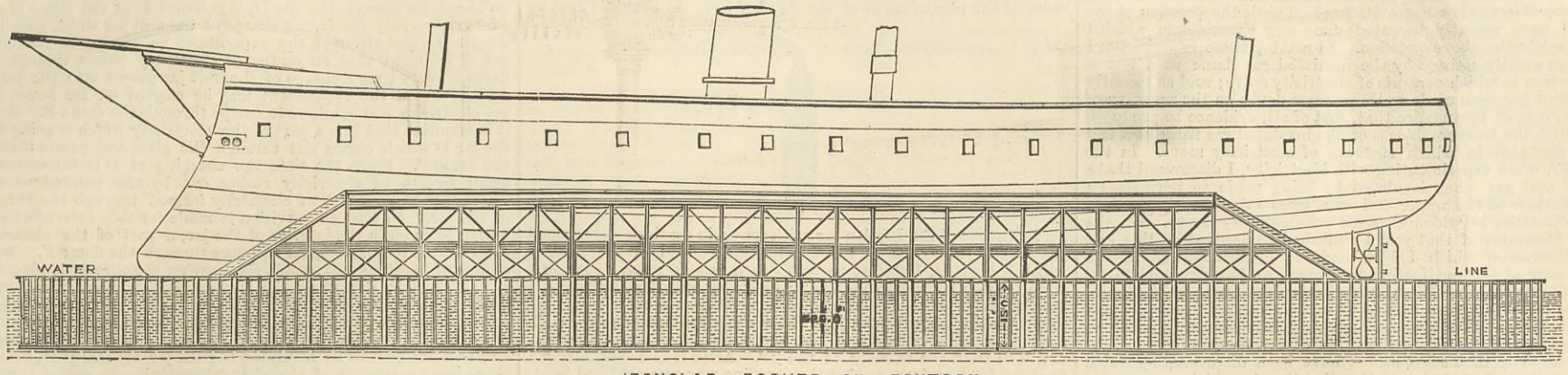
for cleaning the insulating matter off the wires. They are supplied at a very moderate cost by Messrs. Faraday and Son, Berners-street.

Fig. 5 shows a new form of ball-and-socket joint to be used with electrical chandeliers, or "electroliers," also introduced by Mr. A. W. Brewtnall. In this only one wire need be used for the lead, and the return can be made through the outer tube without any chance of short circuiting, however much the "electrolier" may swing. The contact surfaces are large, and are so arranged as to do away with all possibility of "sparking" or corrosion.

HYDRAULIC SHIP LIFTING DOCK, BOMBAY.

MESSRS. CLARK AND STANDFIELD, WESTMINSTER, ENGINEERS.

Fig. 5. SIDE ELEVATION



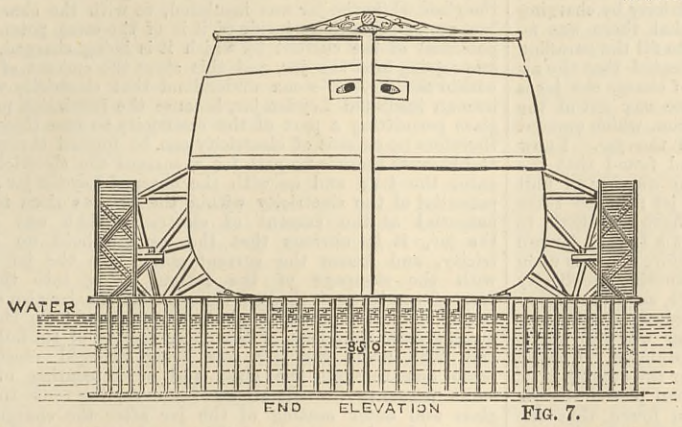


Fig. 7.

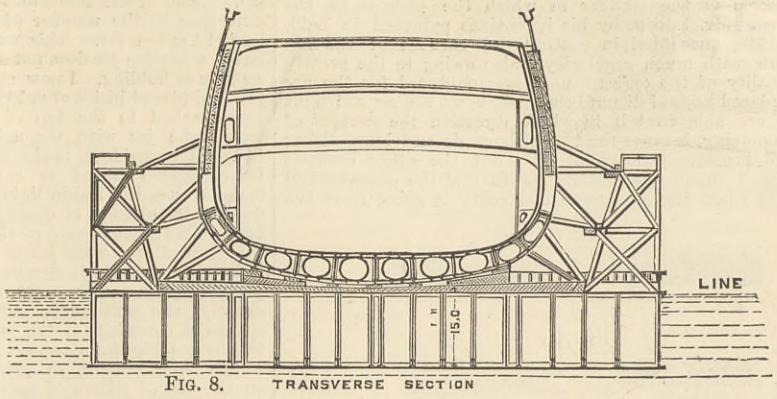
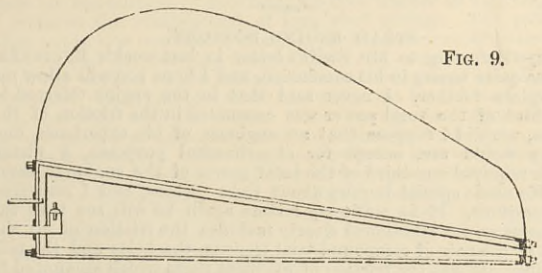


Fig. 8.

Before the committee of the United States Senate appointed to examine the scheme of the Interoceanic Ship Railway Company across the isthmus of Tehuantepec, special recommendation was made of the hydraulic and of the depositing systems for lifting the vessels from the water on to the railway and *vice versâ*. The depositing system is well known from the docks at Sebastopol, Vladivostok, and Barrow, which we have from time to time described; we now lay before our readers some description of the hydraulic system which is the older of the two. There are three examples of this system, viz., one in the Victoria Docks on the Thames, which is the first in order of date, one at Malta, and one at Bombay, the last mentioned being much the largest of the three. Fig. 1 shows a transverse section of this dock, and Fig. 2 a section through one of the columns. It is situated at Hog Island, which is really a projecting part of the main land, sheltered by the island of Elephanta; the depth of water varies from 50ft. to 60ft., the bottom being soft rock; the average rise and fall of the tide is 14ft., with a maximum of 16·7ft.

The dock is 350ft. in length, and has a clear width inside of 88ft., and affords an available draught of water of 30½ft. Each of its sides is formed by a row of eighteen columns placed at intervals varying from 18ft. in the middle to 24ft. at the ends. The columns are filled with Portland cement, and are, of course, firmly secured to the rock. Their length varies according to the

Fig. 9.



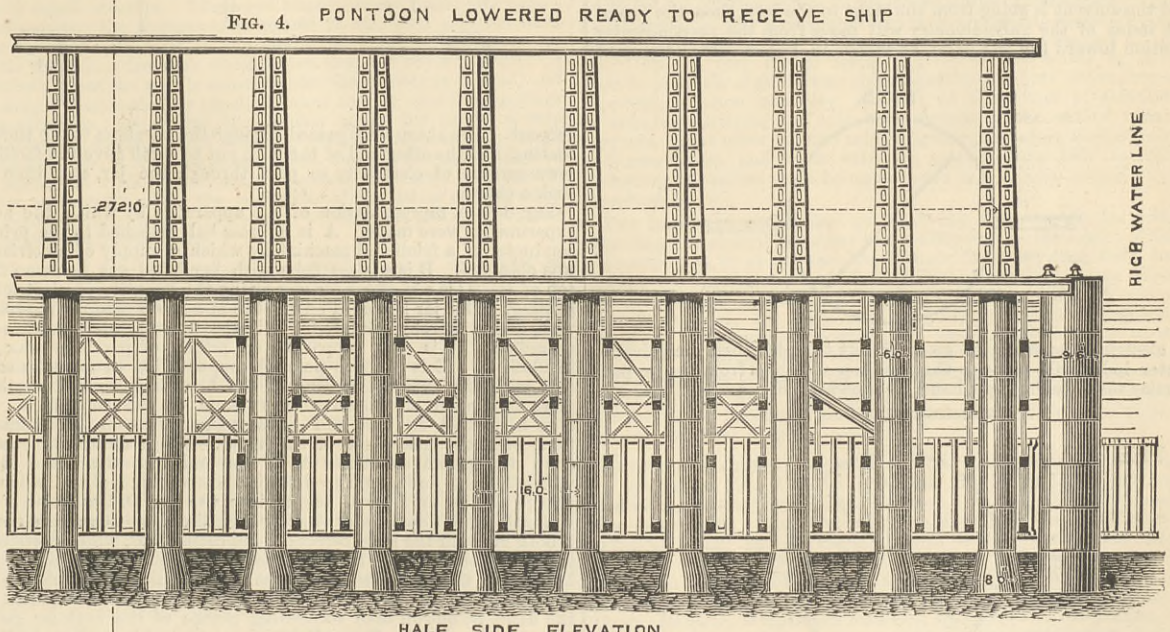
level of the bottom, the longest being 109ft. Each column is 36ft. 6in. above high-water line, and is 7ft. 6in. in diameter at the base and 6ft. 6in. at the top. There are two presses of 35ft. stroke in each column; these presses are each cast in one piece weighing 14 tons. The rams, which are all solid, are 14in. in diameter, and are attached to a crosshead which works up and down in slots in the upper part of the columns. Two rods are suspended from each crosshead, as shown in the figures. The bottom of the dock is formed of lattice girders, one end of each girder being attached to each rod, so that every two opposite columns support a pair of girders. These girders are each 10ft. 8in. in depth, and have no longitudinal connection. On the top of each side of the dock runs a longitudinal girder on which travel four 25-ton cranes used for raising the presses for inspection, &c. There is a gangway along each side of the dock placed on the outer side, 2ft. above high-water. At each end of the dock, seawards, is placed an independent fender column 10ft. in diameter.

The presses are divided into three groups in order to obtain stability, each group being controlled by a small valve; these valves are all together in a valve-house on the neighbouring pier-head, and are controlled by one man. By means of this division the power can be applied at either side or end of the dock as required. Ready means are provided for cutting off any press or presses in case of necessity, without stopping the action of the others. Each ram has a sectional area of 196 circular inches, so that with a pressure of 1 ton to the inch, a weight of more than 14,000 tons could be raised in half an hour.

The pontoon of the dock, which is an open one, is 380ft. long, 85ft. broad, 9ft. 6in. deep at the outside, and 6ft. 6in. deep at the middle; it is divided into thirty-six water-tight compartments, and can take a vessel of 6500 tons dead weight. Fig. 1 shows H.M.'s troopship Malabar being raised on it. Before docking a vessel the pontoon is lowered on to the gridiron or bottom of the dock, and allowed to descend to the requisite depth; the vessel is then brought into the dock and moored in position, the presses are then set to work, and directly the keel blocks on the pontoon touch the keel of the vessel the bilge blocks are adjusted in place, and in a few minutes the vessel and pontoon are raised clear of the water. During the raising the valves in the pontoon are left open, so that the water flows out; the valves are now closed and the gridiron lowered, leaving the pontoon floating with the vessel on it and ready to be towed into any convenient place.

The Victoria Hydraulic Dock, already mentioned, is provided with eight such pontoons of various sizes, and also with a larger pontoon furnished with raised sides, so that it can take a vessel weighing as much as 4500 tons. This dock was built in 1857; it is 310ft. long, 62ft. clear width, and has an available draught of water of 18ft. The Malta Hydraulic Dock, which was built in 1872, is provided with two pontoons, and can accommodate vessels of 3500 tons dead weight. It is 321ft. long, 62½ft. clear width, and affords depth for a draught of 21ft.

Fig. 4. PONTOON LOWERED READY TO RECEIVE SHIP



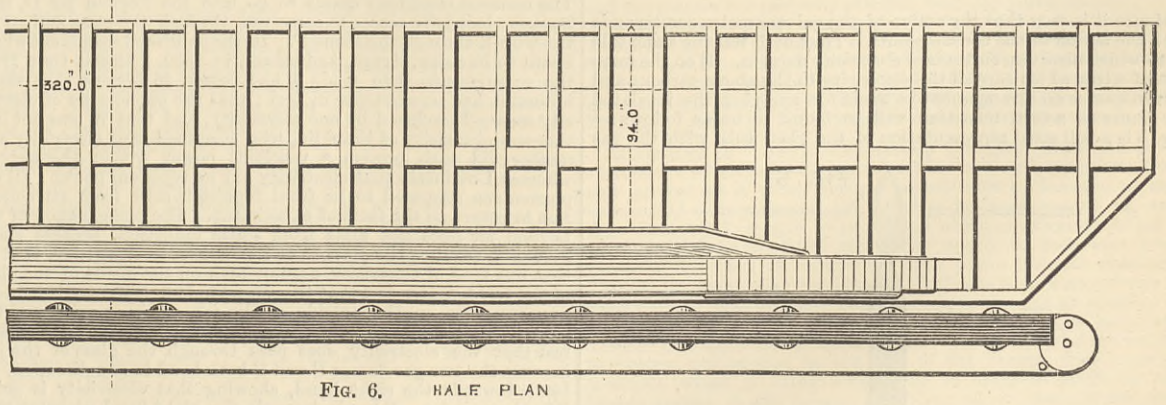


Fig. 6. HALF PLAN

Since these docks were constructed Messrs. Clark and Standfield have made considerable improvements in their designs and details. Fig. 3 shows half-end elevation and transverse section, and Fig. 4 shows half-side elvation of the latest form of hydraulic dock, wherein the bottom girders, or gridirons, are entirely dispensed with, making the pontoon serve their purpose in addition to its own. This arrangement saves much weight and allows the stroke to be considerably shortened, so that its economy is considerable. It will be observed that the suspending rods are attached directly to the sides of the pontoon. When the pontoon with a vessel on it has been raised sufficiently to allow the water to run out, its valves are closed, and it is lowered again till it floats, so that none of its weight is supported by the rams; the rods are then disconnected from the pontoon, leaving the latter free to be towed away, as shown in Fig. 5. The upper part of the columns are of open work to save weight. Fig. 6 shows part of a half breadth plan, and Figs. 7 and 8 show an end view and a transverse section of the pontoon, which it will be noticed is provided with shoring frames, so that the heaviest vessels may be supported in exactly the same manner as in a stone graving dock, although such support may with advantage be superseded by that of sliding bilge carriages each several feet in breadth.

Messrs. Clark and Standfield have prepared special designs both on the hydraulic and on the depositing systems for lifting vessels on and off ship railways, and have long been in communication thereon with Captain Eads, the prime mover of the Tehuantepec Interoceanic Railway, and with others who are bringing forward similar projects in other parts of America, and also in Europe. Although more than twenty years' experience proves the hydraulic system to be very efficient in working, the depositing system appears to be preferred, as it is 50 per cent. cheaper, and allows every part of the apparatus to be got at for cleaning and painting. The blocking proposed to be used with either system consists of separate groups of air cushions alternated with each other, so that the support given by them is the same that the vessel receives from the water, and allows no strain to be incurred in settling on the dock or railway truck. These cushions are composed of many thicknesses of stout canvas embedded in india-rubber. The pressure on the bottom of a vessel drawing 24ft. of water is about 12 lb. per square inch, whereas these bags or cushions are capable of readily supporting a pressure of 30 lb., or even 60 lb., on the square inch, which is much more than can ever be required. The bottom of the cushion is of iron, and the sides also up to a certain level; the upper portion only is flexible, and when inflated assumes a wedge-shaped form, as shown in Fig. 9.

LETTERS TO THE EDITOR.

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

WHAT IS ELECTRICITY?

Sir,—Is electricity energy or is it a peculiar kind of matter which is not subject to the law of gravitation? This is the question of the hour. I have recently invented some new experiments which I believe settle the above question. In making these experiments I have been greatly assisted by the insulated gas flame as a test of the direction in which currents of electricity move; and as recently an attempt has been made to throw some doubt on the accuracy of this test, it is of importance that, first of all, evidence be produced to establish the trustworthiness of the insulated gas flame as a test of the direction in which currents of electricity move. In the year 1839, when experimenting with electricity, I discovered that a flame of coal gas when insulated by being made to burn from a small aperture at the upper end of a glass tube gave indications of the direction in which currents of electricity move. On the 25th of December of that year I published an account of this and other discoveries which I had made in electricity, and sent a printed copy of the publication to Arago, to Faraday, and to all the other electricians of that date whose addresses I could obtain, but none of them appear to have used the insulated gas flame as a test of the direction of electric currents. At that early date there was more room for doubting the value of my discovery than there is now, for since then other means have been discovered by which we know that we can detect the direction in which currents of electricity move. Notably the chief of these is the information we now possess of the manner in which the carbons of the arc light burn. Mr. Staite, by his inventions patented in 1846, 1847, and 1848, succeeded in getting the carbons of the arc light to burn with much regularity; also owing to the greatly improved quality of the carbons now manufactured for the arc lights, it is placed beyond dispute that when we see an arc light burning we are able to tell in which direction the current of electricity is moving, because the two carbons do not burn alike; one of them becomes concave at its point the other becomes convex. Fig. 1 shows the relative position of the concave and convex points when the current of electricity is going from the

FIG. 1.

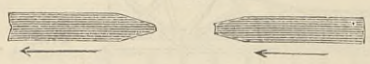
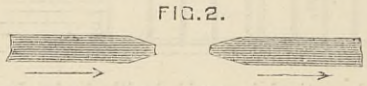


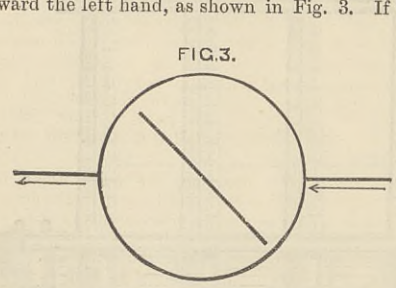
FIG. 2.



right hand to the left. Fig. 2 shows the alteration which takes place in the points of the carbons when the current is reversed.

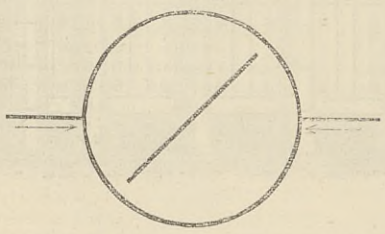
The difference in the points of the two carbons arises from small particles of the carbon being carried from the one point to the other, and we see that the one carbon—the concave—becomes less, while the other—the convex—grows, especially if the light be placed in a vacuum. When the arc light is magnified, and its image thrown on to a screen, the particles of carbon are seen moving from the concave point to the convex one, and hence this phenomenon is ocular proof as to which direction the current of electricity is moving in. If on the line of wire which carried the current of electricity to the above carbons a galvanometer is placed, and the current is going from the right to the left, then the top of the index of the galvanometer will move from the perpendicular position toward the left hand, as shown in Fig. 3. If the current

FIG. 3.



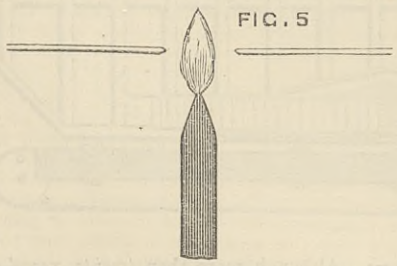
of electricity be made to go from left to right, then the galvano meter index will move so that the top of it goes from the perpendicular towards the right hand, as shown by Fig. 4.

FIG. 4.



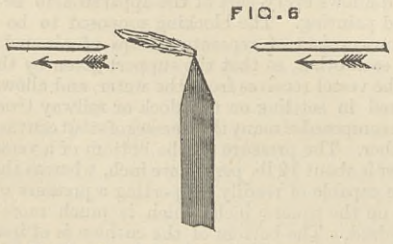
Hence it is seen that the action of the galvanometer corresponds with the action of the carbon points. They both tell the same tale as to which direction currents of electricity move in. If on the same line of wires which carried the electricity to the above carbons and galvanometer an arrangement be made for applying the insulated gas flame as a test, its action will be found to be as follows:—Fig. 5 is a full sized representation of the glass tube with the gas

FIG. 5.



flame at the top of it. When the current of electricity goes from the right hand to the left, as indicated by the carbons and the

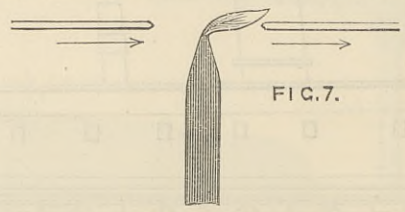
FIG. 6.



galvanometer, the insulated gas flame is blown from the right hand to the left, as shown by Fig. 6, and when the current of electricity goes from the left hand to the right, as indicated by the carbons and the galvanometer, the flame goes from the left to the right, as shown by Fig. 7.

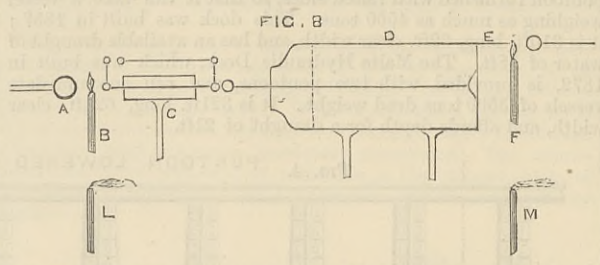
This similarity of action of the insulated gas flame with the action of the carbons and the galvanometer is a sufficient proof of the trustworthiness of the gas flame as an indicator of the direction in which currents of electricity move. The new experiments about to be described were begun with the intention of discovering the cause of the phenomenon of the Leyden jar. As Franklin had by

FIG. 7.



his invention of the Leyden jar with movable coatings determined that the phenomenon of the Leyden jar resided in the glass of which it is made, I wished to test this in another way; so with a large Leyden jar measuring 7in. in diameter and 13in. in height, I ascertained how many charges of electricity of a unit jar it took to charge the large Leyden jar. I then filled this Leyden jar with melted paraffine wax up to the mouth of it, so that all air was excluded from the interior of the jar. After it had been allowed to stand for two days, so that the paraffine wax was cold and hard, I then tested the jar's capacity for holding electricity by charging it by means of the same unit jar, and found that there was no difference in the number of charges required to fill the paraffine loaded Leyden jar. This experiment demonstrated that the air inside a Leyden jar does not affect the amount of charge the jar is capable of holding. I now emptied the paraffine wax out of the jar, and placed inside of it 14 lb. of small scrap iron, which amount just reached to the top of the tinfoil inside the jar. I now tested the jar with the unit jar charges, and found that the 14 lb. of scrap iron made no difference in the number of unit jar charges required to charge the Leyden jar; hence there is proof that the inside lining of tinfoil must have very little to do with the amount of charge of electricity that a Leyden jar can take. The phenomenon of the Leyden jar therefore depends upon the glass of which the jar is made. There is another peculiarity in Leyden jars which requires to be noted here, as it has an important bearing on the explanation of the succeeding experiments, namely, the well-known fact that a Leyden jar will not take a charge of electricity if the jar be thoroughly insulated. I tested this by coating the aforesaid Leyden jar all over the outside of it with a thick coating of paraffine wax, and then placed the jar on the top of pillars of paraffine wax. I then found that the jar could not be charged when in this state, but on passing a sharp pointed wire through the coating of paraffine till it reached the tinfoil coating of the jar, then the jar was able to take a charge of electricity. The reason of the foregoing is that electricity will not move in any direction unless facility be given to it to form a

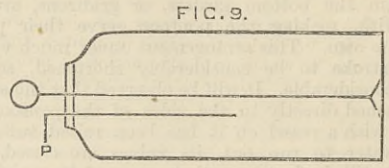
FIG. 8.



current. The sharp wire passed through the paraffine to the tinfoil coating, and the other end of the wire put to earth gave the facility for a current of electricity to pass through the jar, and then it took a charge.

Fig. 8 is a representation of the apparatus by which the new experiments were made. A is a brass ball attached to the prime conductor of a frictional machine by which a supply of electricity was obtained. B is a glass tube with insulated gas flame on the top of it. C is a unit jar for measuring the quantity of electricity passing. This jar is placed on the top of a stand made of paraffine wax, and is thereby insulated. D is the large Leyden jar already described. It is also supported on pillars of paraffine wax to insulate it. E is a sharp pointed copper wire in metallic contact with the external coating of the Leyden jar. F is another glass tube with an insulated gas flame on the top of it. H is a brass ball on the end of a copper wire in communication with the gas pipes of the house. When electricity passes from the prime conductor A to the unit jar the flame B is violently bent down in the direction shown by L; and when a charge of the unit jar C passes into the jar D, the flame F is violently bent down as shown by M. The flame B and the flame F both move in the same direction, indicating that, while electricity is going in through the flame B, electricity is coming out of the jar D through the glass and the flame F. At the first discharge of the unit jar C into the jar D the flame F is as much bent down as the flame B, but on each succeeding charge of the unit jar going into the jar D, the flame F becomes less and less affected till at last the flame F stands upright; the jar D is then fully charged. The moment electricity ceases to go into the Leyden jar D, that instant electricity ceases to come out through the glass and go by the wire E through the flame F. In the published document which I sent to Faraday, Arago, and others, in 1839, I stated that from the experiments then made I had reason to believe that static induction had no existence in fact; that the phenomena of electricity were all produced by one electricity, and that it was not like the one electricity of Franklin, who imagined that electricity and matter did each possess a repellent power within themselves, whereas I maintain that electricity has no repellent power; all the phenomena supposed to be from repulsion arise from attraction. But to return to the facts of experiment. The phenomenon of the Leyden jar does not arise from static induction, because static induction requires the glass to be impervious to electricity, that is, that one kind of electricity accumulates on the inside of the glass of the Leyden jar, and that the other kind of electricity is induced to accumulate on the outside of the jar, and that neither of the electricities can pass through the glass of the jar. Now it is manifest that the electricity does pass through the glass of the jar, because the two gas flames B and F both bend in one direction. B bends towards the right hand, showing that electricity is going into the unit jar. F bends towards the right hand, showing that electricity is coming from the outer coating of the jar. Where is it coming from? It must be coming through the glass. This is proved by the following experiment, and it puts an end to the myth called static induction.

FIG. 9.



The same arrangement of apparatus as before is continued except that a plug of paraffine wax is placed in the mouth of the jar D, and there is inserted into it a piece of No. 16 copper wire (see Fig. 9), through the paraffine plug, so that the wire is insulated. Six inches of the wire extend inside the jar, and it is in contact with nothing but the air inside the jar; the outer end of the wire is sharpened to a fine point. With this arrangement of the jar D a different result takes place. At first the flame F is affected in the same way as in the former experiment, and as each succeeding charge of the unit jar goes into the jar D, the flame F becomes less and less affected, until the flame F stands nearly erect; but when the number of charges of the unit jar have passed into the jar D, which formerly was sufficient to charge the jar D, it is found that the flame is still affected by every succeeding charge of the unit jar which goes into the jar D; and although the experiment be carried on for hours, yet it is found that an escape of electricity passes through the flame F every time a charge of the unit jar passes into the jar D. As I have said the experiment may be carried on for hours, and yet electricity will continue to escape through the flame F. Hence it is manifest that it is a part of the electricity which is going into the jar D which comes out through the glass and passes through the flame F. From the time the charging of D is commenced a small stream of electricity rushes out by the pointed wire P. There is thus a current of electricity formed through the interior of the jar. As long as provision is made for this current of electricity to go on in the interior of the jar, a part of the electricity comes out through the glass and goes through the flame F. When a piece of paraffine wax, made for covering the wire P, is placed on the point of it, this stops the electricity from coming out by P, and this stops the internal current in jar D; then no electricity will go into the jar D from the unit jar, and no electricity comes out through the glass to the flame F. It was proved that electricity will not go into an insulated Leyden jar to charge it, because there was no current of electricity through it—no outlet through the glass while the jar was insulated, so with the charged jar D; because the electricity inside of it is of the same potential as the potential of the current by which it is being charged, electricity stops going into the jar, and this stops the current of electricity within the jar. We can understand that electricity will not go into an insulated Leyden jar, because the insulation prevents the glass permitting a part of the electricity to pass through it, and therefore no current of electricity can be formed through the jar, and because there is no path for a current the electricity will not enter the jar; and so with the charged Leyden jar; when the potential of the electricity within the jar has risen to the same potential as the current of electricity that was going into the jar, it is obvious that the jar can hold no more electricity, and hence the current going into the jar stops, and with the stoppage of the current going into the jar the current coming out through the glass of the jar also stops. But seeing that the potential of the electricity inside the jar is so much greater than that of the outer coating of tin foil of the jar, and that while the jar was being charged electricity did come out through the glass and outer coating of the jar, what prevents the electricity from coming out through the glass and outer coating of the jar after the charging current stops going into the jar? The explanation of this mystery must be looked for in the electricity's own action. As has been already stated, when the first charge of the unit jar passed into the jar D the flame F was violently affected, showing that most of the first charge of the unit jar passed out of D through the glass, but as each succeeding charge of the unit jar entered the jar D the flame F became less and less affected, showing that there is in the electricity which entered D some power of contraction, which increased in amount as the potential of the electricity within D increased, until at last this contracting power had sufficient force to prevent any electricity from passing out through the glass. Now this contracting power can be no other power than that of the electricity's attraction of cohesion for its own particles, and hence it is manifest that electricity is a peculiar kind of matter which possesses attraction of cohesion for its own particles, yet it is not acted on by the law of gravitation. In 1839 I was of the opinion that electricity is the ether of the astronomers, that it fills all the space between the heavenly bodies, but my opinion of it has changed in so far that I believe there must be a small quantity of hydrogen along with the electricity that forms the ether of the astronomers, because electricity has a very powerful attraction towards hydrogen, and as hydrogen is little influenced by the law of gravitation, it is possible that the attraction of electricity for hydrogen overcomes the attraction of gravitation for hydrogen, so that the ether of the astronomers will be a mixture of hydrogen and electricity.

James Johnstone.

Experiment Rooms, 1, James-square,
Edinburgh, May 3rd.

STEAM ENGINE ECONOMY.

Sir,—Referring to Mr. Swift's letter in last week's Engineer, he was quite wrong in his conclusion, and I hope you will allow me to explain further. I never said that in the engine referred to one-third of the total power was consumed in the friction of the piston, nor did I suppose that an engineer of his experience and ability would use, except for experimental purposes, a piston which required one-third of the total power of the engine to move it. He made special inquiry about tight pistons, and I answered his questions. If he reads my letters again he will see that the 104-horse power mentioned clearly includes the friction of all the parts of the pair of compound trial engines, the belts and the mill shafting. It was the friction of all these parts which amounted to one-third of the total power, and which was, as I showed, about double the frictional resistance of simple Corliss engines and the shafting connected with them. If I was correct in supposing that a considerable portion of this friction of the pair of trial compound engines was owing to the tightness of one of the pistons, the results obtained by Mr. Longridge, instead of being "phenomenal" and "extraordinary," could be easily explained in the way that I pointed out.

William Inglis.

Bolton, May 15th.

THE ABSORPTION OF WATER BY BRICKS.

Sir,—I find that Rankine, Molesworth, Spon, and Hurst all agree in stating that bricks absorb about $\frac{1}{15}$ of their weight when immersed in water for twenty-four hours. I shall be glad if some of your readers can inform me to what class of bricks this statement refers, as I have tested for absorption a considerable number of good hand-made bricks from various localities in Lancashire and Cheshire, and I find that they absorb from $\frac{1}{12}$ to $\frac{1}{8}$ of their weight in twenty-four hours. The following are the mean results of my experiments:—

	Weight of brick before immersion.	Weight of brick after immersion.	Increase in weight of brick.
	lb. oz.	lb. oz.	lb. oz.
Common bricks ..	7 9¼	8 8¼	0 15 or $\frac{1}{15}$th.
Pressed bricks ..	7 11	8 8	0 13 or $\frac{1}{9}$th.

The pressed bricks absorbed from $\frac{1}{15}$ to $\frac{1}{7}$ of their weight, so that in only one case, that of a highly-finished pressed white facing brick, have I found the absorption to be as small as stated by the authorities I have quoted.

Inquirer.

Liverpool, May 15th.

CHURCH'S SLIDE VALVE.

Sir,—In your issue of the 12th May Mr. W. Henry Neal makes some remarks on my patent slide valves. He asks why Messrs. Fowler discontinued making them. It was because they thought they could manufacture according to a patent—No. 404—taken in 1879 by some of their partners and draughtsmen. This they found, however, to be an invasion of my rights.

It is not my business at present to suggest "inflated ideas" as to the merits of my valves. Those who are acquainted with them sufficiently appreciate their merits.

W. C. Church.

14, Trinity-square, Brixton, S.W., May 16th.

Naval Engineer Appointment.—Henry Jolliffe, engineer, to the Victoria and Albert, additional, for the Alberta, vice Blackburne.

RAILWAY MATTERS.

THE railway from Port of Spain, Trinidad, to San Fernando will shortly be opened throughout.

BY the opening of the railway to Peshawar on May 1st, we have the communication with the frontier which was so much wanted during the Afghan war.

THE Bill promoted by the Thames and Severn Canal Navigation Company for relinquishing the canal which at present connects these two rivers together, and for the construction of a railway upon a portion of the site of the abandoned canal, was withdrawn at the latter end of last week.

A NEW line is not unlikely to be promoted from Rhondda to Hirwain, thence by co-operation with the Neath and Swansea Canal and Tramway to Swansea. If in connection with this a short line could be run from Merthyr to Hirwain, *viâ* Cefn, over the Brecar and London and North-Western, the North would be brought nearer to Rhondda coal traffic by fifty miles.

THE Great Northern Railway Bill, which has been passed by a Select Committee of the House of Commons, gives the Sutton Bridge Dock Company power to agree with the proprietors to transfer the whole dock undertaking to the Great Northern Railway Company, freed from the control of the dock company or its directors. The Great Northern Company takes powers under the Bill to raise £1,500,000 additional capital, with further borrowing powers not exceeding £500,000.

THE Staffordshire Tramways Extension Bill was on Tuesday referred to a Select Committee of the House of Commons. The Bill seeks to confirm a provisional order of the Board of Trade, authorising the construction of tramways in the parishes of Darlaston, Wednesbury, and Walsall, and amending the Staffordshire Tramways Order, 1879. By this order provision is made for the carriages on the tramways to be moved either by animal, steam, or mechanical power, and for the conveyance to include besides passengers, animals, goods, and minerals. Cheap fares are to be charged to the labouring classes. The Corporation of Walsall are to have the right of purchase of so much of the undertaking as lies within or relates to the borough of Walsall.

IN concluding his report on the accident that occurred on the 30th March at Chartley Station, on the Stafford and Uttoxeter branch of the Great Northern Railway, Colonel F. H. Rich says, "The Great Northern Railway Company have now issued instructions that the speed through the stations where there are loop lines shall not exceed 10 miles an hour, and if this is adhered to, accidents of this kind will certainly not occur. It is desirable that these loop lines should be constructed so that the run through the facing points shall always be on the 'straight,' and that the 'S' curves shall be at the opposite end, where the trains run out on to the single line through the falling points. I think it would increase the strength of the permanent way and thus add to the safety of travelling on railways, if the crossings were tied to the check rails and running rails, with strong iron plates which would act as gauge ties."

A PAPER on the Mexican Railway has recently been read before the Institution of Civil Engineers of Ireland by Mr. W. H. Mills. The main line, which occupied several years in construction, is about 300 miles in length, and from the sea level at Vera Cruz it makes an ascent of over 8000ft. to the table lands on the great plains of Mexico. From the top of the Metlac Valley incline to Orizava the line rises about 650ft. in a distance of eight miles, with varying gradients following the contour of a comparatively open and cultivated country. In the next twenty-five miles above Orizava the steepest gradients have to be encountered, and on this section the line for three miles below the Maltrata station, and for twelve miles above, up to Boca del Monte, is on a gradient of 1 in 25, with frequent curves and reverse curves of 400ft. radius. The town of Maltrata stands on a small plain, hemmed in on every side by mountains. From this place to Boca del Monte the line rises 2373ft. The actual distance in a straight line is about three miles, but by careful study of the ground and contour of the hills a line has been obtained, twelve and a-half miles in length, having an almost continuous gradient of 1 in 25. It was considered preferable to make this length of twelve and a-half miles in one continuous direct ascent rather than resort to any system of zigzag lines. The gauge is 4ft. 8½in. Vignoles rails from 60 lb. to 75 lb. per yard, being used on sleepers 9ft. long and 10in. by 5in. section placed 3ft. apart. The stock is all of the central buffer type.

A NEW motor system is reported to have been developed in Philadelphia—the propulsion of street cars by the expansion of steel springs. For a long time efforts and experiments have been made for the purpose of producing an even temper in long lengths of metal in the manufacture of long steel springs. The patents taken out in this connection claim, says the *American Engineer*, to effect this, as the following description by the company controlling them will explain:—The motor consists of six springs coiled upon a cylinder. Each spring will be made of a flat bar of steel 300ft. long, 6in. wide, and ¼in. thick. These springs are tempered by the new process so uniformly and so delicately that their power becomes tremendous. After first being coiled so that their diameter is 18ft. they are tempered, and then wound up until the diameter is 7½ft. In this condition they are placed upon the motor truck and the appliances of the patents adjusted. A stationary engine at the terminus of the road then winds the springs to a diameter of 40in., and it has been demonstrated that the power of the expansion of the six springs from 40in. to 7½ft. in diameter is sufficient to drive an ordinary street car full of people five miles on any track in Philadelphia. The springs are so entirely under the control of the brakeman that he can use the power of all of them at once or limit the power to one, or in going down a steep grade he can shut them all off. A check prevents the car from running at a greater rate of speed than nine miles an hour.

MESSRS. WILLIAM COLLIER AND CO., of Salford, Manchester, have this week completed for the Lancashire and Yorkshire Railway Company an improved tool for manufacturing railway springs, which, by an ingenious arrangement, combines all the processes of shearing, tapering, shaping, punching, slotting, and nibbing. The machine consists of an upright frame, carrying three slides in the centre, working respectively to a couple of dies for pointing the spring ends and putting on the nibs and to a punch for cutting the horizontal slot. At one end of the machine a fourth slide works to a circular punch for cutting the centre bolt hole, and above is carried a pair of shears for cutting the steel bars to the requisite length, whilst at the opposite end is a pair of rolls for tapering the extremities of the springs. The process of working is very simple. The first operation is the shearing of the steel bar to the proper length; the ends are then tapered by being passed under the rolls, the bottom roll being constructed with grooves to prevent the widening out of the metal under pressure, whilst it is also turned excentric, so that as it revolves in a certain position, the rolls open out about 1in. apart to allow the bar to be passed between until it reaches a stop adjusted to the required distance, when the rolls gradually close and force the bar outwards towards the operator and give the requisite taper. The centre hole for the bolt is next punched, and the spring is then placed on an adjustable stop or peg which passes through this hole and is carried on one of the centre slides to the inverted V-shaped die which cuts out the pointed end to the spring, the cut-off piece of metal being taken away by an automatic arrangement at the back of the machine. The spring is then passed on to the next slide, where it is again held on an adjustable peg through the bolt hole and carried by the second slide under the punch for cutting out the longitudinal slot, after which it is passed on to the third centre slide in similar manner and brought under the die for forming the nib. The spring is then turned round and the opposite end shaped, punched, and nibbed by the same process, when it is ready for being passed on for tempering and finishing. The machine, which is driven by ordinary gearing, is very compact in form, occupying a space of not more than 9ft. by 6ft. 6in., and requires only one man for operating.

NOTES AND MEMORANDA.

THE average consumption of coal per ton of finished iron produced in England, including that used under the boilers, &c., is put at 3 tons.

THE total production of zinc in Europe in 1880 was 203,330 tons. Germany produced 99,405 tons; Belgium, 65,010 tons; England, 22,000 tons; France, 13,715 tons; and Austro-Hungary, 3200 tons.

THE annual rate of mortality last week in twenty-eight of the largest English towns averaged 21·9 per 1000 of their aggregate population, which is estimated at 8,469,571 persons in the middle of this year. In Greater London 3508 births and 1841 deaths were registered, equal to annual rates of 37·4 and 19·7 per 1000 of the population.

A RECENT communication to a contemporary on sea shore alluvion and on Langley Point, by Mr. J. B. Redman, M.I.C.E., concludes: "The remarkable changes in the coast line along Eastbourne Bay, its small depth, the little protection afforded by Beachy Head, and the eastward movement of Langley Point are, as in the Dungeness case, arguments against artificial works in either of these bays."

IN Germany the consumption of fuel in the manufacture of pig iron is exceedingly variable. Mr. Schlink, of Mulheim-on-the-Ruhr, states that at Ilsede the average quantity of coke used per ton of white forge iron is 19⅔ cwt., which is exactly 2½ cwt. less than the same quality of iron is made for in Moravia. Mr. Massenez informed Mr. J. S. Jeans, who read a paper on the subject at the last meeting of the Iron and Steel Institute, that at Hoerde the average consumption of coke for this quality of iron is 18 to 19 cwt., while for grey pig iron the average of the coke used runs up to 26 and 27 cwt. At Bochum, Bessemer pig iron is being regularly made with an average of 19 cwt of coke. At Baron Rothschild's works in Austria the consumption of fuel in 1881 averaged the following figures:—For foundry pig iron, 28 cwt. of coke; Bessemer pig iron, 24⅔ cwt.; forge pig iron, 22½ cwt.; spiegel pig iron, 26; ferro-manganese, 36 cwt. These averages are, of course, exceptionally high, but the coke contains about 11 per cent. of ash and 4 per cent. of water, so that it does not bear comparison with the much purer coke of Durham and Connelsville.

THE increasing use of firebrick stoves has largely contributed to economy of fuel in the blast furnace, and it is probable that much still remains to be done in this direction. Up to the present time the total number of furnaces in the United Kingdom supplied with stoves on the Whitwell and Cowper system is respectively sixty-one and fifty-one, or a total of 112 out of a total of 968 furnaces erected. By the adoption of these stoves an economy has invariably resulted, varying from 10 to 20 per cent. of fuel. The amount of this economy is, of course, dependent upon the condition of the pipe stoves with which the firebrick stoves are compared. Mr. Cowper states that by comparison with common pipe stoves, those which bear his name have usually shown an economy of 20 per cent. in fuel, and that by comparison with pipe stoves of the best kind the economy is 10 per cent.; and that at Bolckow, Vaughan, and Co.'s works, where eight Cowper stoves were erected last year, an economy of 4 to 4½ cwt. of coke per ton of pig iron made has resulted. The stones previously used were, however, out of order. In furnaces using raw coal the economy runs sometimes from 7 to 8 cwt. per ton of pig.

M. P. LAUR'S account of the following experiment on electric current produced by light has appeared in the *Comptes Rendus*. In a dark chamber is placed a glass vessel with plain sides, in which is poured a solution of 100 water, 15 common salt, and 7 sulphate of copper. In this solution is placed a porous vase filled with mercury. Two electrodes, one of platinum another of sulphuret of silver, are inserted, the first into the mercury, the second into a cupric solution. These two electrodes are connected with a galvanometer, the apparatus is placed in the sun, and the dark chamber shut. As soon as the circuit is closed the galvanometer needle turns in a direction which shows that the silver sulphuret is positive; when the needle comes to rest the shutter is opened, and the needle is immediately repelled, soon coming to a new position of equilibrium; on closing the shutter again the needle slowly retrogrades towards its first position. When the needle is placed in the open air, if a cloud passes before the sun the movements of the needle show the variations of luminous intensity. The movements are attributed to the reduction of the silver sulphuret by the cupric proto-chloride, a reduction which takes place only under the action of the sun's rays.

PROFESSOR EDLUND says a vacuum is a good conductor of electricity. In a vacuum tube he distinguishes two resistances to passage of the current—one is that of the column of rarefied gas, the other exists at the places of contact of the electrodes with the gas. As the gas is increasingly rarefied the former decreases, but the latter increases, and at length becomes so great that the current cannot pass. Professor Edlund has furnished proof that this obstacle is due to an electromotive force giving a current opposite in direction to the principal current. One evidence that vacuum presents very little resistance to passage of electricity is that if electrodes be dispensed with, electric movements so considerable as to give light may be produced by induction at a distance, or by friction, in a tube in which the air is too rarefied to allow of a strong induction current passing between electrodes. If vacuum be a good conductor, it must favour the propagation of such influence by virtue of which an electrical disturbance in one body calls forth electrical movements in another. Further, the difficulty as to the great height of the aurora and its electrical nature, seems to be met, and the conception that ordinary matter is necessary for propagation of electricity falls.

AN important contribution to physico-mechanical science has been made by M. Berthelot in a memoir communicated to the Académie des Sciences of Paris, upon the rapidity of propagation of a wave of explosion. An explosion in a gaseous compound propagates itself, it would appear, far more rapidly than a sound wave could travel in the medium. For example, the velocity of sound in mixed oxygen and hydrogen gases is 514 metres per second, while the explosion propagates itself at 2814 metres per second. M. Berthelot concludes that the wave is therefore not an acoustic wave at all, but a wave of chemical action. The characteristics of this new mode of propagation appear, as described by *Nature*, to be the following:—"Uniform velocity of propagation—through tubes—independence of this velocity of the material of the tubes; tubes of lead and gutta-percha of equal calibre conveying the explosion at equal rates. The velocity in a capillary tube is slightly less than in a wide one, being 2390 metres per second for oxyhydric gas as against 2840 metres. The velocity differs in different mixtures, being 1080 metres per second in a mixture of oxygen and carbonic oxide. The velocity is independent of pressure, which in the experiments varied from 1 to 3 atmospheres. M. Berthelot attempts to identify this velocity with that of the translation of the gaseous molecules at the temperature attained in the explosion, as calculated from the formula of Clausius, $v = 29{\cdot}354\sqrt{\frac{T}{\rho}}$ —metres per second—where T is the absolute temperature and ρ the density at 0 deg. of the gas relatively to the air. He assumes T as 3000 deg. in each case, which would give for the oxyhydric mixture a velocity of 2000 to 2500 metres per second and 1300 for carbonic acid. M. Berthelot therefore propounds the following view as to the way in which explosive action is propagated. In the film of gas first kindled a certain number of molecules are urged forward with a velocity corresponding to the maximum temperature of the chemical combination. Their shock against the neighbouring films determines there the commencement of chemical action, and so the movement proceeds, a uniform rate being observed except for those molecules which are close to the walls of the tube which give up in the form of heat a portion of their kinetic energy to the solid matter of the tube.

MISCELLANEA.

A NEW company to work the Fitzgerald incandescent lamp announced.

A COMMITTEE of telegraph engineers is to be appointed to report on fire risk and electric lighting.

A PAMPHLET containing a large number of sections of angle irons, with dimensions, has been published by Mr. J. Lea, London.

THE Luxemburger Bergwerks and Saarbruecken Eisenhuetten Actien Gesellschaft has issued a small hand-book of numerous sections of joist irons, illustrated by coloured lithographed sections.

THE German Government has adopted the plan of attaching experienced architects and engineers to their Embassies and Legations abroad, in order that they may report on new inventions in matters coming under their professional notice.

IT is announced that a joint purse agreement has been executed between the Anglo-American Telegraph Company, Limited, the Direct United States Cable Company, Limited, La Compagnie Française du Télégraphe de Paris á New York, and the American Telegraph and Cable Company.

THE method of sewage disposal for some time in use at Hertford has been so successful that the Corporation have agreed with the Rivers' Purification Association, of Gresham House, London, to continue the purification of the sewage of the town for a further period of five years at an increased subsidy.

SEVERAL of the largest exhibitors of electric lights at the Crystal Palace have been induced to continue their exhibition until about the end of this month. The attractions are therefore now greater than ever, as the light in the buildings and as seen in the grounds adds to the pleasure of a visit during the warmer evenings. The great light in the tropical department is now lighted at a late hour, and throws a fine light into the grounds.

A "SUBMARINE TELEGRAPHIC ENTERTAINMENT," combining popular descriptive history and explanation of the mode of laying submarine telegraph cables, illustrated with large diagrams of the Great Eastern and other ships paying out cables, with suitable musical accompaniments, will be given by Mr. F. C. Webb, M.S.T.E., at half-past two o'clock on Wednesday, the 31st May, in the St. George's Hall, Regent-street, W.

A MOVEMENT in favour of the construction round our coasts of harbours of refuge is being supported by the Earl of Aberdeen, the Duke of Teck, and a large number of members of Parliament and others. The secretary is Mr. F. Johnson, of Norman-road, St. Leonards-on-Sea. The first object is to get a national expression of opinion on this subject, so that something may be done in Parliament towards a recognition of the necessity for such harbours.

THE Newfoundland Legislature has passed an Act authorising special facilities for the construction of a graving dock at St. John's. The builders are to get £6000 annual subsidy, and also the Government endorsement for £120,000 worth of bonds. The proposed dock is to be capable of accommodating the largest steamers. It will be 600ft. long, 100ft. wide at the coping, 83ft. at the bottom, 30ft. in depth, and 66ft. in width at the entrance.

THE London Sanitary Protection Association has just issued its first annual report. This association has a number of officers, including consulting and resident engineers, whose services are devoted to the members, the association having no share capital and cannot be used for profit. By its means an efficient and disinterested survey of a house and its sanitary arrangements may be made for the members, and by this means the most rascally, though thoroughly hidden, work of builders' and plumbers' workmen has already been detected and has explained otherwise unexplainable illnesses.

THE Commissioners of Patents issued last week two volumes of abridgments relating to the all-absorbing subject of electricity. The first includes all the specifications having reference to electro deposition and electrolysis from the earliest period down to the end of the year 1876. A very liberal scope is given to the words, so as to include methods of protecting ships' sheathing where electricity is supposed to come into play, as well as a number of eccentric patents for purifying and extracting metals by the aid of voltaic currents. The other volume relates to the generation of electricity and magnetism, and deals with the patents from 1867 to 1876 inclusive, the earlier years being included in a volume issued some time back.

THE insurance companies see that the scare about fire risks attending the electric light has had reality only in the brains of the gas companies, or at any rate the Phœnix Company does, for it has defined the conditions on which it will insure buildings into which the electric light is introduced. These conditions are, of course, mere formalities, for they require nothing electrical engineers would not in the ordinary course give. The insulation of the wires, the proper union of joints, the regulation of the size of the wires according to the intensity of the current, are to the suppliers of electricity only what the stoppages of leakages and the proper adjustment of "fittings" and the regulation of the sizes of the pipes are to those of gas.

ANOTHER steam towing launch, similar to the one described in our columns on 29th October, 1880, has just been completed and tried on the Mersey by Messrs. Cochran and Co., of Birkenhead, who have built the vessel and also fitted the machinery, including their patent steam launch boiler, which was also specially referred to in our columns a few weeks ago in connection with the Naval and Submarine Exhibition. The new vessel, which is named El Almirante, has been built to the order of Messrs. Balfour, Williamson and Co., of Liverpool, for service in Valparaiso Bay, and the improvements in minor matters of detail has enabled the builders to secure a very marked increase of speed, and the owners are perfectly satisfied with her performances; and that the design—which was originally carried out for the Pacific Steam Navigation Company, of Liverpool—is one eminently suited for the requirements of the trade on the West Coast of South America. The principal dimensions are 45 by 10 by 6, engine single inverted high-pressure cylinder, 9in. diameter by 10½in. stroke, the Cochran's boiler, having 124 square feet of heating surface.

ACCORDING to "Möller's Steamship Circular," after the great excitement which has been prevalent for so long a period we have now arrived at a pause brought about both by foreseen as also unexpected circumstances. Few orders are now coming in, and these are eagerly sought by new firms which are anxious to get a name, whilst the old firms are either unable to undertake more work, or unwilling to reduce the high prices hitherto obtained. There is no doubt that the principal builders have work enough in hand to keep them employed all this year, and some of them even next, but in the meantime many of the new ships have been finished and are seeking employment. Not a few of them belong to France, and as soon as the rest of the French fleet becomes available which is being constructed in order to profit by the bounty system, it will become a problem where they all will find employment, as, comparatively speaking, few of them are for the established regular lines. During the first three months of the year a total of 120 steamers have been launched, of an aggregate tonnage of 220,000 tons, and we may now expect a steady monthly addition of about 100,000 tons until the end of the year. The present state of the freight market is by no means encouraging. The shipments of grain from America have for some time been quite nominal, and the freights have been drooping in consequence to ballast rates. The shipment of live stock has also fallen off to a great extent. Owing to the ruinous competition now going on for outward freights to India, a heavy fall in the rates has taken place, but homeward freights have hitherto been steady. The Black Sea, and more especially the freights from the Azov are well maintained. The great demand for ore from Spain and Africa yields also profitable employment to a large number of ships, but the rates from the Baltic open up extremely low.

HYDRAULIC SHIP LIFTING DOCK, BOMBAY.

MESSRS. CLARK AND STANDFIELD, WESTMINSTER, ENGINEERS.

(*For description see page* 359.)

FIG. 1

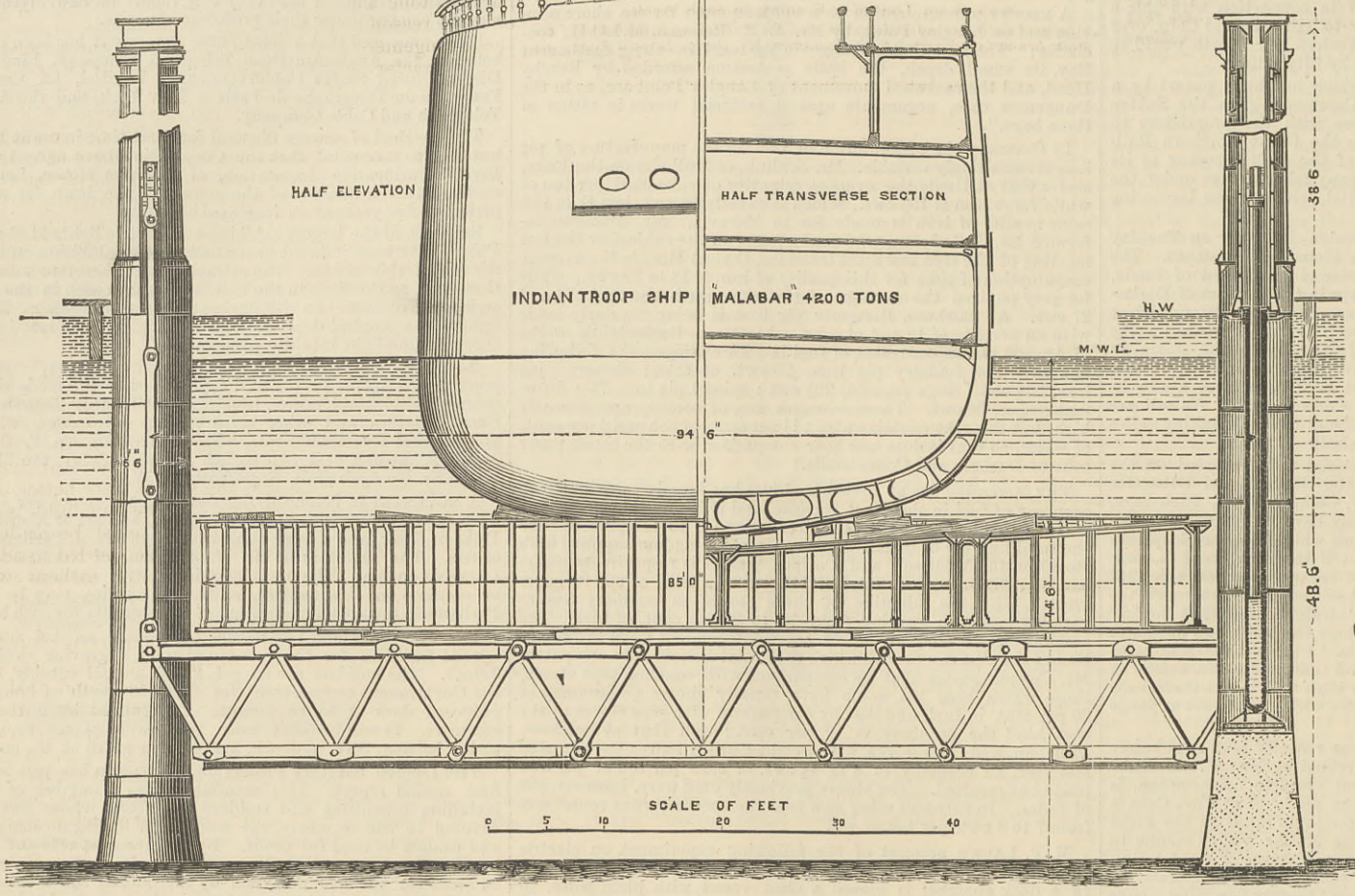


FIG. 2
LONGITUDINAL SECTION THROUGH ONE COLUMN

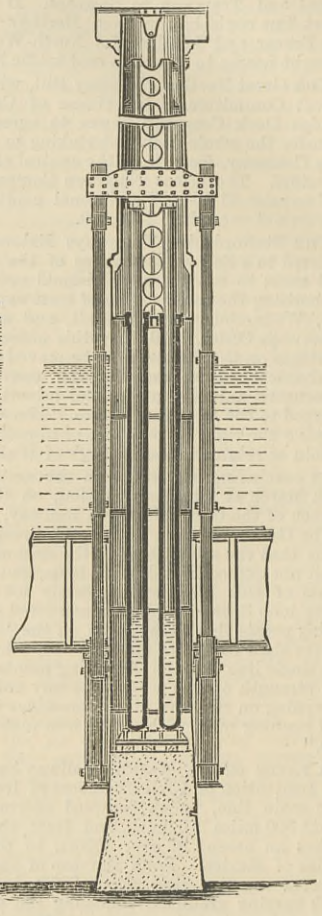
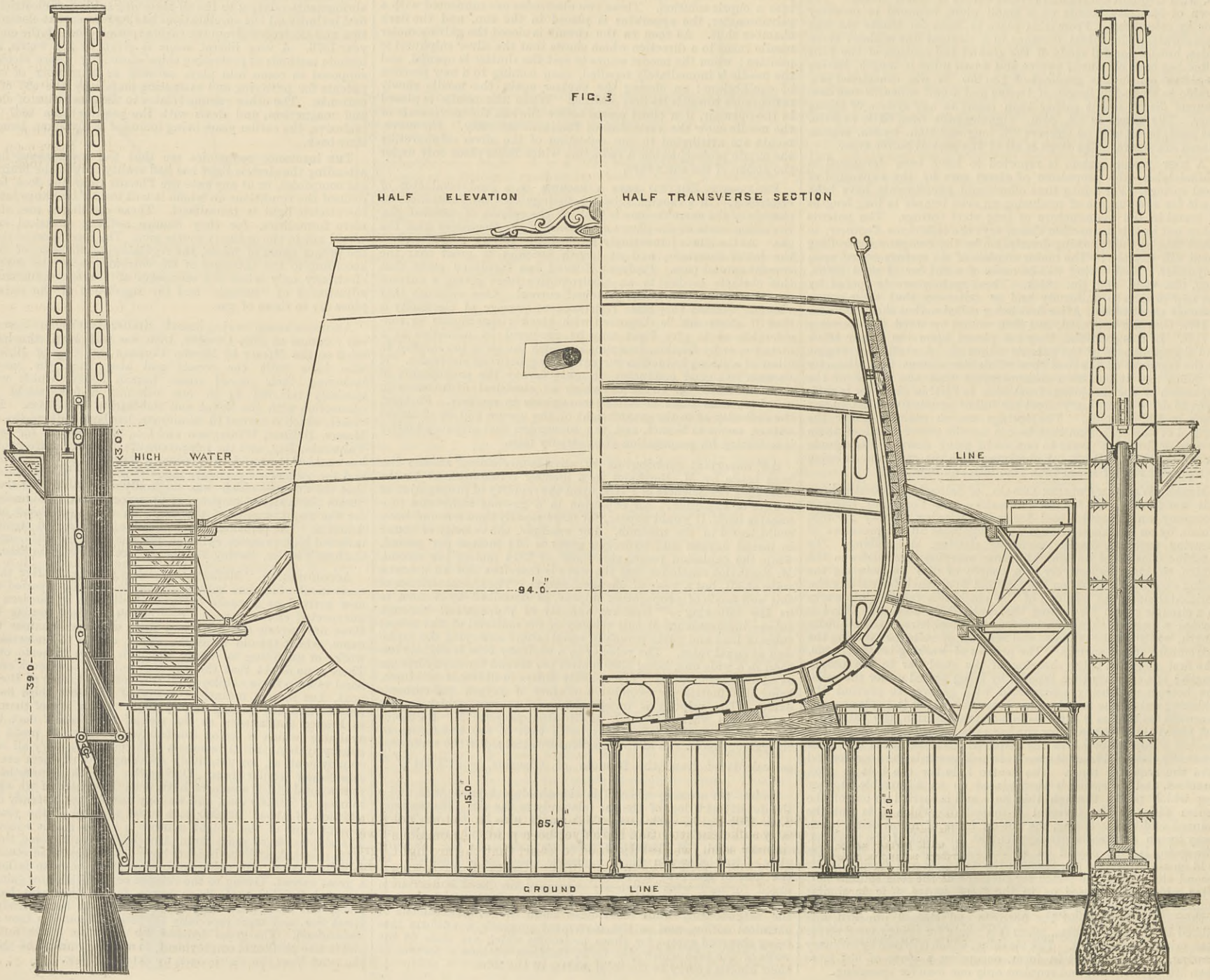


FIG. 3



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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 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.*

J. H. (Hanley).—(1) *There has been no appeal so far as we know.* (2) *Yes, it applies.*

J. D.—*Mr. Pickering,* 21, *Arundel-street, Strand, London, can supply what you require.*

H. L.—*The matter was placed in the hands of a gentleman who has not yet completed his work. Is has not been lost sight of.*

J. P. (Mauritius).—*The question has been asked before in our columns. Messrs. T. Baraclough and Co., engineers and machinists,* 97, *Bridge-street, Manchester, will give you the information you require.*

J.—*There is no fixed rule for the angle of advance or the diameter of the excentrics of a locomotive engine, as you will see if you refer to any good drawings. You can obtain all the information you need from the examples published from time to time in our "Portfolio of Working Drawings."*

J. P.—*Platinum is the most infusible metal used in the arts. Whether it will suit your purpose to make ingot moulds of it or not depends on the size of the moulds, we suppose. If you want to cast glass in any form, brass moulds will do very well for small articles. If you will state clearly what you want to do, we shall be happy to assist you.*

E. R.—*There is no one book that will meet your requirements. Consult the following:—Phillips, J. A., "Mining and Metallurgy of Gold and Silver:" 1867. Spon. Out of print. "Elements of Metallurgy:" Griffin, London. 1874. Küstel, "Roasting and Extraction of Gold and Silver Ores:" Küstel, New York.* 1880. *Randall, "Quartz Operator's Hand-book:" New York.* 2 *dols. "Manual of Hydraulic Mining:" Van Wyeman. New York.* 1 *dol.*

A WORKING ENGINEER.—*The first steamers that crossed the Atlantic were the Savannah and the Curacoa. It is understood that the Royal William was the next steamship to make the voyage, but this has been disputed. The Savannah was built in the United States, and was launched on the* 22*nd of April,* 1818, *and was sold to a St. Petersburgh firm. She steamed first to Savannah, and made the voyage from thence to Liverpool, in* 1819, *in twenty-six days, during eighteen of which she was under steam, and she was propelled by her sails alone on eight days. Her mean speed under steam was* 5½ *miles an hour. She was about* 96*ft. long,* 26*ft. wide, and she drew about* 11*ft. She had a single cylinder* 3*ft.* 4*in. diameter, and a little less than* 5*ft stroke. The Royal William was a ship of* 617 *tons and* 276*-horse power. She belonged to the City of Dublin Steam Pocket Company. She left Liverpool for New York on the* 5*th of July,* 1838, *and arrived in nineteen days. This was the first Atlantic voyage made by a steamer carrying passengers. She arrived in Liverpool again on the* 19*th of August in the same year, after a passage of but* 14½ *days. Concerning the Curacoa, we possess no information.*

MACHINES FOR CUTTING WINE CORKS.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me where I can get a machine for cutting wine corks? INQUIRER.
Enfield, May 18th.

LINOLEUM MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Can any reader favour us with the address of a maker of linoleum machinery? B. AND J.
Manchester, May 13th.

TYLER'S SWITCH.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents give me particulars of an appliance known as Tyler's switch? R. F. A.
London, May 11th.

HEURTVISE'S HYDRAULIC LIFT.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents tell me whether any of the above lifts are being made, and if so, by whom? R. E. W.

YELLOW METAL LETTERS.

(*To the Editor of The Engineer.*)

SIR,—Can any reader supply me with the names of any firms who upply yellow metal numbers and letter brands for burning names, &c., n cases? NEWRY.
Dublin, May 17th.

DETERMINING THE AMOUNT OF MOISTURE IN OIL.

(*To the Editor of The Engineer.*)

SIR,—Will any of your readers kindly give me the details of the *modus operandi* for determining the amount of oil and moisture contained in various seeds and feeding stuffs, or refer me to a published work giving the information? ENQUIRER.
May 11th.

THE PORT ELIZABETH SHOW.

(*To the Editor of The Engineer.*)

SIR,—Will you allow us to correct a statement in your paper of the 12th inst.? At the Port Elizabeth Show in March, the first prize for the best set of pumping machinery was awarded to a 5in. Invincible centrifugal pump made by Messrs. J. and H. Gwynne, Hammersmith, driven by a portable engine made by Messrs. Clayton and Shuttleworth, Lincoln, the set being exhibited by our house at Port Elizabeth, as sole representatives of these well-known firms. The second prize was also awarded to a pump of the same makers, and not, as stated, to a Hornsby pump. The Hornsby pumps only received honourable mention, as you will see from the enclosed advertisement of the exhibitors. Perhaps you will also allow us to state that Messrs. Howard, of Bedford, represented by ourselves, received every prize for ploughs—seven in all—with the single exception mentioned in your paragraph, and all the prizes for heavy harrows. We also received all the prizes for chaff and root cutters, and also the first prizes for corn mills, maize shellers, and churns.
69, Cornhill, London, E., May 17th. HOWARD FARRAR AND Co.

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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.*

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 23rd, at 8 p.m.: Papers to be discussed:—(1) "On the Various Systems of Grinding Wheat, and on the Machines used in Corn Mills," by Mr. W. Proctor Baker. (2) "High Grinding by Roller Mills in England," by Mr. Henry Simon. (3) "Roller Mills and Milling as Practised in Budapest," by Mr. William Bishop Harding.

SOCIETY OF TELEGRAPH ENGINEERS.—Thursday, May 25th, at 8 p.m.: "The Organisation and Operation of the Field Telegraph Corps in the Transvaal, 1881; also some General Remarks on Field Telegraphs," by Lieut. A. H. Bagnold, R.E.

SOCIETY OF ARTS.—Monday, May 22nd, at 8 p.m.: Cantor Lectures, "Book Illustration: Old and New," by Mr. J. Comyns Carr. Lecture III. Modern processes of illustration. Influence of photography. Surface printing. Intaglio printing. Tuesday, May 23rd, at 8 p.m.: Foreign and Colonial Section, "The Gold Fields of West Africa," by Captain Cameron, R.N., and Captain Richard Burton. Wednesday, May 24th, at 8 p.m.: Twenty-third ordinary meeting, "English and Foreign Technical Education," by Mr. E. C. Robins, F.S.A. Professor Fleeming Jenkin, F.R.S., will preside. Thursday, May 25th, at 8 p.m.: Foreign and Colonial Section, "Recent Passages of Zulu-Kafir History," by Mr. Robert James Mann, M.D., F.R.C.S., F.R.G.S. The paper will be illustrated by means of the lime-light lanthorn.

THE ENGINEER.

MAY 19, 1882.

THE ELECTRIC LIGHT.

IT has been pointed out more than once that before any comparison can be drawn between the incandescent and the arc systems of lighting by electricity, some information ought to be obtained concerning the real utility of each. In other words, it is urged that a small number of arc lights is really not so useful as a large number of incandescent lamps, although the aggregate amount of light given out by the arc may be much greater than the aggregate light of the incandescent lamps. This is a very important proposition, and must sooner or later receive the attention which it deserves; and the makers of arc lamps will, perhaps, find themselves called on to devise arrangements and modifications now unasked for, to diffuse the light of the arc and make it carry better than it does now. It is, again, evident that what applies to a comparison drawn between the incandescent and the arc lamp will also apply to a comparison between the latter and gas. It is argued now, and with a great show of justice, that fifty street lamps of 20-candle power each are of far more utility than a single electric light of 1000 candles, and even that four or five lights of 1000 candles each would not be as good as the gas lamps. We think that it must be admitted that in this respect the advocates of gas have the best of the battle; and it is a fortunate circumstance for the electrician that he has such an enormous surplus of power that he can afford to put down lamps enough to give six or eight times the light previously given by gas at about the same cost.

The advocates of the incandescent system hold that they have cut the gordian knot, and that all they have to do is to take possession of the street lamps, and replace gas burners with carbon filaments. Electricity being used on the Swan or Edison systems, no difficulty can arise about the diffusion of light. But on the other hand it is important to remember that the power required to work any district lighted on the incandescent system is much greater than that required to give an equal amount of light on the arc plan. On the latter, one indicated horse-power may be counted upon to give, say, 1800 candles, while it will not give 250 on Edison's or Swan's systems. If, however, the light of 250 candles disposed among, say, twenty lamps, is really more useful than 1800 candles concentrated in one spot, there is nothing to be urged against the former because it demands the same power. In each case we must judge by results. To estimate the value of any system of lighting in terms of candle power and engine power without regard to the true efficiency of the light obtained, is manifestly to overlook the most important factor of all. Two or three thousand candle-power might be dear if obtained with half a horse-power, and one hundred candles might be cheap if got with one horse-power, everything as we have said depending on the service rendered to the public in general, or to the individual in particular, by the light. Ot course the advocates of the arc system hold that it is quite equal to the incandescent system in this respect, yet there is, we think, every reason to believe that the arc lamp is not, in its present form, nearly so useful or efficient as it might be. Indeed there is some prospect that it will be ultimately driven out of the market by the incandescent system, unless measures are taken to avoid such a contingency. There are circumstances under which the arc light is unmistakeably better than the incandescent, though they are comparatively few. But we venture to think that there is still a great future before the arc lamp, if only it can be improved in certain directions, to which not nearly sufficient attention has as yet been paid. Anomalous as it may seem, we feel disposed to assert that the arc light will be more used indoors than in the streets of our towns, and that the incandescent light will find its great sphere of utility out of doors. We are quite aware that this is in flat contradiction to the received notions on the subject, yet a little consideration will, we think, go far to show that we are right. A room, say 20ft. square, and 11ft. or 12ft. high, could be lighted without glare to the remotest corner by an arc lamp of 1000 candles nominal, fitted as a pendant from the ceiling. What is required is that the light given out should be quite steady. Its intensity and its colour can be determined at will by the characteristics of the glass globe in which it is enclosed. It is also essential that the carbons shall not hiss or make any other noise in burning. Against such a lamp as this the incandescent system would find it very difficult to contend. The power required would be small, the fittings very inexpensive. The lamp might be so simple that a domestic servant could without difficulty replace the carbons every morning. The light would in itself be purer in tone than that of the Edison or Swan lamp, for obvious reasons. The fittings of all kinds in the house, the arrangement of wires, &c., could be of the simplest possible character, and the light could be put on and turned off just as the Swan lamp is lighted and put out. It may be asserted that no arc lamp exists which will comply with these conditions. This is true for the moment, but we believe only for the moment. It is impossible to compare the practically silent and steady light of the Crompton, Siemens, André, and many other arc lamps now in use, with the noisy, flaring, flickering light of a couple of years ago, without seeing that an enormous stride has been made. When a better carbon can be had than has yet been got, the incandescent light may look to itself for indoor work, unless, as is possible, large incandescent lamps can be made with success. Maxim lamps of 50-candle power have been tried alone with good results.

When we come to deal with street lighting we find all the conditions changed. There the arc lamp lights small areas with intense brilliancy, and leaves heavy and black shadows. The incandescent light could, on the contrary, take the place of gas with so much ease that the only change noted would be that the streets were better lighted than they ever were before. If the arc light is to be retained in use out of doors, changes must be made in it quite different in character from those needed to adapt it to indoor use. In the latter case the carbons will be reduced in size; in the former it is essential that larger arcs at a lower temperature should be employed, for it seems to be certain that the size of a luminous object exercises an important influence on the power which it possesses of diffusing its light. Again, it may be found that much advantage in this respect would be gained by burning in each lamp simultaneously two or more couples of carbons instead of but one. Of the advantage to be gained in this way, if any, very little is known. Indeed, it is not too much to say that up to the present next to nothing has been done here to determine the conditions under which the arc light can be used to the most advantage as respects diffusion. Mr. Crompton and Mr. Sprague are the only electricians who have as yet given the question serious attention. In the United States it is proposed to get over an acknowledged difficulty by fitting up six or eight 10,000 to 20,000-candle lamps on the top of a mast or tower some 150ft. to 200ft. high. The lamps would then play the part of a miniature sun. It is also not impossible that the system of borrowed light, first used by Stevenson we believe, may be applied in street lighting at least with advantage. Under this system a powerful light, say at one end of a street, and itself invisible, would be fitted with lenses and reflectors in such a way that its beams would be cut up into a dozen sections. Each of these would be thrown on a reflector of suitable construction, which would then apparently shine itself. Stevenson employed this system to light practically inaccessible rocks. On the rock out at sea is erected a reflector, on shore is the lighthouse. The rays of the lamp, instead of being sent directly out to sea, are concentrated on the reflector on the rock, which reflector sends them out to sea. To the crews of ships the lighthouse proper with its lamp may be wholly invisible. The reflector is plainly seen and appears as a lamp. That the arc light is to be regarded as defeated, even for street lighting, by the incandescent system is, we hold, a mistake; but for the reasons we have given, and which are indeed obvious enough, it is clear that steps must be taken to improve and adapt the light to the purposes for which it is required. It is above all desirable that borough surveyors, engineers, and local boards and other municipal authorities should ascertain how many and how few electric lamps are required in given districts to take the place of gas. Can, for example, one arc light of 1000 candles take the place of 20 gas lamps? If not, of how many? Which is the better, a 2000-candle or a 1000-candle arc light? These and many other questions suggest themselves. They must be answered sooner or later, and the sooner the better for all parties concerned.

We cannot conclude this article without warning our readers to consider very carefully what they are about before they invest money in the shares of the multitude of electric light companies now in the market. Those who remember the condition of the railway market about the years 1845 and 1846 will not be slow to draw a parallel between the speculation which then took place and that which is going on now. That a time will come when money may be safely invested in electric lighting we do not doubt. Even now it may be managed, but certainly not by everyone; and we fail to see that any business can be done in the immediate future great enough to earn a dividend on the enormous sums which it is proposed should be obtained from the public. Again, it would be extremely imprudent to act as though the inventions to be worked by the various companies which are being floated in the City possess much permanent value. It is, on the contrary, more than probable that the inventions which will endure can be counted on the fingers of one hand, while all the rest will be superseded. It is for these reasons that we urge upon our readers the necessity for acting with the greatest caution in making investments in electric lighting shares.

THE BOARD OF ARBITRATION FOR THE NORTHERN FINISHED IRON TRADE.

AFTER laying idle almost the whole of the manufactured ironworks in Northumberland, Durham, and the North Riding of York for a fortnight, the ironworkers have at

last thought proper to return to work. The terms upon which they have re-commenced are precisely those against which they struck on the 1st of May. They have given no reason whatever for their change of policy, and it therefore only remains to be concluded that lack of power to continue, and not lack of will, has at length forced them to give in. They had got, in fact, to the "end of their tether," and their tether appears to have been just fourteen days long. During those fourteen days something like 20,000 tons of finished iron have been lost to the market—in other words, that quantity, which might have been, and under other circumstances would have been made, has not been made. About £30,000 sterling which would have been paid in wages to the contending ironworkers has not been paid, and never now will be paid. Instead of 7½ per cent. advance for the current quarter, which they demanded as the price of returning to work, they have actually got no advance whatever; but on the other hand, have suffered a loss of two weeks' work, which is equivalent to 15 per cent. reduction over the same time. It is therefore possible that by this time they are sadder, and it is to be hoped that they are wiser men. The means employed to coerce the employers was the infliction of a similar or a heavier punishment upon them. The men knew that in striking they were incurring the loss of their wages as long as the strike lasted; but they hoped their masters would suffer even more severely, and would therefore give in the first. It is not clear, however, that the employers have suffered at all. The manufactured iron market has for some months had a downward tendency. Orders have not been given out so fast as they have run off. Being well booked at the comparatively low prices of last autumn, manufacturers have held to their prices, but have continually been more and more undersold by merchants. They would soon have had to abandon their position, and fill their books at the best price obtainable, or else follow the example of the smelters, and restrict their output. The ironworkers' strike, however, supervened, and did for them just what they were beginning to recognise the necessity of doing, but had not yet acquired the courage actually to do themselves. Taking 20,000 tons of finished iron out of the market at one swoop has been an enormous benefit from their point of view; and giving the men the good beating they have long been deserving was another, whilst the self-inflicted poverty, from the effects of which the men will take months of regular work to recover, enables the employers now to look forward to a long period of steady industry. The dead charges for an extra fortnight, which must be considered a tax upon the produce of the next six months, is not much to pay for such advantages as the above. We may therefore safely conclude that the employers have come out of this struggle without loss, and perhaps with considerable ultimate benefit.

There were, however, certain peculiarities about the conflict which distinguish it from most previous strikes of similar magnitude. The latter have usually been organised and directed by the officials of a trades union with funds at their back. The best administrators among the men have been those who have directed their efforts, and the whole of the power and resources of their organisation have been brought into play on their behalf. In the present instance, however, we have the unusual spectacle of the union leaders, the union newspapers, and the most intelligent of the union workmen all against the strikers. The latter, indeed, consisted of an insurrectionary body within or without the union, who talked and shouted and yelled at their meetings against the union leaders as much and, indeed, more than against the employers they were actually contending against. Indeed, the strikers consisted almost entirely of puddlers, who, though constituting only one-third of the ironworkers at any works, are the largest class who work under precisely similar circumstances, and are certainly the most ignorant and headstrong. Thus they have been enabled, by sheer force of numbers and community of ideas, to override all the rest for the time being, and to bring into contempt the union and the Board of Arbitration. The present moment seems not inopportune to say a few words as to the present position and future prospects of the Board of Arbitration. It came into existence about the year 1868. The original idea was conceived by Mr. Mundella, M.P., and the first application thereof was to the Nottingham lace trade. Mr. David Dale, of Darlington, was the first to apply it to the northern iron trade, and to his paternal care is largely due any success it may afterwards have obtained. Inaugurated within easy memory of the six months' strike which in 1866 paralysed the trade, both employers and workmen for a time seemed largely to favour the new method of settling trade disputes, and its decisions were for some years fairly respected. We say "fairly" advisedly, because during the period of commercial excitement which preceded the coal famine about nine or ten years since, the ironworkers demanded a heavy advance which was at variance with previous decisions of the Board, and a general strike was only saved by the employers making virtue of necessity and voluntarily giving the advance demanded. During the down-hill period which extended from 1874 to December, 1879, the general effect of the Board was by the cumbrous nature of its routine to prevent or retard the reductions of wages which were from time to time necessary. As this was not unperceived by the men, their attitude towards it in those years was one of approval. It is doubtful whether this slowness of action was really in their favour, however, because numbers of employers were ruined, and their workmen thrown idle. Lower wages might have saved the former, and given half a loaf instead of no bread to the latter. At the close of 1879, when what is now known as the "American boom," was almost at its height, the unfortunate two years' sliding scale, which has just been disdainfully cast aside by the ironworkers, was concocted, and accepted by both sides, subject to the settlement by an independent arbitrator of a single point. That point was whether the basis price for puddling should be 1s. 3d. or 1s. 6d. above shillings for pounds of ascertained net selling price. This point was decided in favour of the men.

Between December, 1879, when the scale was agreed on, subject as above, and May 1st, 1880, when the point had been decided, and it was to come into operation, the circumstances of trade had altogether changed. The American boom had passed away, and a heavy downfall of prices set in. The men, still full of the elated notions prevalent in the previous December, expected a rise. But the higher prices had not lasted long enough for the employers to obtain them upon sales of any magnitude. Consequently the actual realised prices revealed by their books indicated that a fall of wages must be declared. The men immediately struck for a period of seven to ten days. The masters were, however—as they usually are in a falling market—firm, and the men had to succumb. This is the second time when they endeavoured by force to override decisions of the Board. From May, 1880, until February, 1882, there was comparative peace throughout the district; but then the conditions of trade had so altered as to enable the ironworkers to renew their old tactics.

Towards the close of 1881 the activity in shipbuilding had led to higher quotations for manufactured iron. All the works then in operation were full of orders for many months to come, but at the lower prices current in the autumn. The rise in price was simply an indication that more could not readily be booked. It, however, had the effect of disturbing the minds of the men who cannot understand that all iron they see being made and sent away does not necessarily fetch the price they see quoted in the daily papers for new sales. But it is not unlikely that their obtuseness arises from absence of desire to understand what has often, though vainly, been explained to them. The ill effect on the workmen of the rise in quoted prices was aggravated by its effects on the mortgagees of several ironworks in the northern district, which had remained inoperative since the collapse of the iron rail trade some years before. These owners began almost all at once to construct new companies and set their works going, in order to get the advantage of the better prices they now saw quoted. The effect on the labour market was disastrous. The ironworkers virtually said:—"Whatever may have been our bargain, and whatever may have been the relation between the price of labour and the realised price of iron contracts made in the past, it is evident we are now masters of the situation. There are now more firms anxious to employ than staffs of workmen to be employed. Let us repudiate all inconvenient bargains, and take our stand on the present position." This they did in February last. Though the sliding scale to which they had bound themselves did not expire till the 29th of April following, they positively refused to have anything further to do with it. They demanded an immediate 15 per cent. more than it would have yielded, and laid idle all the works until this demand should be acceded to. The employers ought, of course, to have stood out unitedly, as they have more recently done, against such lawlessness and faithlessness; but they did not. They thought the tendency of trade was still upward; they were anxious to realise what profit there was in the contracts on their books. They feared that the new firms would shortly begin to compete for their men and for their customers, and they exhibited so many signs of weakness as materially to encourage the men to persist in their demands. They began to give way piecemeal, and eventually, after seven to ten days' strike, the Board of Arbitration officially conceded a 7½ per cent. advance, and undertook that the question of the further 7½ per cent. should be submitted to the final decision of an independent arbitrator. Thus for a third time the Board of Arbitration was set at naught, and for the second time successfully, by force on the part of the men, aided by want of united action on the part of the masters.

Elated by this unmerited victory, the men now became exceedingly difficult to manage. The claims since brought before the Board in no sense include all or even a majority of those which they have been perpetually making. Indeed, the position of a manager of an ironworks has been most harassing ever since. All this has culminated in the fortnight's strike which terminated on the 15th inst. The claim for the second 7½ per cent. was duly submitted to the arbitrament of Sir J. W. Pease, M.P., who sat two long days at Middlesbrough during the Easter holidays, and laboriously weighed and sifted elaborate statements and statistics submitted by both sides, and patiently listened to their protracted arguments. After a fortnight's consideration he issued his award, giving no advance for the present or previous quarters, but a part of that claimed for the following quarter. The result is well known. The award was instantly rejected by the men—the arbitrator was soundly abused. A new arbitration, by a new arbitrator, was demanded, and it was declared that work would not be resumed until the new decision was known and approved by the men. The officials of the Board, some of whom honestly did their best to get its decisions respected, were hissed and howled down, and the puddlers at several works decided unanimously to leave the Board of Arbitration at once. The principal Union men, and all the chief Union officials, seem throughout to have been entirely averse to this lawlessness. The Union secretary, Mr. E. Trow, issued a manifesto condemning the action of the men in striking. But all these efforts were powerless until impecuniosity came to the rescue. Then, and not till then, when there was no more money for beer or tobacco, or for victuals for themselves, children, or wives—the order of these nouns is the result of some thought—then they concluded, without rhyme, reason, or explanation, to resume work.

It is now for the employers to consider what action they should take with regard to the Board of Arbitration. As a Board for simply ascertaining what is reasonable as between the buyer and seller of labour, its success has been very doubtful. As an authority able to enforce its own decisions, its failures have been, as we have shown, frequent and complete. Its demand on the valuable time of employers has been out of all proportion to the worth of the decisions come to and enforced. It has afforded direct encouragement to the growth of a class of mischief-making delegates, by paying the latter better wages for hatching disputes than for working at their callings. Its slowness and cumbrousness of action, by reason of its multitude of councillors, impede the quick adaptation of rates of wages to altering conditions of trade, a defect which brings peril to the trade itself, and disadvantage to all living by it. It is unfair in its action, inasmuch as it binds the employers, who have characters to lose; and is set at naught by the ironworkers who, as a body, have none, whenever its decisions are unpalatable to them. It appears to be in ill odour with the majority of the workmen; and does not command the respect of the employers. In fact—whatever good or evil it may have done in its day—its day is over; it is dead and done for, and blocks the way as regards something better. Now is the time for giving it decent interment. There is no need to kill it, it has been killed by the ironworkers themselves. Let the employers recognise this; let them meet together and formally pass a resolution to that effect, and then invite the workmen's leaders to help them to build up upon its ashes something better, something more adapted to present times and circumstances, and in accordance with the experience which has been so dearly bought. Let them recognise that the leading defects in the Board are want of organisation and of unity in considering and adopting a common policy, first on the part of the employers, and secondly on the part of the ironworkers, and thirdly the want of power and determination on the part of both to enforce joint decisions.

We see no difficulty in avoiding the defects of the Board of Arbitration, and at the same time retaining all its useful qualities. All that is needed is a good strong union on either side, with a joint committee, with power to refer. A sheet of wages rates should be published periodically, say every six months. No alteration should be made in any rates upon this sheet, except through and by authorisation of the joint committee. Reference to an arbitrator would not be obligatory, as with the Board hitherto, but only permissive, so that either party might refuse to refer, and a strike or lock-out might take place, without bringing the whole organisation into ridicule as now. There would be, however, every facility for friendly argument, and force would probably only be employed when and where inevitable in any case. After all, the great superiority of the proposed plan over the old Board would mainly consist in the constant presence of a strong power to enforce. The backbone of that power would be in the resolute attitude of the employers' union, peaceably inclined, but not bound to a peace-at-any-price policy, and able, and not unwilling, to strike promptly and strike hard when it did strike. We understand that the South Durham Coalowners' Association is founded on something like the above lines, and has so far been extremely successful in avoiding and adjusting labour disputes.

THE INDUCTOPHONE.

The nomenclature of electrical science is rapidly increasing by the naming of new pieces of apparatus and the results of investigations. Mr. Willoughby Smith, whose name is so well known in cable work, and to scientific men for his discoveries in relation to the electrical action of selenium, has recently been investigating other electrical phenomena—an investigation which has led to an extraordinary discovery. We have been able, by the courtesy of Mr. Smith, to go through his experiments and to see his apparatus. The latter is extremely simple, and we hope in our next issue to give illustrations. The important part of the electrical circuit is a large flat coil of silk insulated small section wire. This is connected by a make-and-break arrangement, consisting of a large tuning fork and springs with a few Leclanché cells. The current as it passes through the coil produces a large field of electrical lines of force, and of course, because of the make-and-break arrangement, the field of force is never constant but always changing. Now a magnet or a piece of iron or other magnetic substance being placed in the constantly changing field will also undergo constant magnetic changes, and these changes will synchronise more or less with the vibrations of the tuning-fork, which causes the alterations in the field. If that vibrates 250 times per second then the action on the iron or magnet in the field changes 250 times per second, and there is a molecular action which gives rise to similar sound waves to those of the make-and-break apparatus. It is, of course, easy to prophecy after the event, and to tell when we know what would take place. If, then, the tuning-fork be set into vibration, and a telephone, or a diaphragm from a telephone, or a bar of iron, such as a poker or a magnet—but so far the investigation shows the combination of magnet and diaphragm to act best—if, we say, either of these is brought into the magnetic or electrical field without any metallic connection with any part of the acting circuit, the musical sound is faithfully reproduced. Some very interesting knowledge is obtained by investigating the lines or field of force in this way. It is found, for example, that so long as the plane of the diaphragm makes an angle with the plane of the coil different from the plane of the line or lines of force at that point, the music is reproduced with fidelity; but that when the plane of the diaphragm is at right angles to the plane of the coil—the axis of the diaphragm and coil being in the same straight line—the neutral point is reached and no sound is heard. In this position Mr. Smith supposes the lines of force to be parallel to the plane of the diaphragm, which hence, so to speak, do not impinge on it; or rather, as the diaphragm is very thin, do not act upon it sufficiently in that direction to give sound of enough strength to be heard. Another interesting fact is that so far, the lines of force seem to extend indefinitely and to pass through brick walls, or walls of any other material; and not only through the walls, but through the walls and air of room after room, so that the magnetic action can be picked up in any room of the house in which the inductophone is, so far as the delicacy of the instrument will permit.

BRIDGES BELOW LONDON.

As an illustration of the sort of argument used against the construction of a bridge below London Bridge, the following is taken from the speech of the leading speaker at a special meeting of inhabitants and occupiers in Bridge Ward on the 15th inst. may be cited. This speaker said, "there were two causes that had mainly led to the prosperity of London. One was the free navigation up to London Bridge, and the other was free trade. Ships up to 2000 tons burden could come up to the very heart of the city, and that was the reason that London had grown to be the city that it is. The whole question as to whether a bridge should be erected east of London Bridge was considered several years ago by a Select Committee of the House of Commons, called Lord

Henry Lennox's Committee, who decided against the proposal; and he thought it hard that the wharfingers should have to fight the battle over again. If such a bridge should be built ships could not come up to the wharves as they did now, and the trade would leave the port of London;" and he then moved, "That the construction of any bridge east of London Bridge would so impede the navigation of the river Thames, and injuriously affect the wharves and commercial premises on each side of the river, that the public inconvenience resulting therefrom would outweigh any advantage which might be afforded to the traffic passing over the bridge." If ships were prevented from coming to the London docks it might be a very serious thing, but it will be seen that this representative of the Bridge Ward arrogates to a few wharfingers between the existing London Bridge, and a new one, say, just below the Custom House, the importance of having "mainly led to the prosperity of London," and that if these few wharfingers have to find wharves somewhere else, or cannot find them, the particular barges or other small things they get their goods in are of such importance that "the trade would leave the port of London." This might sound very badly were it not that this leader of the Bridge Ward speaks of his own wharf, or a few hundreds of feet on each side the river below bridge as "the Port of London," whilst in truth it is a part of the "Port of London" of such utter insignificance in these days of large docks and railways below the city, that the whole might be extinguished or shut up to-morrow and London be not one farthing the worse off. The meeting, however, actually passed the above resolution. We mention the fact as showing what may be passed at a meeting of the Bridge Ward. It might perhaps also be worth while to mention that none of the craft at present coming up to London Bridge would necessarily be prevented from doing so when a new bridge is built. It should here be noted that an influential counter-meeting, headed by the Lord Mayor, on Wednesday unanimously passed a resolution, "That it is desirable in the interests of the trading community especially, and the inhabitants of the metropolis generally, that means of vehicular communication should be provided without delay between the north and south of the Thames below London Bridge."

THE EDDYSTONE LIGHTHOUSE.

THE new structure which is to replace Smeaton's Eddystone Lighthouse was lighted by the Duke of Edinburgh yesterday, just two years and three-quarters since he laid what is called the first stone. The new lighthouse, in its nearly finished state, was illustrated in THE ENGINEER of the 25th December last, and at various times it has been fully described by us. Smeaton's lighthouse was completed in 1759, and has now to be removed, because it is feared that its foundation is sufficiently undermined to be unsafe. It will be taken down and re-erected at Plymouth, after having withstood 123 years of raging storms in an exposed situation, and still being able to withstand an equal period. It was proposed to remove the Eddystone rock itself when the Smeaton tower was condemned to removal, as it was thought that this removal would make a lighthouse unnecessary. But the Trinity Board considered that it was not simply to tell the seaman that there was a rock beneath its light, but was important as determining position, and providing an essential link in the chain of Channel passing lights. The new tower has, therefore, been built under the superintendence of Mr. N. Douglass, the engineer to the Trinity Board. It is of the same character and built in the same way as Smeaton's. It is 130ft. in height, considerably higher than the old tower, and is built entirely of granite from the De Lank quarries of Messrs. Hugh Shearer and Co., near Bodmin. Those who are desirous of a complete account of the work may be referred to our last volume, and to the book by E. P. Edwards, which also contains an abstract of Smeaton's own account of his work, by F. Williams, and published by Messrs. Simpkin, Marshall, and Co.

KILLING THE GOOSE.

IT is just three years since a four weeks' strike of the Durham colliers produced such financial embarrassment to three large coal-consuming firms in the north as to cause their suspension. In one day Messrs. Hopkins, Gilkes, and Co., Limited, Lloyd and Co., and the Skerne Iron Co., failed to meet their obligations. No doubt all of these firms were financially weak, and the strike was only the last straw that broke them down. The works have all now passed into other and stronger hands, but with the exception of Messrs. Hopkins, Gilkes, and Co., which never ceased work entirely, they remained idle several months, and an immense number of men were thrown out of employment. In these cases it was not the *employés* of the tottering firms who made the strike. It was the colliers who worked for the colliery owners who supplied them with coal, and the punishment, although it was first visited on the ironworkers, extended no doubt largely to the colliers, whose coal and coke was for a time no longer wanted. All this happened in May, 1879. Now in May, 1882, we have another and indeed more direct and flagrant case of "ripping up the goose." The failure just announced of Messrs. Johnson and Reay, iron manufacturers and coalowners, of Stockton-on-Tees was immediately caused by the fortnight's strike of ironworkers against Sir J. W. Pease's award. We need not go into the circumstances attending the claim, the arbitration, the award, the strike against it, and the eventual acceptance of it. The facts have been placed before our readers from week to week in our correspondence from the affected district. Our present object is to point out how the operative classes punish themselves in seeking to gain their ends by the unjust punishment of others. Æsop's fable of the goose and golden eggs never had a clearer and more forcible application than this. To force a 7½ per cent. advance, which the independent arbitrator, after a patient hearing, decided was not due, the workmen employed by Messrs. Johnson and Reay have lost their situations, altogether and driven their employers into bankruptcy; and all this by a body of men who are subscribers to, and have hitherto professed to be upholders of, a system of "arbitration and conciliation."

LITERATURE.

Sewage Disposal, for the Guidance of Sanitary Authorities. By HENRY ROBINSON, Memb. Inst. C.E. Second edition. London: E. and F. N. Spon. 1882.

THIS is a very useful little work, of eighty-six octavo pages. Its principal value consists in the clear and terse description given of the various methods of dealing with sewage which have been adopted in the case of various towns named by the author. We have in this way much useful information put into a very convenient form; but it must not be supposed that instructions are given which will enable any engineer who is comparatively ignorant of his subject to design a complete system of sewage disposal which shall give satisfaction.

It can hardly have failed to occur to our readers that of late very little has been heard of sewage disposal, or irrigation or drainage schemes; and yet it is quite certain that not much has been done in this direction compared with what, according to some persons, remains to be done. The truth seems to be that a few years ago there was a great scare concerning the pollution of rivers. The effects of this scare have nearly died away, and the tendency is now to err on the other side, and do too little. No doubt much nonsense has been talked about rivers' pollution, and yet more by those who hoped to make money out of sewage. Mr. Robinson's book brings to the hard test of experience many of these statements, and they turn out to have been much exaggerated. We may cite one case—that of Aylesbury—where the A B C process is in use. The manure produced costs the corporation £3 2s. per ton, and, according to Professor Wanklyn, it contains only 0·07 per cent. of free ammonia, and 0·02 per cent of albumenoid ammonia. According to Dr. Wallace it is worth 33s. per ton, but we do not know what price is obtained for it. It is stated that the sewage, after clarification, is delivered quite clear and harmless; but the quantity of ammonia taken out of it is so small that it would seem that the sewage, to begin with, must have been almost innocuous, whatever its colour may have been. It would seem that in some districts advantage has been derived from "fortifying" sewage sludge. Thus at Wrexham, to each 12 parts of dried sewage sludge are added 7 parts of fine raw bone meal and 1 per cent. sulphate of ammonia. The resulting manure gives on analysis 4 per cent. of ammonia and 20 per cent. of bone phosphate, and is cheap to the farmer at £6 10s. per ton. What it costs the town we do not know.

Mr. Robinson might, apparently with little trouble, have made his book more useful than it is by giving a few figures. Thus, he might have told his readers what prices are obtained for sewage manure, and he might have given its cost more minutely than he has done in some instances; but even as it is, the work is one which we can recommend to every borough engineer, and we might say every town councillor. It is small, handy, well printed, and conveniently arranged, and we have no reason to doubt that the information it conveys is trustworthy.

ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES.

By PROFESSOR OLIVER J. LODGE, D.Sc.

No. I.

A BATTERY is an arrangement for setting electricity in motion, *i.e.*, for producing an electric current by means of chemical action. It generally, or always, consists of a liquid able to conduct electricity and of two solid conductors immersed in it, on which it is able to act chemically. If the two conductors differ in the smallest degree in respect of their chemical affinity for some active constituent of the liquid in which they are immersed, then, as soon as they are joined by a wire, a current is always found to flow—strong or weak according to the degree of the difference between the surfaces of the two conductors, and also according to the dimensions and nature of the connecting wire and of the conducting liquid.

The distinction between a primary and a secondary battery is in no sense an important one when we are considering either as the producer of a current; and we may have in our minds an old Volta cell, or a Smee, Grove, or Daniell, just as satisfactorily as a Planté or a Faure, while we consider the ensuing few theoretical remarks.

I shall use the term "radicle" in preference to "element," as being more general. Radicles may be elementary, but they may also be compound. The atom of hydrogen, of oxygen, or of lead, is a radicle, but so is the group SO_4 or NO_3. A radicle is any group of atoms that can combine, or be removed from combination, with another group. Chemists have long been accustomed to divide radicles into electro-positive and electro-negative, or "basylous" and "chlorous," though they have been slow to recognise the full physical meaning of this distinction. They have also classified them into monad, diad, triad radicles, and the like; and without entering into the disputed question of whether atomicities are fixed or variable, it is absolutely certain that in a definite compound, and when released from definite compounds, certain radicles are monad, diad, or triad, as the case may be.

It is, moreover, known that radicles can exist temporarily in the free state, when they are said to be dissociated; and that many liquids—not to speak of gases—contain a number of such dissociated molecules, the number depending on the temperature as well as on the nature of the liquid, and being on the average pretty constant—that is, they are equally distributed through the whole liquid, and if some are by any means removed, more will at once be formed to keep up the average. Not that any one radicle need remain long dissociated—there is, no doubt, a continual interchange—but the average number dissociated is definite under definite physical conditions.

Now there is a large class of liquids whose dissociated radicles are all charged with electricity—half of them with positive, and these are they which chemists call electro-positive or basylous radicles—half of them with negative, called therefore electro-negative or chlorous. Moreover it was shown by Faraday that the charge possessed by every monad radicle, of what kind soever, is precisely the same in quantity, though it may differ in sign; and that diads have twice, triads thrice, this atomic charge, and so on. The existence of these charges is certain from the facts of electro-chemistry, and the electrical charge appears to be the essential condition for even the momentary existence of a free radicle. It further appears that when two opposite radicles combine their charges are either lost or are masked by proximity; and that before two radicles of the same kind can unite into a molecule their charges must be given up to some third body. A liquid which possesses such dissociated and oppositely charged radicles, sauntering about in it, is *ipso facto* susceptible of being decomposed by electrical means, and is called an electrolyte. Liquids which have no such charged and dissociated molecules are not electrolytes, and will not conduct electricity. Electrolytes conduct electricity by a bodily transfer in opposite directions of the oppositely charged radicles; they conduct it, in fact, as a convection current, or rather perhaps of two equal opposite convection currents, one of the positive radicles the other of the negative. The resistance of the liquid depends upon the slow shearing asunder of these two sets of radicles by a process closely analogous to diffusion, for it is possibly only assisted or directed by electricity in the immediate—molecular—vicinity of the electrodes.

What are these electrodes? They are conductors introduced into the liquid, with the property of exerting upon the charged radicles in their immediate neighbourhood unequal, or else opposite, forces. Thus, suppose they are two plates of platinum connected with a battery, so that one plate is always +, the other always −; and suppose for simplicity that the dissociated radicles are hydrogen—electro-positive, and oxygen—electro-negative, respectively. Oxygen atoms close to the positive electrode are attracted by it; they deliver up their charges to it, and uniting into molecules, rise as gas. Their places are taken by others from the slightly more remote region, and so on, a virtual procession of oxygen atoms continually taking place towards the positive plate, each carrying its charge with it. The same thing happens on the hydrogen side, only that twice as many hydrogen atoms take part in the action, the charge of each being half that of an oxygen atom.

This, then, appears to be the state of things in ordinary electro-chemical decomposition; only the radicles liberated on the surface of the electrode will combine with it, if in any way possible, instead of merely combining with each other and becoming free. Thus the hydrogen alloys itself as well as it can with the platinum; and the oxygen, if it finds any copper or other less noble metal on the surface of the electrode, will readily combine with it; the ordinary chemical affinities being enhanced by the electrical attractions.

But now, instead of two oppositely charged plates of the same material, let us immerse in the liquid a plate of zinc and a plate of copper, or any two metals which have a different affinity for oxygen. The oxygen atoms are now attracted to the zinc just as they were to the positive plate, but apparently by a chemical, not an electrical, force. It may be possible ultimately to reduce chemical forces to electrical ones, or *vice versâ*; but at present it seems necessary to draw a distinction between them. This attraction for the oxygen is, as before, only to be supposed to be effective within far less than a microscopic distance of the plate. The replenishment of the oxygen into this region is wholly carried on by diffusion and fresh dissociation. The copper on the other side pulls the oxygen too, but less powerfully. Nothing more than slight motion and very slow combination, however, is found to go on so long as the two plates are kept separate, provided both are pure and homogeneous; but the tending of the negatively charged oxygen towards the zinc makes it transfer negative electricity to the copper as soon as they are connected by a wire.

The copper so connected, being now negatively charged, actually repels the oxygen atoms, and is protected from their attack, while it attracts the hydrogen. We now therefore have the continuous opposite processions again, the oxygen atoms combining with the zinc, and neutralising by their charges positive electricity at its surface, in other words, partially giving up negative electricity to it; the hydrogen atoms going to the copper, hydrogenising it to some extent, but soon giving up their positive charges to it, unting with each other and escaping from the liquid. A constant current must therefore be flowing along the connecting wire, of negative electricity from the zinc to the copper, of positive from the copper to the zinc.

Next, suppose two plates of the same metal, say both platinum or both lead, not connected with any battery, but with their surfaces in different chemical conditions—say one coated with hydrogen, the other with oxygen. Plainly the same kind of action can go on. The oxygenised plate will be attracting the hydrogen like the copper, or like the negatively charged plate connected with the pole of a battery; the hydrogenised plate will behave like the zinc or the positively charged plate. The positive current will flow along the connecting wire from the oxidised plate to the hydrogen-coated one.

We have thus a battery which will maintain a current so long as the plates continue coated or combined with the two gases; but the action of the current is obviously to destroy these gases and restore the plates to a condition of equality. A battery may be made, then, either of two different metals, one of which attracts oxygen more than the other—this case we will not now further consider—or else of two pieces of the same metal, one more oxidised than the other or one more hydrogenised than the other; or, still better, one oxidised and the other hydrogenised. Take, for instance, two plates of lead and immerse them in dilute sulphuric acid; let one be bright and metallic, the other rusted over with a coat of oxide of lead. As soon as metallic communication is made between the two plates, a positive current of electricity continually flows along it from the oxidised plate to the other, the bright plate becoming gradually oxidised and the other becoming gradually reduced. If the plate has been oxidised by exposure to hot air, or by ordinary chemical means, such a battery would be called a primary one; if the coat of oxide has been produced by passing through the cell an electric current from some independent source, then the battery is called a secondary one.

I will next week consider more particularly the constitution and detailed behaviour of such secondary batteries.

Queen's College, Liverpool, May 16th.

DEATH OF MR. DUGALD CAMPBELL.—We have to record the death of Mr. Dugald Campbell, which took place on the 12th inst. at his house in Holland-road, Kensington. For many years past Mr. Campbell has been known as an analytical chemist and expert witness, especially on questions relating to water supply and sewage. He was frequently consulted by various departments of the Government, especially by the Inland Revenue, and the Commissioners of Patents entrusted him with the preparation of several volumes of abridgments. During many years he was ably seconded in his various researches by his assistant, Mr. H. R. Gregory. Mr. Campbell was in his sixty-fourth year.

THE ELECTRIC LIGHTING COMMITTEE.

The Select Hybrid Committee on the Electric Lighting Bill, introduced this session by the Board of Trade and sundry private promoters, resumed their inquiry on Thursday, May 11th, the chairman, Mr. E. Stanhope, stating that in consequence of the great public importance of this inquiry the Committee had resolved to sit as usual on that day, although there had been some desire to adjourn because of the funeral of Lord F. Cavendish. The order in which the several interests represented should be taken having been settled,

Mr. Farrar, Secretary to the Board of Trade, was recalled for a moment, in order to explain that the Bill did not propose to make any distinction between England and Scotland in regard to the preferential claim of local authorities to supply the electric light, whether there were now gas supplies or not, or in respect to those at present supplying gas, whether they were corporations or companies.

Sir Joseph Heron, town clerk of Liverpool, was called and examined by Mr. Littler, Q.C., as the first witness in support of the case of gas supplying corporations. He stated that the Corporation of Manchester were favourable to electric lighting, and would be prepared to undertake such a supply if necessary or generally desired, irrespective of the question of cost, but they had the strongest objection to any but themselves being authorised to undertake the supply, and for that purpose to have power to break up their streets. In support of this contention he mentioned that for years the Board of Trade had been urging upon municipal bodies the desirability of getting the lighting and water supplies into their hands, in order to have control over the disturbance of the streets. There was no reason, in his opinion, for any difference between the conditions imposed on gas supply and on electric light supply; and he claimed that a gas supplying corporation which had done its work satisfactorily ought to be protected by Parliament against injurious innovations, although he would not have them able to prevent proper experiments with electric lighting. In expressing these views he was representing about 150 corporations and other local authorities, who had an aggregate capital of 40 or 50 millions involved in their undertakings. The Manchester Corporation supplied gas to 400,000 consumers in their own boundaries, and to 250,000 beyond those limits, who preferred to take the Corporation gas in order to get it at a less price than those districts could supply it, and also to be free from the nuisance of gasworks. A large profit was made out of this supply, and the Corporation had for many years spent about £50,000 a year out of the profits in local improvements, from which course the outlying districts derived some advantage without any risk or liability. The Corporation could refuse assent to an application for a licence to supply electricity in their own limits, but not an application affecting the outside township, for by the Bill only the consent of the local authority was required. That would of course deprive the Corporation of any power of control, although they were really the lighting authority, and the result of a licence being granted in any of those districts would be to diminish the demand for gas, and so injure the business of the Corporation. That difficulty might be met to some extent if every party interested had an opportunity of being heard before the Board of Trade, as Mr. Farrar had suggested, but he contended that there ought to be an ultimate appeal to Parliament in regard to licences, as in the case of provisional orders. He objected to the decision resting with the Board of Trade, for he had little confidence in that department in this matter, and he urged that licences should be placed in precisely the same position as provisional orders. A power of refusal by the Corporation would tend to prevent extravagant experiments, and would promote rather than hinder the real objects of the Bill; and as a matter of public economy it would be better to entrust electric lighting to corporations in the same way as in the case of gas lighting. He also thought the licences to be granted should be strictly limited to experiments, for otherwise a local authority might give a concession to a bogus electric company in order to reduce the price of gas or lowering the value of a gas property. Again, any such experiments ought to apply to a whole district, because, if that were not done, an electric company might take the best part of a district, and leave the rest to be supplied by the Corporation or existing gas companies at a loss, because they were bound to maintain their works and give a supply where it was demanded.

In reply to Mr. Wright, on behalf of the Liverpool Corporation, Sir Joseph Heron said it would be a serious inconvenience for several bodies to have the right to break up streets independently of the municipal authority. He could not say how the wires might ultimately be laid, but he hoped they would be laid underground, for overground wires were both unsightly and dangerous. He thought it would be more practicable to lay the wires under the footway than under the carriage way.

In answer to Mr. Moulton, who represented various electric light companies, the witness said the Manchester Corporation did not object to electric lighting in the city or elsewhere, if they had some power in regard to the licence; but the breaking up of the streets ought certainly to be in the hands of the Corporation, and therefore they ought to have some part in the supply of electric lighting. If this power of control was not given them, then they must be relieved of their present liability to supply gas.

Replying to members of the Committee, Sir J. Heron said he thought the Corporation, as a gas company, would be entitled to some sort of compensation if electric light companies were allowed to enter their present supply limits, though he did not expect to get any. He did not propose that the Corporation should have a power of veto upon an application for a licence, but simply that they should be entitled to be heard as well as the local authority. In his view a gas-supplying authority should have a prior right to supply electric light if they were willing to supply it, and he should prefer to have a statutory preferential right; but not hoping to get much from the Board of Trade, he only asked to be placed in the same position as a local board in respect to a licence. A preferential right would not, however, constitute a monopoly, because it could be made subject to conditions as gas was.

Some further evidence somewhat similar in effect was submitted, and the Committee adjourned.

On Friday Mr. Thomas Mosscrop, alderman for the borough of Bolton, and chairman of the Gas Committee of the Corporation, was examined by Mr. Pembroke Stephens, Q.C. He said the gas works at Bolton would be taken over by the Corporation, who had already spent over half a million of money on the works, and were now seeking parliamentary powers to construct additional works and raise more funds. The Corporation had extended the works from time to time, not from any grasping spirit on their part, but at the request of customers. The Corporation had been compelled to extend their supply to outside districts, and the amount consumed in these districts was about one-fifth of the entire supply. If electric lighting were supplied in the outside districts by private independent companies, it would have a serious and prejudicial effect upon the Corporation as manufacturers of gas. He believed the Corporation were willing to supply this light themselves; in fact, they had a bill before Parliament for that purpose. In his opinion the Corporation could give, with much greater advantage than anyone else, whatever new species of light might be adopted.

Mr. Gaine, town clerk of the borough of Blackburn, was also examined on behalf of the gas-supplying corporations. He considered the Bill should state clearly that the licences to be granted were to be experimental only. In his opinion power to renew them should be omitted from the measure. When an application was about to be made for a licence, full notice should be given to the local authority supplying gas; in fact, for himself he would carry it even beyond that. He was in favour of the local authority supplying gas being in a position to give consent to the application. He, however, would be content if the Bill made the licences experimental, though it did not give an actual veto to the local authority supplying gas. Three years would, in his opinion, be ample time to test whether any system of electric lighting could be made a commercial success or not. He particularly desired to guard against the licences becoming undertakings which might at some future period compete with the existing gas undertaking. The Corporation of Blackburn had devoted the whole of their profits to the reduction of the price of gas to the consumers within the whole of the gas limits of the Corporation. He was fully of opinion that the suggestion that the Municipal Corporations' Association's Board made in their memorial to the Board of Trade should be submitted to the Committee, namely, that so far as the provisional body was concerned, the local authority supplying gas ought to have priority if an electric lighting undertaking was to be established. He considered the Corporation he represented ought to have the right of supplying the new light in their district upon the ground that they had spent a large amount of public money. He believed it was of the utmost importance that only the municipal authorities should have power to open up the streets. If there had been time cases would have been presented, not only in the interests of Blackburn, but in the interests of Bolton, Birkenhead, Birmingham, Batley, Bury, Aberdeen, Belfast, Greenock, Carlisle, Limerick, Leeds, Leicester, Oldham, Nottingham, Macclesfield, Wigan, Stockton, and various other towns. In his opinion it would be most inequitable if the local boards in the outer districts were permitted to take the cream of those districts that supply them with electric light, leaving the present gas authority still under obligation to supply gas. When they had once put mains down they could not stop their supply to the private consumer, because as long as they carried on the undertaking they had no right to take up a main. If they attempted to do so they could be restrained by an injunction. It was clear, he thought, that the obligation remained on a Corporation supplying gas to continue supplying it to outside districts.

In answer to questions put by various members of the Committee, witness said that if electric lighting was required in his district the Corporation should have priority when the claims of different parties to supply it came to be considered. He believed that if the electric light were a success the public would have it, and no doubt would unite with the Corporations supplying it. He did not argue that Corporations should stand in the way of progress, but that if progress were to be made it should be done by Corporations. Whilst the old gas company at Blackburn used to charge 4s. per thousand for their gas the Corporation now charged 3s. 4d. per thousand. The effect of a new company coming to supply light would be a general rising of the rates. He considered the Corporation was more likely to attend to the interest of the consumers for the cheapening and development of the light, if the supplying of it were entrusted to them, than would be an independent new comer. If electricity was to take the place of gas, the same thing would occur with regard to it as had taken place with regard to gas, and the Corporations would have to buy up the undertakings. He certainly was of opinion that Corporations could make and supply the electric light at a cheaper rate than a private company, because they did not require a profit to pay a percentage as did a private company. He did not think the preferential right for which he asked would put an end to experiment. Doubtless the electric light companies would consider themselves contractors under the Corporations, and consequently they would make experiments with a view of having contracts given them on behalf of the public. He was in favour of private companies being allowed to supply the electric light if the Corporations did not do so. The success of the electric light would injure the capital invested by Corporations in gas undertakings. To save the capital he thought that whatever profit was to be made out of the new form of lighting should go to the Corporations. Whilst he thought the conditions of purchase offered the Corporations were favourable, he did not think they went far enough. He did not consider it should be allowed to come to purchasing; he was in favour of the local authorities having the power to start the undertakings in the first instance. He did not think the electric light would stand a poor chance in some municipalities, owing to its being looked upon as a rival to gas. If the electric light proved to be a success the public would demand it and the Corporations would have to supply it. He believed the rights of public authorities who merely supplied gas within their own municipalities would be protected by the provisions of the Bill. If municipalities got the right of priority, if they desired to have the supply in their own hands, he was satisfied with the clause having reference to provisional orders.

Having received this evidence, the Committee decided not to hear any further witnesses on the case of the gas-supplying Corporations, inasmuch as according to the learned counsel their views were generally the same.

Mr. Littler therefore addressed the Committee on behalf of the Corporations, and the Committee adjourned until Monday.

On the reassembling of the Committee on Monday,

Mr. Pope addressed them in support of the case of the several gas companies petitioning on the Bill. The learned counsel said the companies he represented disclaimed entirely any right to a monopoly of the supply of light, for they were quite prepared to take the ordinary chances of competition as the result of scientific investigation; but if a competing system was to be authorised they felt they ought to be relieved of the liabilities of supply to which they had consented as the price of their *quasi* monopoly. Municipal authorities and speculative companies he thought might be left to take care of themselves; and as the practicability of the electric light could only be tested by practical experiments on a large scale, the whole question resolved itself into one of disturbance of streets and private property. He held that electric lighting had not yet sufficiently advanced for the fixing of statutory conditions as to price, &c., such as were imposed on gas undertakings, and therefore legislation was premature. This difficulty was not got rid of by leaving the matter to the Board of Trade, and moreover, the suggestion of legislation by departments was totally at variance with the principle of constitutional and representative government. Inventors and companies should be free to press their schemes in their own way with the stimulus of profit in view, under conditions, however, which would prevent a local authority from making arrangements with bogus companies in order to reduce the price of gas, or to depreciate the value of a gas undertaking which they wished to purchase. The gas companies objected to being held to their statutory obligations if electric lighting companies were to come in and deprive them of their benefits; but if the Board of Trade only allowed experiments, then they would ask to have their liability suspended during the progress of the experiments.

Mr. Michael, Q.C., also addressed the Committee, on behalf of the Liverpool Gas Company, and while following principally the line taken by Mr. Pope, he strongly enforced the principle which he said had always been maintained by Parliament, that public money ought not to be used against private enterprise, as would be the case if local authorities were allowed a preferential right to supply electric light under this measure.

Two or three witnesses were examined on behalf of the different interests, and the Committee adjourned.

On Tuesday, before the inquiry was resumed, Mr. Wright asked whether the Committee intended to invite any evidence with respect to the extensive experiments in the City of London with electric light.

The Chairman replied that the Committee had not yet made up their minds upon that question.

Mr. Dunscombe, engineer to the Corporation of Liverpool, was then called, and in reply to Mr. Wright, he stated that the electric lighting experiments which had been made in that city had not succeeded, first, because people had damaged their wires, which were stretched from pole to pole along the streets; and secondly, because on account of special circumstances the Corporation had not been able to allow the wires to be laid underground.

Mr. Wright addressed the Committee as the representative of the Liverpool Corporation, and Mr. Fitzgerald argued the opposition to certain parts of the Bill of a number of districts around Glasgow.

Mr. Lang, chairman of the Northern Light and Power Company, Dundee, was examined on behalf of that company, against the Bill, and then

Sir Frederick Bramwell was called on behalf of the electric lighting companies, and examined by Mr. Moulton. He said: I am interested in electric lighting, and have given a good deal of attention to the subject. Since 1879 electric lighting has made great progress, the most important being the introduction of the incandescent light, which gets rid of the difficulty that the committee on electric lighting felt, namely, the subdivision of lights, and which makes it applicable for domestic purposes.

In consequence of this progress, in your opinion is electric lighting at the present time capable of taking upon itself the burden of lighting the whole of a town?—I think it has arrived at that position, to be enabled to supply light to the whole community. Have you given your attention to the Bill before this Committee?—Yes, and it has for its object the facilitating of electric lighting for the wants of the community. There seems to be a great deal of power vested in the Board of Trade, but I presume that it is properly left there. — Contrasting the electric lighting with gas, would the interference with the streets be as important in electric lighting as with gas?—No; obviously a bendable wire is much more manageable than a cast iron pipe.—Do you think a lamp or burner which would injure the supply should be prohibited?—I think it should. There are similar provisions in the water companies' bills, prohibiting cisterns used for rain water being used for the water supplied by the water companies.—Speaking as an electrician, you think it quite possible that a person applying this kind of electricity to an unsuitable purpose might affect the supply to his neighbours, and that that ought to be guarded against?—Yes; I would have a provision so as to have lamps used that would not interfere with other lamps.—You have convinced yourself that electricity might be supplied at a cost comparable with that of gas?—I think so.—What conditions do you consider absolutely essential for electric lighting to succeed commercially?—I think it should be supplied in what I would call a wholesale way, by the supply of a sufficiently large district to enable the apparatus to be put up to secure economy in working and in management. I think that the conditions ought to be such as to stimulate the parties to carry it through successfully. I should like to have a population of some fifty thousand at least, both for public lighting and for private lighting, to develope the thing properly. Engines of enormous power would be required, and there would be great economy by having the thing tried on a large scale. Is there anything in the Bill which is detrimental to electric lighting?—Clause 3, which provides for proceeding to the Board of Trade from time to time by provisional order, and authorising any local authority or company to supply electricity with or without the consent of the local authority, says that the power shall be exercised for seven years, and then that the local authority may insist upon purchasing the undertaking, and if they did not do so, they could reassert their power at the end of other seven years. I do not think that any persons with capital would embark their money to carry out electric lighting, when they would have to surrender their plant at the end of seven years on the terms proposed in the Bill. If the electric companies are only to have this short time for making profit, they will no doubt get the maximum price consistent with getting the maximum return from the business, and this would restrict the area which would benefit by the light. I would lengthen the time for the purchase of electric lighting companies to at least twenty-one years.—You are perfectly willing that one condition of the provisional order should be that the supply should be effective?—Quite so.

Mr. Michael: You think that the electric light has got out of its experimental stage?—Yes.—What company do you belong to?—The Edison.—You would be in favour of supplying the Edison light all over the country?—Yes, unless there was another as good.—Then you are a witness for the Edison Company?—I am a witness for the Edison and others.—Supposing that the Board of Trade should determine that the Edison light should be used at Manchester, do you know of any local circumstances which would render it possible that any other than that electric light should be adopted there?—I do not know that, but I do not suppose that one company is to do the whole work of the United Kingdom.—How would you propose that the value of the electric light should be ascertained at the end of twenty-one years?—I suggest that they should be paid for the profits being made at that time, and not receive prospective profits or back dividends, as in the case of gas and water companies.—But the object of the Government in bringing in this Bill is expressly to prevent anything being paid for, except the undertaking *quâ* undertaking?—I confess it appears to be so monstrous a proposition that I can hardly believe it.—Is there such an amount of information at the present time as would enable the Board of Trade to make regulations and restrictions similar to those observed with respect to the supply of gas and water?—No: but power is taken to make regulations from time to time, as knowledge increases.

Cross-examined by Mr. Littler: Would you not have to provide insulators and a tolerably sized trench to carry your wires?—Yes. Would not there be some danger without having good insulators?—I do not believe there would be any more danger than with gas.—What do you think of the position of those Corporations who have been encouraged by Parliament to spend money for gas, and the electric light coming in and destroying their property?—I think that they will have to supply gas for the purpose of power and the purpose of heating; and there will be a large market for it.—You do not anticipate any loss?—I cannot say that.—I want to know whether we have enough knowledge to limit the profit or the price of electricity?—I think you may the profit, but not the price.—Do not you think that in any general Act there should be some limit put upon them?—Yes.—Can you put any limit as to the illuminating power?—No.

Re-examined by Mr. Moulton: Is there anything in the Bill to compel the Board of Trade to allow any particular number of electric lighting companies to interfere with the streets?—No.—Have you any fear that the Board of Trade would not make such regulations as are necessary for the purpose of electric lighting?—I have not.—With regard to Corporations becoming trading communities, you are strongly against that?—Yes.—Do you think that the consumption of gas will be less than when gas companies were formed?—In the immediate future I think it will increase, but I do not think it will go on increasing. I think that gas will be largely used in the distribution of power.

The Committee again adjourned.

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

(*From our own Correspondent.*)

The anxiety of local consumers of best sheets to complete orde for manufactured hardwares before the Whitsuntide holidays causing a pressure at the best sheet mills. The same mills are also busy on export account, Australia, Germany, and Russia being good customers, through merchants. £12 to £14 was again quoted for working-up sheets, but it was not easy to get these figures.

The somewhat better tone observable last week about the galvanising and general merchant sheet trade is maintained, but the improvement has not as a rule increased in the interval. One evidence of this is the fact that some makers who supply their own raw iron wants are curtailing their production in this latter department, having large stocks already accumulated. There is much complaining as to the lowness of sheet prices, and disappointment is expressed that greater success should not have attended the recent effort to bring about a uniform curtailment

of production. It is some satisfaction, however, that at numbers of mills masters are of their own free will limiting the output to some extent. Singles were to-day re-quoted at £8, doubles at £8 10s. to £9, and trebles at £9 10s. to £10.

The hoop and bar firms display most activity after the sheet trade. Much of the work is for foreign customers. The prices quoted for hoops were £7 to £7 2s. 6d., ordinary qualities, but consumers are generally desirous of purchasing at from 2s. 6d. to 5s. under these rates, and they are not wholly unsuccessful. Bars of medium quality were priced at £6 15s. to £6 10s.; and common bars at £6 5s. to £6. This last figure was the price asked for hurdle bars, but here and there they might have been had at less. There has of late been some discussion on the market as to whether the £7 10s. which the "list" houses quote for bars is being actually realised by them. In the face of the much lower figure than this £7 10s., at which bars of excellent quality can be got, there were numbers of people who freely expressed the opinion that the "list" prices were not being obtained.

The Round Oak bars of the Earl of Dudley were quoted £8 7s. 6d. Plates rolled by the "list" houses were £9 and £9 10s. for boiler sorts.

Tin-plates made in much part by the East Worcestershire houses were reported quiet, but prices are tolerably well maintained.

In the pig iron trade the increased vigour reported last week in foreign brands was again noticeable this afternoon. Leicestershire, Derbyshire, and Northampton were the descriptions which went off best.

Prices of Derbyshire and Leicestershire pigs were much the same. Special brands of the former, such as "Stantin" and "Staveley" were quoted at 47s. 6d. delivered, but the highest prices that could be generally obtained were 46s. to 45s. Northampton pigs were on the average 44s. per ton delivered at works. Wiltshire pigs were quoted at 44s. delivered at railway stations, but the figure was rather too high to encourage business.

Hematites were quoted at 67s. 6d. for West Coast and Welsh sorts, but the price was beyond what buyers would give; few of them offered anything above 65s. Staffordshire all-mine pigs were 70s. to 67s. 6d. for hot-blast sorts. An exceptional reduction in price appeared in respect of one of the best brands of part-mine pigs offered on these exchanges. Three or four weeks ago, the brand referred to was quoted at 60s.; this afternoon it was quoted at 52s. 6d.—a drop, as will be seen, of no less than 7s. 6d. per ton. The general run of part-mines were priced at 50s. to 47s. 6d. easy. Cinder pigs were £2 to £1 17s. 6d.

South Wales "scrap," composed mainly of sheet shearings, was offered at 62s. 6d. per ton delivered; but buyers were attempting to secure supplies at 2s. 6d. under this figure. Vendors, however, refused to come below 61s.

Coal was in over-supply as to all descriptions. Furnace coal was 7s. to 8s. 6d. at the pits, and occasionally 9s. Steam coal for railway use, mined on Cannock Chase, 5s. 6d. to 6s. 6d.; and forge coal mined in the same district, 6s. to 6s. 6d. and 7s.

The work of the South Staffordshire Mines Drainage Commissioners is beginning to bring forth good results in the Bilston district. Preparations are now being actively made for the re-starting of the Yew Tree Colliery, Coseley, which has been standing for five or six years owing to the flooding of the mines. The pumping operations of the large water engine in the neighbourhood, recently started by the Commissioners, has lowered the water sufficiently to enable the proprietors to renew mining operations.

Amongst other constructive work in hand at the Darlaston engine yards are two domes, which are to surmount a large Government building at Calcutta, the roofing and girders for which have lately left Darlaston. Also some pontoons and landing stages for the Thames, and some railway bridges for the London district.

At a meeting of the makers of brass and copper wire, held in Birmingham on Tuesday, brass wire was advanced to 7½d. per pound, and copper wire 9½d. per pound.

The operatives engaged in the Birmingham file trade have resolved that seven weeks' notice, ending on July 1st, be given to the Birmingham file manufacturers, that, if the discount allowed from the 1872 list be not restored from that date, the men will cease work. Probably they have been induced to take this step by the fact that the Sheffield file manufacturers have just restored to the Sheffield operatives a discount allowed from an 1873 list.

At the beginning of the week there was a representative interview between the puddlers, shinglers, and forge rollers of North Staffordshire, and a number of the ironmasters of the North Staffordshire district, on the subject of revising the wages scale. The puddlers want to be paid the same rates, when doubling with the steam hammer and making scrap ball, as are paid in South Staffordshire. The shinglers and forge rollers want a restoration of the 5 per cent. which they allege was taken off their wages in 1878. The employers assert that the pay in North Staffordshire is as good as that of any other district.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here, so far as the actual amount of new business offering is concerned, is probably in a condition quite as depressed as at any time during the dullest period of last year.

Lancashire makers of pig iron have been doing extremely little business during the week. For foundry iron, which is now going into stock, there has been scarcely any inquiry, and forge iron is only in very limited demand, but for this quality local makers are pretty well supplied with orders for the present. The prices now quoted are about 46s. to 47s., less 2½ for forge and foundry delivered equal to Manchester. Lincolnshire iron is quoted at about the same figure by makers, but there are sellers in some cases at quite 1s. per ton less.

The principal finished iron makers in the district are as a rule still kept fairly employed with deliveries under contract and the few new orders coming in, but some of the forges are getting short of work, and there is some cutting in prices to secure new orders. For bars delivered into the Manchester district £6 10s. is still the average quoted price, but buyers with good specifications to give out would have no difficulty in placing them at a lower figure.

The condition of the engineering branches of trade continues generally satisfactory so far as the amount of work in hand is concerned. Last month's reports just issued from the various Lancashire districts connected with the Amalgamated Society of Engineers show all through an improvement, with a continued reduction in the number of men out of employment, there being fewer members in the Manchester district at present in receipt of out-of-work donation than for the last eight years, and of the total number of members there is not more than 2 per cent. actually out of employment. Of special classes of workmen, such as tool-fitters, pattern makers, and heavy smiths, there are, in fact, at present none on the books of the society. My own inquiries throughout different works in the district also corroborate pretty generally the above reports. Tool makers as a rule are very busy, and although there has been a falling off in the amount of work coming in on American account, there are good orders in hand for France and Belgium, whilst the home demand is also good both for special and general classes of tools. General engineers, locomotive builders, and boiler makers are also well supplied with work, and although machinists are not so full of orders as other branches of trade, the large firms are mostly well employed.

The Messrs. Collier have in hand for a Belgian ironworks an improved double machine for rolling solid weldless steel tires, with two sets of rolls, one set for roughing out the blooms as they come from the hammer until they are within a few inches of the requisite size, and the other for finishing the tires to the exact size and section. The machine, which is being constructed for rolling tires from 1ft. 6in. up to 9ft. diameter, is to be of exceptionally powerful construction, and when complete will, with engines and condensers, weigh nearly 100 tons. I also noticed in hand several very heavy planing machines, in which improvements are being introduced by Messrs. Collier and Co.; but further details with regard to the above and the tire mill I must reserve until the work is in a finished state.

The general committee appointed to carry out the arrangements for the forthcoming Trades' Union Congress in Manchester have fixed September 18th and the five following days for holding the meetings, and the Co-operative Hall, Downing-street, has been selected in which to hold the sittings of the Congress.

The strike at Messrs. Harland and Wolff, shipbuilders, Belfast, against two men who had been regularly apprenticed to the firm, to which I referred last week, has been settled. The firm stand taken by the employers in refusing to dismiss the two men has been successful, and the men who had struck have now returned to work.

In the coal trade business has shown a decided falling off during the past week. Any extra demand arising through the North Wales strike has been got through, and the general local trade is also quieter. Stocks are again accumulating in wagons, and pits are not working more than four to five days a week. Quoted rates are without material change, but prices are generally wanting in firmness, and sellers in most cases are open to offers where good orders are concerned. At the pit mouth the average prices are about as under:—Best coals, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common, 4s. 9d. to 5s. 6d.; burgy, 4s. 6d. to 4s. 9d.; good slack, 3s. 6d. to 4s.; and common, 3s. per ton.

Barrow.—I am in a position to report a slightly improved tone in the Bessemer pig iron trade of this district, but the state of the market is not anything like so brisk or buoyant as was the case three months ago. The effect of the increased demand has been the means of keeping prices unchanged; but whether this will effect the downward tendency is doubtful, as not much reliance is to be placed in the present spurt, the indications being that some time will elapse before the market again occupies a satisfactory position. Mixed Nos. of Bessemer are quoted at 53s. per ton. No. 3 and 4 forge, 51s. to 52s. Quotations for America are 4s. lower. The deliveries by sea and land are large, and this tends to keep stocks from increasing. Steel rails are unchanged, the quotation being £5 17s. 6d. The mills are very busy, but the demand is only slack. Iron shipbuilders have not secured any fresh contracts, but have several inquiries on hand. The minor industries are very steadily employed. Iron ore in steady demand at unchanged rates. Coal and coke steady.

The pig iron trade in the Cleator Moor district is spoken of as being in a very active condition, and smelters are said to experience no difficulty in securing orders.

Rapid progress has been made during the past few weeks with the construction of the new dock at Maryport. The sea embankment is practically finished, and the entrance walls will be completed and ready for the gates in a short time.

Six per cent. dividend free of income tax has been declared by the directors of the West Cumberland Iron and Steel Company for the six months ending March 31st.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE iron market held at Middlesbrough on Tuesday last was well attended, and was characterised by a steadiness of tone. The ironmasters held their usual meeting before 'Change, and decided to make no alteration in price. The collapse of the ironworkers' strike has saved them from the necessity of the further restriction of output which they had gravely contemplated a few days before. The strike, while it has lasted, must have prevented the consumption of about 25,000 tons of pig iron, and it will take some weeks before that excess of make is absorbed. This has afforded unexpected relief to the "bears," who were being very hard pressed to deliver the iron they had sold, and could not purchase. However, the ironmasters do not intend to allow themselves to be diverted from their previously determined course on this account. They will steadily pursue their policy of regulating their production by the demand, and there is little doubt but that they will be successful in the long run. No. 3 g.m.b. was quoted by makers at 43s. 6d. f.o.b., and by merchants at 43s. Warrants, which were rather more plentiful than the week before, were offered at 43s. The manufactured iron trade is dull. The platemakers had their usual meeting before 'Change to confer upon position and prospects. They regard the strike as having had a strengthening effect on the prices, inasmuch as it has had the effect of taking about 20,000 tons of manufactured iron out of the market. It was reported that the men had resumed work at every ironworks, on the terms against which they struck. Being naturally much impoverished by the struggle, they are now working well in every instance. The moral effect upon them has also been very good; in fact, the undeserved victory they obtained in February so elated them, that they have been extremely difficult to manage ever since, and would have been until some other struggle took place in which they were worsted.

The failure is announced of Messrs. Johnson and Reay, of Stockton, iron manufacturers and coalowners. The immediate cause was the embarrassment produced by the strike, and the immediate effect will be to throw some 800 or 900 men out of employment. Thus again, and in another way, will these foolish men be punished for their unreasonable conduct in resisting Mr. Pease's award. It appears that Messrs. J. Backhouse and Co., bankers, held a mortgage over the works for £24,000, including principal and interest which was in arrear for some years, and they have foreclosed. A bailiff has been put in possession on their account. It is not known yet whether the bankers will carry on the works for the present, or whether they will allow them to stand. Much sympathy is felt for Mr. Till Reay, the managing partner, who is universally respected.

The price of plates is still £7 5s. at works, and of bars and angles £6 10s. It is said, however, that holders of second-hand lots are willing to take from 5s. to 7s. 6d. per ton less than these prices.

The Hammond Electric Light Company has issued a prospectus setting forth that it is now prepared to rent lights to the various works at £25 per annum per lamp with ¾d. per hour in addition for carbons. The Brush system is the one which will be employed. It is probable that this system of renting will promote the adoption of the electric light better than any other method. It is a condition that renters shall make themselves responsible for one year in any case, after which they will be at liberty to have the lamps removed if they do not like them or find gas lighting cheaper.

It would seem, however, that the Middlesbrough Corporation, who are gas manufacturers, and who make more than cent. per cent. profit, do not fear that their trade is about to leave them. They have decided to build a large new gasometer, and fit it to a certain enormous tank, which was made before Mr. John Stephenson was chairman of the committee, and which fell in at certain places, and was altogether a disastrous venture. It will now cost a great deal of money to get it into working order, but the committee have decided to do what is necessary, as the consumption of gas is increasing greatly, and the capabilities of the present plant are already overtaxed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE iron trade is in a languid state, except in the case of companies which are engaged in the production of specialities.

It is interesting to notice from the Board of Trade returns for April that there were exported during that month 345,704 tons of steel and iron, being not quite 17,000 tons more than last year. The value was £2,433,215, or an increase of £95,746. The United States is Britain's leading customer for pig iron, bars, angles, &c. Steel rails were exported to the weight of 52,223 tons—decrease, 4000 tons. The total quantity of rails and railway iron was 64,959 tons. To Sweden, Spain, Italy, Holland, South Africa, Canada, and Mexico, there was increase; but the demand for the United States fell from 38,753 to 16,360 tons, for Australia from 11,164 to 4685 tons, and for Russia from 2064 to 72. At one time Russia competed with the United States in being Sheffield's best customer for rails. For steel the United States has doubled its demand, rising from 7517 in April, 1881, to 14,474 in April, 1882. The shipments to the States, however, were chiefly Bessemer billets and blooms. An increase is also to be noted in steel and iron wire, hardware, and cutlery—the improvement being over £27,000. Of the improving markets Australia shows a value of £56,627 against £38,704 last April. Sheffield manufacturers are confident that Australia will yet be our most important market for many leading Sheffield specialities.

Another dreadful accident has taken place in the Derbyshire lead mines—this time at the Wheel Rake Mine, near Youlgreave. Two miners, named Ernest Garratt and James Watts, were descending the shaft in the cage for the midnight shift, when the cage suddenly stopped 27 yards from the bottom. The rope, however, was still being paid out. Perceiving their perilous position, the two men tried to reach the alarm rope, but in doing so set the cage at liberty, and it fell to the bottom of the shaft. Garratt was killed, and Watts fearfully injured.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Glasgow warrant market has been very quiet during the the greater part of the week. Business was done in the warrant market on Friday at from 47s. 3½d. to 47s. 1d. cash. On Monday the prices fluctuated between 47s. 1½d. and 47s. cash. The market was quiet on Tuesday forenoon, with business at 47s. and 47s. 1d. cash, and 47s. 2d. to 47s. 2½d. one month. The market was rather firmer on Wednesday, with a fair business done up to 47s. 5d. cash, and 47s. 6d. one month. To-day—Thursday—the tone was again firm, with business at 47s. 6½d. cash, and 47s. 8d. one month.

There is little alteration in the prices of makers' iron, which are in some cases somewhat firmer. Gartsherrie, f.o.b. at Glasgow, per ton, No. 1 is quoted at 58s. 6d.; No. 3, 53s. 6d.; Coltness, 59s. and 54s. 6d.; Langloan, 59s. and 54s. 6d.; Summerlee, 57s. 6d. and 50s. 6d.; Calder, 57s. and 51s.; Carnbroe, 51s. 6d. and 48s. 6d.; Clyde, 51s. and 49s.; Monkland, 48s. 6d. and 47s.; Quarter, 48s. 6d. and 47s.; Govan at Broomielaw, 49s. and 47s. 6d.; Shotts at Leith, 59s. and 54s. 6d.; Carron at Grangemouth, 49s. 6d.—specially selected, 52s.—and 48s. 6d.; Kinneil at Bo'ness, 47s. 6d. and 46s. 6d.; Glengarnock at Ardrossan, 51s. 6d. and 48s. 6d.; Eglinton, 48s. 6d. and 46s. 6d.; Dalmellington, 48s. 6d. and 47s.

The arrivals of Cleveland iron are considerably larger this week than last, amounting to 3175 tons, against 1360 in the preceding week, and 4260 in the corresponding week of last year.

The demand for hematite iron continues flat, and stocks are accumulating. Inquiries with reference to the condition of matters at the malleable ironworks are of a satisfactory nature, nearly all the works being very busy.

The general engineering works are likewise very busy, and a large number of additional firms have, in the course of the week, conceded the advance of ½d. per hour to their workmen. It is now believed that the advance will without delay become general, and that no serious dispute will take place. Important consignments of locomotives are being made to Canada, the States, and India.

The sewing machine manufacture at Glasgow continues to develope in a very satisfactory manner. The week's exports of machines from the Clyde generally vary from £5000 to £8000 in value, but it is noticeable that during last week no less than £12,815 worth were despatched, the greater portion of which went to Mediterranean ports.

Messrs. James and Wm. Wood, coalmasters, Glasgow, have purchased the Drumpellier Collieries at Coatbridge, which belonged to the firm of Henderson and Dimmock, and will carry them on under the title of the Drumpellier Coal Company.

A satisfactory report can be given of the coal trade. A few days ago a meeting of the Scottish Miners' Association was held at Uddingston, near Glasgow, at which a number of delegates attended from various districts of Lanark and Ayrshire, and a recommendation was adopted and submitted to a mass meeting of miners, held immediately afterwards, to the following effect:—"That in view of the fact of the great output of coal being in excess of the steady demand, this meeting resolves to restrict its labour to eight hours per day and five days per week." It was stated by one of the speakers that although the coal market was in a good condition, the miners were earning not more than on an average of 3s. 6d. per day, and they were apprehensive that unless the extensive output was reduced by restriction, the masters would ere long enforce a reduction of wages. It is doubtful whether the miners generally throughout the west country will adhere to the resolution which was adopted, more particularly as a large number of men employed in the busiest part of the Clyde basin were unrepresented at the meeting. Efforts are now being made, both by the miners of Fife and Clackmannan and Mid and East Lothian, to induce the employers to return to them the recent reduction of 12½ per cent. on their wages.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE Miners' Provident Fund, which was started in Wales a few years ago on the lines of the Lancashire Fund by Mr. Campbell, has had a hard fight for existence, but Mr. W. T. Lewis, who took it in hand, has the special merit of ignoring failure. He has kept persistently on, until at present date there are 6000 members enrolled. This week, after a long series of strenuous efforts, Mr. Lewis had the gratification of handing over to it the balance of the Hartley Fund, amounting to £3294 15s.

I note that the Bute Dock Bill has passed the House of Lords. This, of course, does not secure the Bill, as the battle in the other House is to be fought; but supporters are sanguine, especially as opponents are falling off.

The coal trade is looking up again. Excluding all coal sent by rail to London and Liverpool, and Midland counties, the enormous quantity of 205,436 tons was sent away from Welsh ports last week. There is a good deal of buoyancy also in price, and new takings are coming into notice, one especially in the new district that is being opened out by the Taff Vale Railway. A pair of pits is being sunk in the Clydach, valley by Mr. Beith, favourably known in deep coal enterprises as the successful engineer of the Harris Deep Navigation, and also of the New Tredegar pit. In a few days the second pit at Merthyr Vale will also come into operation.

Side by side with this great activity in the development of the coal fields, is to be noticed, especially at Cardiff, an increase in electric light adaptation. Many of the collieries are being supplied with it for outdoor purposes.

Changes are contemplated in the Ebbw Vale management, and Mr. Holland is named as a likely appointment.

The Government Commissioners of Mines have ended their labours for the time on gas experiments in the Rhondda Valley last week. Professor Tyndall was present.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending May 13th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9730; mercantile marine, building materials, and other collections, 3283. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 1657; mercantile marine, building materials, and other collections, 365. Total, 15,035. Average of corresponding week in former years, 14,372. Total from the opening of the museum, 20,920,624.

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.

9th May, 1882.

2161. Refining Sugar, A. Scott, jun., J. D. Scott, and T. R. Ogilvie, Greenock.
2162. Horseshoes, R. C. Eames, Westminster.
2163. Pyrometer, A. Sauvée.—(*E. H. Amagat, Lyons.*)
2164. Regulating Flow of Water, T. S. Borrodaile, London, and E. J. C. Welch, Westminster.
2165. Holders, F. Steitz, London.
2166. Utilising Heat, T. Charlton & J. Wright, London.
2167. Rotary Engines, W. P. Thompson. —(*D. D. Hardy, Chicago.*)
2168. Filters, G. Macaulay-Cruikshank.—(*H. Rice, U.S.*)
2169. Advertising, E. P. Alexander.—(*J. Hemardinquer, Paris.*)
2170. Kilns, G. W. H. Brogden and E. Casper, London.
2171. Refrigerating, W. P. Thompson.—(*McMillan and Johnson, U.S.*)
2172. Velocipedes, J. Harrington, Coventry.
2173. Connecting Apparatus, E. Wright, London.
2174. Tricycles, C. Harvey & W. Paddock, Birmingham.
2175. Horseshoes, A. Vanderkerken and J. Mans, Brussels.
2176. Wire Bands, A. W. Reddie.—(*G. Nicholson, U.S.*)
2177. Purifying Water, P. Spence and F. M. Spence, Manchester.
2178. Colouring Matters, J. A. Dixon.—(*Meister, Lucius, and Brüning, Germany.*)
2179. Squeegees, A. Foster, Watford.
2180. Recording Distances, G. C. Lilley, London.
2181. Gas Furnaces, W. Batho.—(*E. Stoltz, Berlin.*)
2182. Clocks, A. Harder, Prussia.
2183. Dressing Silk, A. M. Clark.—(*Vicompte de Gombert, Paris.*)
2184. Electro-magnetic Engines, C. Varley, Kent.
2185. Electro-magnetic Engines, C. Varley, Kent.
2186. Electric Lamps, H. Lea, Birmingham.

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2187. Articulated Levers, A. Gain, London.
2188. Opening Bottles, P. Murat and A. Motet, Manchester.
2189. Sharpening Razors, A. Payne, East Moulsey.
2190. Railway Signals, W. Goalen, London.
2191. Hats, S. Wilde and H. Beech, Denton.
2192. Electric Lamps, C. J. Allport, London.
2193. Nitro-sulphuric Acid, W. Brookes, London.—(*T. Holliday, Huddersfield.*)
2194. Whalebone, A. C. Henderson.—(*F. Robin, Paris.*)
2195. Signalling, A. Smith and S. Taylor, Kibworth.
2196. Winding Cotton, H. C. Hill and H. H. Brown, Stalybridge.
2197. Anchors, C. Martin, Brighton.
2198. Preparing Hides, J. Stocks & B. Stocks, Leeds.
2199. Steamship Screws, G. von Nawrocki.—(*F. Maringer, Düsseldorf.*)
2200. Indicating a Ship's Position, A. W. Tuer, London, and J. Cleminson, Westminster.
2201. Railway Signals, A. W. Tuer, London, and J. Cleminson, Westminster.
2202. Motor Engines, S. Clayton, Bradford.
2203. Printing Machines, W. Lake.—(*J. Hawkins, U.S.*)
2204. Printing Machines, W. Lake.—(*J. Hawkins, U.S.*)
2205. Curing Gapes in Birds, J. H. Clark, Tardebigge.
2206. Filling Sacks, H. Haddan.—(*L. Rohmer, France.*)
2207. Magneto-electric Engines, C. Varley, Kent.
2208. Printing Machines, W. Lake.—(*J. Hawkins, U.S.*)
2209. Ornamenting Surfaces, S. J. J. Kelly, London, and C. B. Lindsay, Blackheath.
2210. Swing Looking-glasses, H. Carter, London.
2211. Ornamenting Tin-plates, C. Johnson, London
2212. Wire Woven Fabric, A. Arnold, Halifax.
2213. Hides, A. M. Clark.—(*J. L. Moret, Paris.*)
2214. Cleaning Grain, W. Korth, Belfast.

11th May, 1882

2215. Sights for Rifles, T. Gilbert, London.
2216, Water-closets, T. C. Summers, Portsea.
2217. Knife Cleaner, H. Woodward, London.
2218. Elastic Couplings, J. Greenwood, Southend.
2219. Steel, &c., T. N. Muller, Middlesbrough-on-Tees.
2220. Ornamenting Ribbons, A. H. Horsfall, Coventry.
2221. Lamp Globes, J. Archer and T. L. Archer, Manchester.
2222. Treating Offal, H. J. Haddan.—(*J. N. B. Bond, jun., New York.*)
2223. Car Couplings, H. J. Haddan.—(*R. Brooks, U.S.*)
2224. Nitrous Vapours, G. Prim, Mons.
2225. Dynamo-electric Machines, T. Floyd, Westminster, and T. Kirkland, jun., Upper Norwood.
2226. Electric Lamp, T. Floyd, Westminster, and J. Probert, Surrey.
2227. Pneumatic Brakes, F. W. Eames, Leeds.
2228. Freezing Liquids, A. Allworth, Camberwell.
2229. Candlesticks, W. Blundell, London.
2230. Winding Engines, T. Perkins, Hitchin.
2231. Gas, B. Russ, Chancery-lane.
2232. Electric Currents, J. M. Stuart, London.
2233. Electric Lamps, J. M. Stuart, London.
2234. Life-preserving Beds, A. M. Clark.—(*M. H. Holmes and J. R. Steiner, St. Paul, U.S.*)
2235. Colouring Matter, J. H. Loder, Holland.
2236. Beverage, J. H. Loder, Leiden, Holland.
2237. Microphones, J. H. Johnson.—(*A. D'Arsonval, Paris.*)
2238. Furnaces, J. H. Johnson.—(*J. Mallett, jun., U.S.*)
2239. Separating Sugar from Molasses, C. Scheibler, Berlin.
2240. Locks, M. Gilmour, Paisley.

12th May, 1882.

2241. Boilers, S. Jones, Wrexham.
2242. Colouring Matters, J. Erskine.—(*C. Rumpff, Aprath, Germany.*)
2243. Capstans, A. Kennedy, Ailsa.
2244. Stairs, J. Thallon, London.
2245. Saving Life, J. R. Hodgson, Limehouse.
2246. Pulleys, W. R. Lake.—(*F. Roy, France.*)
2247. Signalling, J. McLaren & H. Sherratt, London.
2248. Measuring Electrical Currents, T. Varley, Walthamstow, and H. B. Greenwood, London.
2249. Reels, A. J. Boult.—(*A. Descamps, Lille.*)
2250. Barrels, S. Wright, Liverpool.
2251. Rock Boring, J. Urwin, Scotswood-on-Tyne.
2252. Steel Pinned Covering, T. R. Harding and T. W. Harding, Leeds.
2253. Spinning and Doubling, H. Hall, Blackpool.

13th May, 1882.

2254. Figured Pile Fabrics, T. Anderson, York.
2255. Looped Fabrics, J. & H. Kiddier, Nottingham.
2256. Electric Light, H. Wilde, Manchester.
2257. Gas Engines, O. Mobbs, Northampton.
2258. Windlasses, W. H. Whettem, Gateshead.
2259. Transmitting Sounds, W. C. Barney, London.
2260. Planing Metals, G. Richards.—(*J. Richards, U.S.*)
2261. Umbrellas, W. H. Beck.—(*A. Rolland, Paris.*)
2262. Embroidery, F. and E. Stanton, Lewisham.
2263. Secondary Batteries, A. Tribe, London.
2264. Engraving, T. R. Johnston, Edinburgh.
2265. Lamps, J. Hinks, Birmingham.
2266. Letter-box, W. Newell & T. Tollett, Birmingham.
2267. Fastenings for Gloves, W. R. Lake.—(*W. S. Richardson and P. K. Dumarsq, U.S.*)
2268. Velocipedes, H. Davey and P. Holst, London.

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2269. Harrows, R., J., and H. Wilder, Wallingford.
2270. Electricity, R. H. Simons, Brixton.
2271. Heating Carriages, J. Imray.—(*A. Morel, Paris.*)
2272. Stench Traps, J. M. Hale, London.
2273. Chimney-top, C. H. von Ullner, London.
2274. Flour Mill, A. B. Wilson, Co. Down.
2275. Bedsteads, Couches, &c., T. Welton, London.
2276. Heat and Light, A. H. Hearington, London.
2277. Producing Pictures, H. J. Haddan.—(*E. Godard, Paris.*)
2278. Oxide of Lead, H. H. Lake.—(*G. T. Lewis, U.S.*)
2279. Pricking-up Apparatus, J. Day, Stafford.
2280. Filling Bottles, C. M. Sombart.—(*O. Assmann, Holland.*)
2281. Fire-escapes, J. Gordon, Leeds.
2282. Velocipedes, J. and H. Brookes and M. Green, Smethwick.
2283. Gold and Silver Thread, F. Wirth.—(*C. O. Harz and W. von Miller, Munich.*)
2284. Rotary Engines and Pumps, E. Peck, Charlton.
2285. Mattresses, J. W. Watts, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

2160. Bottle Cleaner, A. M. Clark, Chancery-lane, London.—A communication from W. S. Wood, New York, and L. H. Livingston, jun., Rhinebeck, U.S. —8*th May*, 1882.
2223. Car Couplings, H. J. Haddan, Kensington.—A communication from R. M. Brooks, Georgia, U.S. —11*th May*, 1882.

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

1824. Cast Iron Structures, J. A. Brodie and D. Jack, Leith.—8*th May*, 1879.
1850. Cutters or Shears, R. C. Fletcher, Tarleton.—9*th May*, 1879.
1855. Metallic Sulphides, J. B. Spence, London.—9*th May*, 1879.
1856. Furnaces, W. Pinkney, Egglestone.—9*th May*, 1879.
1857. Reaping Machines, J. Howard, E. T. Bousfield, and G. Gibbs, Bedford.—9*th May*, 1879.
1859. Water Meters, W. R. Lake, London.—9*th May*, 1879.
1970. Cod-liver Oil, J. Fordred, Tottenham.—16*th May*, 1879.
1520. Sash Fasteners, R. Adams, Southwark.—18*th April*, 1879.
1854. Measuring Taps, P. Everitt, Great Ryburgh.—9*th May*, 1879.
1865. Nitro-cellulose, H. Parkes, Gravelly Hill.—10*th May*, 1879.
1866. Varnishes, H. Parkes, Gravelly Hill. — 10*th May*, 1879.
1883. Reaping Machines, C. T. Burgess, Brentwood. —12*th May*, 1879.
1899. Steam Steering, G. Donkin and B. G. Nichol, Newcastle-upon-Tyne.—13*th May*, 1879.
1940. Paper, &c., G. Boyce, King's Norton.—14*th May*, 1879.
1958. Gas, &c., Fittings, S. Duffield, Darlaston.—16*th May*, 1879.
2062. Boring Metals, J. Barrow, Leeds.—23*rd May*, 1879.
1305. Casement Stays, R. Adams, Southwark.—4*th April*, 1877.
1861. Stoppering Bottles, H. Barrett, Hampton.—10*th May*, 1879.
1867. Window Frames, A. C. Henderson, Holborn.—10*th May*, 1879.
1870. Iron and Steel, C. F. Claus, London.—10*th May*, 1879.
1914. Machine Driving Chains, W. R. Lake, London. —13*th May*, 1879.
2163. Tramway Cars, A. M. Clark, London.—30*th May*, 1879.
2597. Fuses, C. A. McEvoy, London.—27*th June*, 1879.
1893. Sewing Machines, W. L. Bigelow, London.—13*th May*, 1879.
2053. Metallic Fences, P. M. Justice, London.—23*rd May*, 1879.
2273. Hydraulic Lifts, S. Duer, Westminster.—9*th June*, 1879.
2399. Explosives, H. E. Newton, London.—17*th June*, 1879.
1876. Refrigerating, K. Knott, Finsbury.—12*th May*, 1879.
1910. Cutting Heads on Stays, R. Peacock and C. Holt, Gorton.—13*th May*, 1879.
1916. Head Measuring Bands, G. Heath, London.—14*th May*, 1879.
1927. Swing Looking-glasses, J. Parry, Sale.—13*th May*, 1879.
1930. Window Sashes, C. H. Pennycook, Glasgow.—14*th May*, 1879.
1932. Knitting, W. H. McNary, Nottingham.—14*th May*, 1879.
1972. Lamps, J. L. English, Epping.—16*th May*, 1879.
1984. Sextants and Octants, G. W. Heath, Crayford —19*th May*, 1879.
1990. Purifying Water, J. H. Porter, Blackfriars.—20*th May*, 1879.
1926. Tin and Terne Plates, W. A. Johns, Gilwern.—14*th May*, 1879.
2037. Steering Gear, G. A. C. Bremme, Liverpool.—22*nd May*, 1879.

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

1710. Glass Combination, P. R. de F. D'Humy, London.—8*th May*, 1875.
1926. Furnaces, R. Dunn, Wylam-on-Tyne.—26*th May*, 1875.
2161. Ornamenting Fabrics, H. E. Newton, London. —12*th June*, 1875.
1736. Shaping Potters' Clay, J. M. Napier, Lambeth. —10*th May*, 1875.
1812. Composing Type, A. Fraser, Edinburgh.—15*th May*, 1875.
1902. Small-arms, W. M. Scott, Birmingham.—25*th May*, 1875.
1819. Driving Spindles, A. W. Finlayson, Johnstone. —15*th May*, 1875.
1856. Permanent Way, J. H. Johnson, London.—20*th May*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 2nd June, 1882.

82. Recording Fixed Amounts, J. T. Parlour, London. —6*th January*, 1882.
83. Reclamation of Land, W. R. Lake, London.—A communication from G. Howell.—6*th January*, 1882.
91. Heddle Frames, F. W. Pim and T. Sands, Dublin. —7*th January*, 1882.
94. Sugar, J. W. Culmer, Moscow.—A communication from E. Wernickenck.—7*th January*, 1882.
99. Velocipedes, M. D. Rucker, jun., Bethnal Green. —7*th January*, 1882.
117. Railway Signalling, N. Ager, Pimlico.—9*th January*, 1882.
123. Stillions, R. Moreland, jun., London.—10*th January*, 1882.
124. Reproducing Engravings, L. H. Philippi, Hamburg.—10*th January*, 1882.
128. Army Trenching Tool, A. H. Storey, Wandsworth.—10*th January*, 1882.
137. Tip Wagons, J. W. Glover, Warwick.—10*th January*, 1882.
177. Steel, W. T. Whiteman, London.—A communication from C. Martin.—13*th January*, 1882.
184. Gas Burners, T. A. Richardson, London.—A com. from J. H. Smith.—13*th January*, 1882.
204. Distilling Apparatus, G. E. Vaughan, London. —A com. from F. Lürmann.—14*th January*, 1882.
207. Perambulators, J. H. Miles, Birmingham.—14*th January*, 1882.
213. Breech-loading Fire-arms, H. A. A. Thorn, London. —16*th January*, 1882.
219. Corrugated Tubes, S. Fox, New Wortley.—16*th January*, 1882.
221. Corrugated Tubes, S. Fox and J. Whitley, Leeds. —16*th January*, 1882.
307. Weaving Looms, T. Sutcliffe, Todmorden.—21*st January*, 1882.
399 Ornamenting Earthenware, W. H. Slater, Stoke, and E. C. Hancock, Worcester.—26*th January*, 1882.
427. Steam Boilers, P. Jensen, London.—A communication from W. Wilmsmann.—27*th January*, 1882.
696. Treating Metals, A. M. Clark, London.—A communication from L. Clémandot.—13*th February*, 1882.
756. Producing Electric Currents, J. Brockie, Brixton.—16*th February*, 1882.
898. Electric Arc Lamps, J. Brockie, Brixton.—24*th February*, 1882.
1319. Fire-escapes, G. Lakeman, Exeter, and G. Jelly, Liverpool.—18*th March*, 1882.
1363. Secondary Batteries, F. Maxwell-Lyte, London.—21*st March*, 1882.
1548. Secondary Batteries, W. B. Brain, Cinderford. —30*th March*, 1882.
1597. Bottle Stoppers, H. J. West, Southwark.—1*st April*, 1882.
1620. Plaster, P. M. Justice, London.—A communication from M. B. Church.—4*th April*, 1882.
1688. Packing Cases, D. Nicoll, Strand.—6*th April*, 1882.
1726. Railway Signalling, E. Tyer, London.—12*th April*, 1882.
1784. Hot-air Engines, M. P. W. Boulton, Tew Park. —14*th April*, 1882.
1788. Caloric Engines, M. P. W. Boulton, Tew Park, and E. Perrett, London.—14*th April*, 1882.
1834. Block Ice, W. W. Nightingale, Southport.—18*th April*, 1882.
1851. Insulated Supports, C. Curtoys, London.—18*th April*, 1882.
1879. Saccharine Compounds, W. R. Lake, London.—A com. from E. Wilhelm.—19*th April*, 1882.
1915. Electric Lamps, W. T. Whiteman, London.—A com. from M. Bauer and Co.—22*nd April*, 1882.
2160. Bottle Cleaner, A. M. Clark, London.—A com. from W. Wood & L. Livingstone, U.S.—8*th May*, 1882.

Last day for filing opposition, 6th June, 1882.

130. Obtaining Electric Currents, W. T. Henley, Plaistow.—10*th January*, 1882.
135. Fire-lighters, F. Holmes, New Cross.—10*th January*, 1882.
139. Railway Signalling, A. H. Perry and E. J. Houghton, London.—10*th January*, 1882.
146. Lithographic Printing Machines, G. Newsum, Leeds.—11*th January*, 1882.
150. Extinguishing Fire, W. Dennis, Brixton.—11*th January*, 1882.
166. Indicating Speed, L. Smith, London.—12*th January*, 1882.
167. Dyeing Felt, J. Allan, London.—12*th January*, 1882.
168. Lubricant, T. G. Alcock, Manchester, and J. Johnson, Stretford.—12*th January*, 1882.
169. Electro-motors, H. S. Raison, Bayswater.—12*th January*, 1882.
171. Looms, C. Turner, Colne.—12*th January*, 1882.
174. Polishing Rods, A. Watt, Fairfield.—12*th January*, 1882.
178. Railway Signalling, C. E. Spagnoletti, Maida Hill.—12*th January*, 1882.
182. Forging Rivets, F. W. Wallner, Cologne.—13*th January*, 1882.
186. Coke, H. J. Haddan, Kensington.—A communication from G. Seibel.—13*th January*, 1882.
195. Wine, E. G. Brewer, London.—A communication from A. and L. Q. Brin.—13*th January*, 1882.
198. Electric Block Signals, J. Radcliffe, Retford.—13*th January*, 1882.
209. Glazing Greenhouses, T. R. Shelley, Smethwick.—14*th January*, 1882.
212. Corking Bottles, K. F. C. Petersen, Hamburg. —16*th January*, 1882.
214. Steel-yards, J. Spencer & J. Consterdine, Hollinwood, & J. Greenwood, Salford.—16*th January*, 1882.
218. Railway Couplings, H. E. Newton, London.—A communication from the Société Anonyme des appareils automatiques pour accrochor et décrocher les wagons de chemins de fer.—16*th January*, 1882.
239. Ground for Colours, F. Wirth, Germany.—A communication from O. Kall.—17*th January*, 1882.
252. Secondary Batteries, H. H. Lake, London.—A communication from La Société Universelle d'Electricité Tommasi.—18*th January*, 1882.
264. Ascertaining Depths, T. Bassnett, Liverpool.—19*th January*, 1882
292. Rudders, H. Lumley, London.—20*th January*, 1882.
360. Supporting Window-sashes, W. R. Lake, London. —A com. from P. W. Blyth.—24*th January*, 1882.
518. Velocipedes, A. G. Meeze, A. G. Salamon, and R. E. Phillips, London.—2*nd February*, 1882.
630. Lamps, S. Pitt, Sutton.—A communication from H. Peigniet.—9*th February*, 1882.
691. Fire-bars, S. Barlow, Castleton.—13*th February*, 1882.
900. Gas Burners, G. S. Grimston, Brockley.—24*th February*, 1882.
1037. Rotary Air Pumps, R. Skene, Lambeth.—3*rd March*, 1882.
1100. Pianofortes, J. Ainsworth, Brinscall.—7*th March*, 1882.
1152. Reaping Machines, J. Macgregor, Edinburgh, & G. Redfearn, Berwick-on-Tweed.—9*th March*, 1882.
1221. Roller Bearings, T. F. Hemmich, Reading.—14*th March*, 1882.
1350. Looms, A. Priestman and J. Ackroyd, Bradford. —20*th March*, 1882.
1462. Electric Lamps, S. Waters, London.—27*th March*, 1882.
1570. Electric Arc Lamps, W. Jeffery, North Woolwich.—31*st March*, 1882.
1590. Gas-motor Engines, R. Skene, Lambeth.—1*st April*, 1882.
1594. Reverberatory Furnaces, W. W. Hughes, Bayswater.—1*st April*, 1882.
1728. Glycerine, B. J. Young, Manchester.—A communication from J. P. Battershall.—12*th April*, 1882.
1819. Collecting Water, T. Pullin and H. Bonsor, Newcastle-under-Lyme.—17*th April*, 1882.
1838. Packing, J. Bell, Liverpool, and R. H. Harper, London.—18*th April*, 1882.
1874. Production of Gas, W. C. Brown, Sheffield.—19*th April*, 1882.
1877. Grinding Rolls, W. P. Thompson, London.—A com. from R. Birkholz & E. Allis.—19*th April*, 1882.
1878. Dynamo-electric Machines, J. H. Johnson, London.—A communication from J. M. A. Gerard-Lescuyer.—19*th April*, 1882.
1881. Breech-loading Small-arms, W. Tranter, Birmingham.—19*th April*, 1882.
1887. Steam Engines, J. W. Richardson, Neptune Works.—20*th April*, 1882.
1896. Telephonic Signalling, A. C. Brown and H. A. C. Saunders, London.—20*th April*, 1882.
1898. Stoppers for Bottles, J. Ballard, Nottingham. —21*st April*, 1882.
1942. Fastenings for Gloves, W. Bown, Birmingham. —24*th April*, 1882.
1958. Steam Boilers, G. W. Hawksley and M. Wild, Sheffield.—25*th April*, 1882.
1960. Clock Mechanism, H. H. Lake, London.—A communication from F. A. Lane.—25*th April*, 1882.
1978. Cleansing Chinese Nettle, W. R. Lake, London. —A com. from P. A. Favier.—26*th April*, 1882.
1934. Refrigerating, J. Chambers, Manchester.—27*th April*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 12th May*, 1882.)

4972. Metallic Fasteners, W. F. Lotz, London.—14*th November*, 1881.
4981. Hoppers, &c., J. Higginbottom and O. Stuart, Liverpool.—14*th November*, 1881.
4985. Teeth Brushes, E. Pierrepont, London.—14*th November*, 1881.
4986. Pickers, E. Hallas, Huddersfield.—14*th November*, 1881.
4995. Measuring Speed, C. E. Kelway and F. Dyer, London.—15*th November*, 1881.
5005. Velocipedes, E. J. Castle, London.—15*th November*, 1881.
5016. Treating Fabrics, J. and P. Hawthorn and J. P. Liddell, New Mills.—16*th November*, 1881.
5017. Fire-arms, A. Dardelle, Pentonville.—16*th November*, 1881.
5023. Charging Syphons, T. G. Messenger, Loughborough.—16*th November*, 1881.
5031. Spinning Cotton, M. Dickie, jun., Stockport.—17*th November*, 1881.
5032. Railway Signalling, S. Brear and A. Hudson, Bradford.—17*th November*, 1881.
5036. Mixing Gas, J. A. B. Bennett, King's Heath, and B. P. Walker, Birmingham.—17*th November*, 1881.
5047. Smiths' Hearths, A. Wilson, Handsworth.—17*th November*, 1881.
5053. Telescopic Sights, L. K. Scott, London.—18*th November*, 1881.
5058. Sheet Iron, &c., W. Morgan-Brown, London.—10*th November*, 1881.
5070. Telephonic Repeater, C. Moseley, Manchester. —19*th November*, 1881.
5101. Mechanical Heels, A. Steenberg, Copenhagen. —22*nd November*, 1881.
5118. Constructing Roads, H. J. Haddan, London.—23*rd November*, 1881.
5164. Lawn-tennis Poles, E. Haskell, London.—26*th November*, 1881.
5246. Separating Ores, F. C. Glaser, Berlin.—30*th November*, 1881.
5286. Producing Electric Light, A. R. Sennett, Worthing.—3*rd December*, 1881.
5398. Tubes, T. and W. J. Nicholls, London.—9*th December*, 1881.
5428. Burners, R. H. Brandon, Paris.—12*th December*, 1881.
5472. Mechanical Stoppers, N. Fritzner, Berlin.—14*th December*, 1881.
5562. Separating Grain, W. Burley and J. H. Morgan, St. John's.—19*th December*, 1881.
5691. Trueing Surfaces of Cylinders, C. A. Barlow. Manchester.—28*th December*, 1881.
173. Fire Signals, C. B. Crisp, London.—12*th January*, 1882.
190. Gas Kilns, D. and W. H. Thompson, Leeds.—13*th January*, 1882.
258. Stoves, R. G. Greig, London.—18*th January*, 1882.
478. Disintegrating Jute, H. J. Haddan, London.—31*st January*, 1882.
536. Ovens, D. and W. Thompson and W. J. Booer Leeds.—3*rd February*, 1882.
912. Washing Gases, H. A. Bonneville, London.—25*th February*, 1882.
1106. Preventing Shifting of Grain, W. R. Lake, London.—7*th March*, 1882.
1246. Musical Instruments, H. H. Lake, London.—14*th March*, 1882.

(*List of Letters Patent which passed the Great Seal on the 16th May*, 1882.)

5033. Artificial Marble, B. O'Neill, London.—17*th November*, 1881.
5056. Hot-air Engines, A. E. and H. Robinson, Manchester.—18*th November*, 1881.
5059. Spinning Cotton, E. Edwards, London.—18*th November*, 1881.
5061. Steam Engines, H. J. Coles, Southwark.—19*th November*, 1881.
5062. Pistons, J. Hopkinson, Sheffield.—19*th November*, 1881.
5064. Fire-proof Floors, E. Homan, Turnham Green. —19*th November*, 1881.
5072. Grinding Corn, E. Phillips, London.—19*th November*, 1881.
5087. Treating Horn, W. Hughes, Pimlico.—21*st November*, 1881.
5089. Combing Wool, A. Smith and M. Firth, Bradford.—21*st November*, 1881.
5107. Horseshoes, E. Kimber, West Dulwich.—22*nd November*, 1881.
5109. Vacuum Brake, J. Gresham, Salford.—23*rd November*, 1881.
5114. Jacquard Machines, A. Place, Macclesfield.—23*rd November*, 1881.
5125. Screw Spanners, H. Waters, sen., and A. Vickerstaff, Birmingham.—23*rd November*, 1881.
5129. Umbrellas, &c., R. H. Brandon, Paris.—24*th November*, 1881.
5143. Fire-arms, T. W. and H. Webley, Birmingham. —24*th November*, 1881.
5160. Cutting Coal, J. R. Bower, J. F. A. Pflaum, and J. T. Tannett, Leeds.—25*th November*, 1881.
5217. Cranes, W. Clarke, Gateshead-on-Tyne.—29*th November*, 1881.
5219. Nippers, F. J. Cheesbrough, Liverpool.—29*th November*, 1881.
5245. Ships' Propellers, C. D. Abel, London.—30*th November*, 1881.
5252. Clothes Dryer, H. J. Haddan, Kensington.—1*st December*, 1881.
5282. Fancy Yarns, E. Horsfall, Bradford.—2*nd December*, 1881.
5289. Steam Generators, W. L. Wise, London.—3*rd December*, 1881.
5321. Printing Machinery, J. Salmon, M. Smith, and J. Hamilton, Manchester.—6*th December*, 1881.
5399. Gas, J. Laycock and T. Clapham, Keighley.—9*th December*, 1881.
5422. Substitute for Cardboard, H. J. Haddan, London.—12*th December*, 1881.
5563. Furnaces, W. L. Wise, London.—20*th December*, 1881.
5582. Tipping Wagons, H. Grafton, London.—21*st December*, 1881.
5615. Cables, J. N. Culbertson, Antwerp, and J. W. Brown, London.—22*nd December*, 1881.
5625. Cooling Air, J. J. Coleman, Glasgow.—23*rd December*, 1881.
5645. Spinning Cotton, J. Walker, Hyde.—24*th December*, 1881.
5660. Electric Lamps, L. S. Powell, London.—24*th December*, 1881.
5708. Anchors, J. Nock, Hasskeni.—29*th December*, 1881.
70. Ships' Seats, E. S. Copeman, Downham Market.—6*th January*, 1882.
638. Refrigerating, J. J. Coleman, Glasgow.—10*th February*, 1882.
711. Diminishing Vibrations, W. J. J. Robinson, Limerick.—14*th February*, 1882.
971. Ratchet Braces, C. T. Colebrook, Islington.—28*th February*, 1882.
1089. Steel, J. Gjers, Middlesbrough-on-Tees.—7*th March*, 1882.
1190. Scraping Cane, W. R. Lake, London.—11*th March*, 1882.
1196. Car Couplings, J. E. Carmalt, Scranton, U.S.—11*th March*, 1882.
1224. Sewing Furniture Tufts, G. Doolittle, Bridgeport.—14*th March*, 1882.
1266. Artificial Indigo, J. H. Johnson, London.—16*th March*, 1882.
1292. Treating Alcohols, H. A. Bonneville, London. —17*th March*, 1882.
1300. Wall Paper, A. M. Clark, London.—17*th March*, 1882.
1328. Electric Signalling, L. J. Crossley, W. Emmott, Halifax, & J. Harrison, Bradford.—18*th March*, 1882.
1360. Gas Motor Engines, H. Sumner, Manchester.—21*st March*, 1882.

List of Specifications published during the week ending May 13th, 1882.

2783, 6d.; 3910, 6d.; 3931, 2d.; 4091, 6d.; 4097, 6d.; 4157, 4d.; 4261, 6d.; 4282, 6d.; 4285, 1s. 8d.; 4304, 6d.; 4313, 6d.; 4324, 6d.; 4327, 4d.; 4331, 6d.; 4332, 6d.; 4334, 6d.; 4340, 8d.; 4345, 10d.; 4346, 6d.; 4348, 6d.; 4349, 6d.; 4350, 6d.; 4353, 6d.; 4356, 6d.; 4359, 6d.; 4361, 6d.; 4362, 6d.; 4373, 8d.; 4374, 6d.; 4386, 8d.; 4390, 6d.; 4391, 4d.; 4392, 2d.; 4395, 2d.; 4396, 2d.; 4398, 2d.; 4399, 6d.; 4401, 2d.; 4402, 8d.; 4404, 8d.; 4405, 10d.; 4407, 4d.; 4412, 2d.; 4413, 2d.; 4414, 2d.; 4416, 2d.; 4417, 6d.; 4422, 6d.; 4426, 10d.; 4427, 6d.; 4428, 6d.; 4429, 2d.; 4431, 6d.; 4436, 4d.; 4438, 2d.; 4441, 2d.; 4443, 2d.; 4446, 4d.; 4447, 2d.; 4456, 6d.; 4457, 2d.; 4462, 6d.; 4463, 2d.; 4467, 2d.; 4468, 2d.; 4469, 2d.; 4471, 4d.; 4475, 2d.; 4476, 2d.; 4478, 6d.; 4479, 4d.; 4480, 2d.; 4482, 2d.; 4483, 2d.; 4484, 6d.; 4485, 4d.; 4486, 4d.; 4487, 6d.; 4488, 2d.; 4489, 2d.; 4490, 2d.; 4491, 6d.; 4493, 2d.; 4494, 2d.; 4495, 6d.; 4497, 6d.; 4498, 2d.; 4500, 2d.; 4501, 4d.; 4502, 2d.; 4505, 2d.; 4506, 4d.; 4507, 2d.; 4508, 4d.; 4512, 2d.; 4519, 6d.; 4531, 4d.; 4538, 4d.; 4541, 6d.; 4560, 6d.; 4605, 6d.; 384, 6d.; 741, 4d.; 832, 6d.; 834, 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.*

2783. ADJUSTING AND REGULATING THE WORKING OF INSTANTANEOUS PHOTOGRAPHIC SHUTTERS, *C. Sands, Leicester-square.—25th June*, 1881. 6*d*.

The object is to afford means for regulating the strength of a spring by which the shutter is worked, so as to determine the duration of the exposure, and consists in employing a spiral spring in a box with a ratchet and pawl arrangement to regulate the tension.

3441. IMPROVEMENTS IN AND APPERTAINING TO APPARATUS FOR GENERATING ELECTRICITY, AND MEANS FOR UTILISING THE SAME IN PRODUCING THE ELECTRIC LIGHT, *R. R. Moffatt and S. Chichester, Brooklyn, New York.—9th August*, 1881. 8*d*.

This invention relates to an improved dynamo machine and arc lamp. The improvements in the machine consist in an armature having its greatest length of cross section parallel with its axis, and being mounted on a central carrier, with the poles of the exciting magnet so arranged that they will envelope a larger portion of both inner and outer surfaces of the armature cylinder than is usual, thus reducing the amount of resistance to a minimum. Also to the application of iron lugs upon both inner and outer surfaces of the core, so as to cause the latter to be more highly charged owing to its closer metallic proximity. The improvements in the construction of an electric lamp consist of electro-magnets located in the main circuit, and in a shunt circuit, these magnets acting on armatures mounted on a rocking frame in connection with a brake, so as to regulate the feed of the carbons. The patent specification is illustrated with drawings of the machine and lamp.

3821. IMPROVEMENTS IN ELECTRIC LAMPS OR REGULATORS, *A. L. Fyfe, London, and J. Main, Brixton.—2nd September*, 1881. 6*d*.

In this lamp the upper carbon is automatically fed forward by a train of wheels, which train is controlled by the current. The carbon holder and train are capable of receiving from an electro-magnet in the main circuit a slight longitudinal movement bodily in the lamp frame, whereby they are raised for the purpose of separating the carbons and establishing the arc, the brake on the train being actuated by another electro-magnet so as to permit the descent of the carbon holder independently of the train for feeding the carbon as it is consumed.

3871. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *H. A. Harborow, London.—6th September*, 1881.—(*Not proceeded with.*) 2*d*.

This consists of a dynamo-machine with two armatures revolving in opposite directions, and independently if required.

3910. MONETARY AND OTHER DOCUMENTS FOR COMMERCIAL PURPOSES, &c., TO PREVENT FRAUDS, *A. A. Cochrane, Westminster.—9th September*, 1881. (*Void.*) 6*d*.

This relates to means for preventing the alteration of the value of cheques, and consists in the use of printed letters and figures, arranged in rows or columns, some of which are to be effaced, to show the amount for which the cheque was drawn.

3931. WRINGING COTTON, LINEN, OR OTHER FIBROUS YARNS, &c., *J. Wolstenholme, near Manchester.—10th September*, 1881.—(*Not proceeded with.*) 2*d*.

The material to be wrung is placed on two hooks, one of which remains stationary, while the other is caused to revolve, a spring or weight being attached to the stationary hook so as to regulate the degree of tightness in wringing.

4091. TRICYCLES, &c., *J. Adams, Camberwell.—22nd September*, 1881. 6*d*.

The driving axle is made with two, three, or more cranks, and has two, three, or more cog or band wheels keyed to it, and over its centre is a frame carrying other wheels gearing into the former, and capable of being thrown in or out of gear to vary the speed. The upper wheel is fitted with handles for the rider to assist in locomotion, and the cranks are worked by treadles. The steering wheel is worked by worm and worm wheel.

4097. MAKING CARDS, *J. Sellers, near Cleckheaton.—23rd September*, 1881. 6*d*.

The object is to arrange card-setting machines so as to produce cards with two bends between the crown and point of each tooth, thereby giving the teeth more elasticity and making them suitable for raising the nap on cloth or plush fabrics. In place of the ordinary crookers a perforated plate is employed, and is raised by the crooker lever until the top of the perforation is above the line of teeth being set. Directly the tooth is inserted in the foundation the plate is lowered and forms the first bend over the ordinary back head bar. The tooth is then driven home in the foundation, where a bar actuated by a lever in connection with the tappet shaft is raised to such a height that a slight bend is given to the tooth, and whilst such bar is in contact with the tooth the top of the plate is pressed against the tooth on the other side of the foundation and completes the second bend.

4156. FLOATING BATTERIES, *A. Longsdon, London.—27th September*, 1881.—(*A communication from A. Krupp, Essen, Germany.*) 6*d*.

The vessel consists of a skin A or vessel proper, of a circular or polygonal or annular form in plan. It is by means of radial bulkheads B divided into a number of sector-shaped compartments. Each compartment has a double bottom or stem C, and is fitted with a number of water-tight boxes D. F represents ballast, which is placed on the bottom of the hull. G is a large ballast weight in the water suspended in chains or ropes from winches H.

4156. FLOATING BATTERIES, *A. Longsdon, London.—27th September*, 1881.—(*A communication from A. Krupp, Essen, Germany.*) 6*d*.

This consists in the combination with a floating battery or gun platform, of detachably connected and separately removable water-tight boxes, to render it unsinkable even when riddled with shot below the water-line. In the centre an adjustable ballast weight is suspended by chains from winches.

4157. REFLECTORS, &c., OF DAYLIGHT, *F. and F. A. Hamilton, London.—27th September*, 1881.—(*Not proceeded with.*) 4*d*.

The object is to provide better means of transmitting light through openings in decks, floors, &c., and consists in the use of glass bent, blown, or moulded with parts plain or polished, or silvered, or coated with any material having a reflecting surface and fixed to the underside of the deck or floor, so as to be nearly air-tight to prevent dust resting upon the reflecting surfaces.

4159. BOOK-BINDING, *W. Morgan-Brown, London.—27th September*, 1881—(*A communication from E. S. Boynton, Bridgeport, U.S.*) 6*d*.

This consists, First, in the combination with the signatures of a book and a band piece laid across the back thereof, of binding threads sewn directly through the band piece and passed within the signatures to hold the inner sheets in place, whereby the different signatures are strongly fastened together, and the sheets of each signature securely held therein; Secondly, in the combination with the signatures of internal threads lying in the fold of the inner sheets of each signature, the band pieces and the binding threads interlooped with the internal threads and connecting them with the band pieces; and Thirdly, in providing the signatures with a series of saw cuts to receive the band pieces, the ends of the internal threads being drawn through the saw cuts nearest the ends of the sheets.

4161. WROUGHT IRON RIGGERS, *A. Goodwin, Southwark.—27th September*, 1881. 6*d*.

This consists in making the rim or periphery by bending or curving to a circle of the required radius a bar or bars of metal having a plano-convex form in cross section (that is to say, flat on one side and convex on the other side.)

4208. STANDS OR FRAMES FOR LIQUEUR, SPIRIT, AND SCENT BOTTLES, &c., *J. Meeson, Sheffield.—29th September*, 1881. 6*d*.

This relates to stands in which the bottles can be tilted over without removing them, and it consists in forming the frame in two parts, one sliding on the other and carrying the bottle capable of turning on pivots, but which can only be so turned when the sliding frame has been moved to its highest position.

4209. CUTLERY, *L. Meyer, Sheffield.—29th September*, 1881.—(*A communication from L. Frobeen, Berlin.*) 6*d*.

This relates to pocket and other knives in which the blades are required to be protected when not in use, and it consists in forming the base of the blade with a double hinge joint, to which the handle is pivotted, being made in two parts, which, when turned over, enclose the blade between them.

4213. DRYING CUT PILE FABRICS, *J. Worral, Salford.—29th September*, 1881. 6*d*.

The object is to prevent cut pile fabrics, which have been scoured, bleached, &c., from curling and creasing while being dried, and for preventing the pile from being crushed while in a wet state. A pair of endless tenter chains carry the fabrics through the drying stove, and are so arranged by passing them over rollers and pendant guides, as to carry the fabrics through the stove, without subjecting their faces to the pressure of any guide bar or roller.

4215. KNITTING MACHINERY, &c., *W. H. McNary, Brooklyn, U.S.—29th September*, 1881. 1*s*. 10*d*.

This relates to improvements on patents No. 315, A.D. 1878, and No. 1932, A.D. 1879, and consists, First, in a novel construction of mechanism by which the yarn guides for presenting the threads to the needles may be so separated as to enable the machine to produce a new kind of knitted fabric without any change in the mechanism being required to recommence the manufacture of any other form and quality of knitted fabric. The new fabric is made of two sets of threads, one being knitted and floated alternately, and the other being interlaced as weft threads with the knitted fabric. Other improvements consist in a novel construction of the forked switch lever; the mechanism for feeding and delivering the yarns to the yarn guides; a positive locking device for the yarn guide slides after every endway movement they have received, so as to ensure their retaining the position to which they have been moved; to mechanism for producing fine work in this class of circular knitting machines in adapting the "latch needle" to circular knitting machines; and lastly, to a stop motion by which the knitting may be stopped on the breakage or slackening of any thread.

4219. SECURING KNOBS TO SPINDLES FOR DOOR LOCKS, AND LATCHES, *J. Hill, London.—30th September*, 1881. 4*d*.

The spindle is square, with a thread cut on the angles at one end, and along one side a groove is formed. One knob is permanently fixed to the plain end of the spindle, and the other knob is screwed on the opposite end, its neck being tapped with a hole to receive a set screw, the end of which fits in the groove in the spindle. A revolving back-plate is attached to the neck of knob and fitted with a flange, through which a hole is drilled for the passage of the set screw.

4225. COLLIERY CORVES AND OTHER SIMILAR VEHICLES, *J. Trippett and F. Hallam, Sheffield.—30th September*, 1881. 6*d*.

The side frames are made of metal instead of wood, and have buffers, pedestals, and oil or grease boxes and pockets for the end frames, bosses for the tie rods, and also if required an upper flange, to which the side and end boards or sheets can be secured.

4227. IMPROVEMENTS IN AND RELATING TO INSULATORS FOR ANIMAL MAGNETISM, *J. Lyon, St. Helens, Lancashire.—30th September*, 1881. 4*d*.

This consists in making the body of the insulator of glass, preferably rectangular, with rounded edges, one or more sides being hollowed out the more easily to retain the foot of the article supported. In the hollowed side a hole, or holes, are cut and filled in with a resinous non-conductor, as a mixture of resin and shellac. The inventor claims the combination in one insulator of a reservoir and vitreous non-conductor.

4228. RECEPTACLES FOR WATCHES, &c., *T. Hughes, Birmingham.—30th September*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in so constructing receptacles for watches, &c., that they can receive watches of different sizes, and it consists in inserting a spring ring stamped from thin steel in the case or receptacle.

4229. MACHINERY FOR COMPOSING AND DISTRIBUTING TYPE, *H. J. Haddan, Kensington.—30th September*, 1881.—(*A communication from C. G. Fischer, Schloss Holte, and A. von Langen, Düsseldorf, Germany.*) 6*d*.

The types are provided with notches, each notch serving in turn for moving a mechanism which sends the type to the type-collecting tube. The classing machinery consists of two discs secured to a vertical spindle revolved by a friction pulley, the lower disc supporting a number of tubes for containing the types to be classed. The disc is provided at its outer edge with a number of slits corresponding to the number of receiving or classing tubes, the tubes being partly masked by another disc placed underneath. Around the circumference of the upper disc is fitted a concentrically movable ring, with similar slits fitting on those in the disc. Above these devices is another vertical tube containing the types to be sorted out by levers projecting into the tubes. The composing machinery is constructed as follows:—A belt combined with guide frames is used for carrying the types to the composing galley; the types fall into channels, which at first are made parallel, and then successively join and finally form only one channel; springs are provided at the points where the channels join for preventing the types from turning. From the last main channel the types enter an inclined channel leading to the galley.

4230. CARDING CANS, *H. J. Haddan, Kensington.—30th September*, 1881.—(*A communication from Galmiche-Narjoz, Luxeuil, France.*) 4*d*.

The cans are made of a metal cylinder with a bottom soldered with double seam to the foot of the cylinder, strengthened by a metal ring soldered to the cylinder and to the double seam, combined with an inner cylinder fixed to the first cylinder and terminating at the top with a metal lip.

4231. FEEDING BOTTLES, *H. J. Haddan, Kensington.—30th September*, 1881.—(*A communication from F. Klingspor, Germany.*) 4*d*.

The object is to render the outflow of liquid more regular by providing an air inlet in the cap closing the bottle.

4241. MANUFACTURE AND RE-BURNING OR REVIVIFYING OF BONE BLACK, &c., *A. W. L. Reddie, London.—30th September*, 1881.—(*A communication from R. A. Chesebrough, New York.*) 6*d*.

This consists, First, in subjecting the bone or bone black to the burning or re-burning operation in pots or receptacles placed on a car or carriage which runs into and from the oven; Secondly, in the combination in apparatus for making bone black of a furnace and an oven heated by said furnace.

4242. AUTOMATICALLY SHUTTING-OFF THE SUPPLY OF GAS TO GAS BURNERS AND METERS, *A. Aron, London.—30th September*, 1881.—(*A communication from A. S. Fribourg, France.*)—(*Not proceeded with.*) 2*d*.

A compound bar composed of two bars of unequally expanding metals is subjected to the action of the gas flame, one end of such bar being secured to the gas burner, and the other connected to the cock or tap which regulates the supply of gas to the burner.

4243. GENERATING STEAM BY THE COMBUSTION OF GAS OR INFLAMMABLE VAPOURS INSIDE STEAM BOILERS, &c., *G. W. Wigner and J. Dixon, London.—30th September*, 1881. 6*d*.

A combustion chamber is formed inside the boiler, and has openings which allow the products of combustion resulting from the combustion of gas or inflammable vapours to escape into the steam space of the boiler. The gas or inflammable vapour is forced into the chamber in regulated quantities and ignited by a flame through a slide, or by spongy platinum, or any incandescent substance, or by electricity.

4254. LIFTS, *M. T. Medway, New Cross.—1st October*, 1881.—(*Not proceeded with.*) 2*d*.

From a prime moving shaft a screw is worked by suitable gearing, and turns in a nut attached to a set of movable pulleys, round which a rope passes and also round another set, and is connected over a top guide pulley to the platform or cage. The latter is balanced so as to relieve the screw gear of part of the load when the weight is ascending.

4256. RAISING AND FORCING LIQUIDS OR FLUIDS FOR LUBRICATING, &c., *J. W. Lowther, Manchester.—1st October*, 1881.—(*A communication from W. Charmock and T. Ormston, Russia.*)—(*Not proceeded with.*) 2*d*.

This consists of a drum or boss mounted excentrically within a cylinder fitted with a slide of the same diameter as the cylinder in which suitable inlet and outlet orifices are provided for the lubricating fluid.

4257. GAS HEATING STOVES, &c., *J. Wadsworth, Manchester.—1st October*, 1881—(*Not proceeded with.*) 2*d*.

This relates, First, to a stove for heating a large quantity of air to a moderate temperature, and consists in employing one or more ordinary burners in the lowest part of the stove, the products of combustion passing into a conical hood rising some distance into the stove, and surrounded by a head formed with passages through which air enters, and, mingling with the current from the burners is discharged through conical outlets; Secondly, to a stove in which the products of combustion are prevented from entering the apartment in which the stove is used, and consists in carrying the hood up into a receiver surrounded by an outer casing in which air circulates.

4258. LOOMS, *W. Ashworth, Burnley.—1st October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to an improved taking-up apparatus by which the change wheels used may be more easily changed. The ordinary change wheel stud is replaced by a stationary stud, on which the ratchet wheel and pinion revolve and are connected by a boss. The part of the boss on which the ratchet wheel is placed is made square.

4259. PASSENGER AND FARE REGISTER, *H. H. M. Smith, London.—1st October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to apparatus in which the amount of fare paid, together with the number of the passengers of each of several distinct classes of fares, is exhibited as the apparatus is actuated for registering such numbers.

4260. FOLDING LADDER AND MEASURE COMBINED, *W. Clark, London.—1st October*, 1881.—(*A communication from A. Schlaefli, Switzerland.*)—(*Not proceeded with.*) 2*d*.

The ladder consists of two side pieces attached to one another by parallel rods loosely jointed to the side pieces and forming the ladder steps. When the ladder is collapsed one side lies flat against the other so as to form a single plain rod, which is graduated to serve as a measure.

4261. CUTTING AND COLLECTING WEEDS IN RIVERS, &c., *G. Hamit, Haddenham.—1st October*, 1881. 6*d*.

This consists in the employment of horizontal revolving or reciprocating scythes or cutters mounted on the lower extremity of a vertical spindle supported in a frame at one end of a boat and of a swinging gatherer or rake at the other end of the boat, which collects the weeds into heaps on the surface of the water for subsequent removal by hand.

4262. APPARATUS, &c., FOR USE ON FLATS AND OTHER VESSELS FOR TRANS-SHIPPING SALT OR COAL, *R. Verdin, Chester.—1st October*, 1881. 6*d*.

This consists, First, in placing round the mast placed in the bows a broad sleeve with an angle iron base as a bearing, such sleeve rotating freely on the mast, while its base runs on a ring fixed to the mast; to the sleeve the swinging boom is jointed; Secondly, in placing a similar sleeve on the mast to which the rope or chain regulating the vertical angle of the boom is attached, by which means the boom can be swung round the mast in every direction and raised or lowered to suit the size of the ship or wharf at which the unloading takes place.

4263. SELF-ACTING APPARATUS FOR ACTUATING STEAM BOILER DAMPERS, *G. Wainwright, Sheffield.—1st October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to means for opening and closing the dampers of steam boilers so as to regulate and govern the draught, and thus economise the consumption of fuel, and it consists in the method of actuating a piston by means of the pressure of steam acting on water in contact with a diaphragm of elastic material placed between the underside of the piston and the top of a cylinder connected with the water in the boiler, the vertical motion of the piston being communicated through suitable levers to the damper.

4264. TRICYCLES, &c., *G. Schulz and W. Harrison, Manchester.—1st October*, 1881.—(*Not proceeded with.*) 2*d*.

The tricycle is adapted to carry one or more persons, or an extra amount of luggage. It is made so that it will fold up into a small compass.

4266. FURNITURE CORD OR TRIMMING, &c., *L. A. Walters and A. George, London.—1st October*, 1881. 6*d*.

The invention consists in the employment of a gimp, braid, tape, band, or like woven material, with or without a fringe or fringes, in combination with a suitable core or body, which core or body may be composed of one or more twisted or untwisted threads, strands, or cords, the said gimp, braid, or the like being wound or wrapped around the said core or body by means of apparatus forming part of the invention.

4267. APPARATUS FOR PRESENTING OR EXHIBITING TO AN AUDIENCE THE WORDS OR SCORE OF AN OPERA OR OTHER PERFORMANCE, &c., *W. R. Lake, London.—1st October*, 1881.—(*A communication from T. L. Jones, St. Louis, Mississippi, U.S.*)—(*Complete.*) 6*d*.

The invention consists mainly in a movable transparency bearing the words or symbols, and illuminated by a light at its rear. This transparency moves past an opening which is between the audience and the light, the movement of the said transparency being so timed as to carry the words corresponding with those being uttered past the opening, preferably at its centre.

4268. TRACTION ENGINES FOR TRAMWAY CARS, *W. Wilkinson, Wigan.—1st October*, 1881. 6*d*.

This consists in the combination with the exhaust ports of the cylinders of chambers or jackets attached to the boiler, and a chamber in communication therewith situated inside the furnace, whereby the exhaust steam is exhausted and superheated before its exit, whether or not there be used in combination therewith means for conducting also the steam from the safety valves or from the waste pipes of the cylinders into the said chambers.

4279. PRINTING MACHINES, *H. Jullien, Molenbeek St. Jean, Belgium.—3rd October*, 1881. 6*d*.

This relates to the construction of the machine, by which both sides of the paper from a roll are printed automatically and with exact register from flat type formes or stereotype plates during the passage of the paper through the machine, the paper after the printing is effected being severed into sheets of the required size.

4280. MACHINERY FOR FINISHING NUTS, BOLTS, AND SCREWS, *J. P. Binns, Halifax.—3rd October*, 1881.—(*Not proceeded with.*) 2*d*.

The object is to simplify the construction of machinery for finishing nuts, &c., and to render the same machine, by means of interchangeable parts, applicable for facing or finishing both nuts, bolts, and screws.

4281. PRODUCTION OF MAGNESIA AND HYDROCHLORIC ACID FROM CHLORIDE OF MAGNESIUM, *F. Wirth, Frankfort.—3rd October*, 1881.—(*A communication from A. Blumenthal, Halle-on-the-Saale, Germany.*)—(*Not proceeded with.*) 2*d*.

The chloride of magnesium is divided into magnesia and hydrochloric acid by being heated with or without the addition of carbonate of magnesium or of the carbonate of some other suitable earthy substance under admittance of atmospheric air or free oxygen. The magnesia-oxychloride produced in this way is divided into magnesia and chloride of magnesium by being boiled with water, either in closed vessels under pressure or in open vessels under ordinary atmospheric pressure.

4282. LOZENGES, &c., *J. L. Collier, Rochdale.—3rd October*, 1881. 6*d*.

The lozenge paste is placed on a table and carried between two metal rollers, round each of which passes a woollen web supplied with sugar or farina dust. The paste is then passed between a pair of highly-finished rollers which reduce it to the desired thickness, and an endless web then carries it over a steel plate formed with slots, through which work a set of stamps bearing the letter or figure, which is thus impressed on the paste, which then passes over round holes in the plate, and is acted upon by cutters, the lozenges produced falling on to a travelling web.

4283. DRYING GRAIN, &c., *J. Coultas, Grantham.—3rd October*, 1881.—(*Not proceeded with.*) 2*d*.

A current of air is employed, obtained from a fan driven by a portable or other engine. The fan is mounted upon a frame having wheels, so that it may be readily conveyed from place to place. The fan is connected when in use with a box or casing, which is the drying chamber. This is also carried upon wheels. The drying machine also comprises an elevator and dressing screens and apparatus.

4284. DISTILLING SHALE, &c., *G. T. Beilby, Mid Calder N.B.—3rd October*, 1881. 6*d*.

This relates to improvements on patent No. 2169, dated 18th May, 1881. By the present invention the upper parts of the retorts, whether the retorts be made entirely of one material or partly of iron and partly of fireclay, are suspended by means of counter-weighted levers or otherwise suitably held up, so that their weight or a large part of it does not rest on the lower parts, which are subjected to the higher heat, and thereby rendered liable to injury by supercumbent weight.

4285. LETTER-PRESS PRINTING, &c., *W. Conquest, London.—3rd October*, 1881.—(*A communication from R. Hoe and Co., New York.*) 1*s*. 8*d*.

This relates chiefly to web printing machines in which only one type cylinder is used on which the formes to print both sides are placed, the paper after being printed on one side being reversed and then printed on the opposite side; and it consists, First, in a novel manner of entering the end of the web of paper through the machine; Secondly, in a novel arrangement of the paper travelling rollers, whereby the printing is effected in a more expeditious and satisfactory manner, and the machinery is rendered applicable to the printing of supplements to newspapers; Thirdly, in a novel arrangement of folding apparatus forming part of such machine; and, Fourthly, in the addition to the printing and folding mechanism of apparatus for further folding, wrapping up, pasting, and addressing the printed matter ready for posting.

4286. DYEING WITH COAL-TAR COLOURS, *J. R. Beard, Macclesfield, and C. Faesch, Godley Gate.—3rd October*, 1881.—(*Not proceeded with.*) 2*d*.

The material is impregnated with fatty or oleaginous matter, or with albuminous, gelatinous, or such-like substances, which is fixed by steaming or drying. The material is then immersed in a solution of acid, preferably organic acid, or of acid salts, or when oil or fat has been used it is immersed in a solution of alkali or alkaline salts, and in some cases it is wsahed, whereupon it is ready for being dyed.

4287. AUTOMATIC CHECK VALVE, &c., *M. Merichenski, Poplar.—3rd October*, 1881. 6*d*.

This relates to a novel construction and arrangement of check valve and apparatus in connection therewith for regulating the flow of liquids, such as oil, to the wicks of lamps; also applicable to boilers or stoves where a regular and continuous flow of oil is required for heating the same, and for regulating the supply of water to cisterns, and also providing a regular flow of water, beer, and other liquids.

4304. IMPROVEMENTS IN DYNAMO MACHINES FOR THE PRODUCTION AND DISTRIBUTION OF ELECTRIC CURRENTS, *H. Aylesbury, Bristol.—4th October*, 1881. 6*d*.

The inventor fixes in the main axle of his machine a large pulley having two V-grooves in its circumference, and on the interior of the surrounding cylindrical case he mounts a number of smaller friction pulleys, gearing with the grooves in the large pulley. On each side of each friction pulley he arranges a number, say from 2 to 12, of electro-magnets, and these revolve against permanent magnets mounted all round the circular case. Each pulley has an adjustable screw, so that it can be thrown in or out of gearing as required. The inventor thus claims to be able to regulate the production of the current at will.

4313. APPARATUS FOR SURVEYING, *G. H. Stephens and H. Wilmer, London.—4th October*, 1881. 6*d*.

This relates to apparatus for determining the length of a line, its magnetic course and its inclination, and it consists of a telescope mounted on a stand by a ball-and-socket joint, and in its diaphragm are fixed two horizontal hairs and one vertical hair, for the purpose of ascertaining the length of the line by

observing the length subtended by means of the horizontal hairs on an ordinary level staff held vertically at the end of the line, the distance between the cross hairs being adjustable. The magnetic course is determined by means of a prismatic compass hinged over the centre line of the telescope, and the inclination is ascertained by a segmental or circular bar or frame fixed to the underside of the telescope, and from the centre of which is suspended a weighted pointer.

4324. Fluid Meters, &c., *A. Wightman, Sheffield.—5th October*, 1881. 6*d*.

This consists in the use of movable cylinders acting as slide valves, and worked by the piston alone, whereby the use of excentrics for working such valves is dispensed with, and also in the arrangement of two or more cylinders working within one casing. As applied to a water meter with two cylinders, an outer casing or tank is provided with a cover and an inlet for the water supply. Near one end, and preferably at each side of the interior of the tank, is formed an enclosed chamber, to the interior of which the outlet pipe communicates, and round which discharge chamber the water has free access. Suitable openings are made in both ends of the discharge chamber in which the cylinders are fitted, and which act as bearings for the cylinders to slide in. Ports are cut in the periphery of the cylinder at each end, and in such positions that when those at one end are open to the tank, those at the other are open to the discharge chamber. Each cylinder is fitted with a piston, the rod of which is connected to a double-throw crank, and the rotary motion is transmitted by wheels to an index or dial plate.

4327. Making Silk Rags into Silk Shoddy, *C. Dawerdt, Berlin.—5th October*, 1881.—(*Not proceeded with.*) 4*d*.

The silk rags are first subjected to a chemical process and then brought under a slowly revolving india-rubber roller and held by a presser whilst being acted upon by a toothed roller caused to revolve at a high velocity.

4331. Manufacturing and Decorating Artistic Articles known as "French Cloisonnes," *W. H. Beck, London.—5th October*, 1881.—(*A communication from H. Starcke, Paris.*) 6*d*.

This consists, First, in applying and fixing on the background, by means of marble cement, metal strips intended to form the design required; Secondly, in filling in the coloured parts of the design with marble cement coloured according to the shades to be obtained; Thirdly, in filling in the ground, that is all that remains outside the cloisonné, with marble cement, coloured or not; Fourthly, in equalising the external surface by metal tools capable of cutting both the material forming the cloisonné and the cement; and Fifthly, in giving to the object the desired polish and finish by polishing with hard stone.

4332. Mortise Locks, *E. de Pass, London.—5th October*, 1881.—(*A communication from A. H. Elliott, New York.*) 6*d*.

The lock consists of an outer cylindrical case with longitudinal ribs to prevent it turning in the mortise, a key-way being formed in its side, and its lower end closed by a cap. An inner sheath contains the mechanism, and is in the form of an open-ended rectangular trough, the upper end of which is closed by a face plate, while the open side is arranged to be closed by a side plate having a circular key-way in it, and also an opening to receive a tumbler pin. The inner sheath can slide in the outer case, so as to cause the keyways to coincide. The operating mechanism consists of a bolt, tumblers, and pinion.

4334. Street and other Lamps, *A. W. Calvert, Leeds.—5th October*, 1881. 6*d*.

Around and above the bottom of the lamp are provided a double row of perforated plates to admit air to the flame, the inner row having finer perforations than the outer row, and wire gauze being placed round the inside so as to divide the air into small jets. A cup or baffler is placed round the supply pipe below the burner, so as to prevent the air approaching the flame in a large volume. The staves of the lamp frame are hollow and open at the bottom, and near the top an opening communicates with the interior of the lamp, so that a current of air passes up and mixes with the products of combustion, which it assists to expel through the usual ventilator at top. Reflectors are fitted above and outside the lamp.

4337. Propulsion of Ships, &c., *W. R. Kinipple, Westminster.—5th October*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in an arrangement of one or more paddle-wheels of large diameter at or near to midship or the centre of the vessel.

4338. Looms, *J. Leeming, Bradford.—5th October*, 1881. —(*Not proceeded with.*) 2*d*.

This relates to apparatus for reversing the motion of the loom by power for finding the broken pick or other requirement.

4339. Manufacture of Achromatic Lenses, *N. Lazarus, Paddington.—5th October*, 1881. 2*d*.

Two pieces of glass of different material, such as crown glass and flint glass, after having been horizontally ground and polished, are welded or cemented together, the glass is then ground and polished.

4341. Umbrella Furniture, *T. W. Haddon, Birmingham.—5th October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the runners and top notches used for securing the ribs.

4342. Gas Stoves, *T. Fletcher, Warrington.—6th October*, 1881. 2*d*.

This consists in the combination of one or more visible illuminating flames of gas with a series of tubes or passages in the construction of a gas heating stove.

4343. Extinguishing Fire, *J. Dutton, Bermondsey.—6th October*, 1881. 6*d*.

Metal troughs or gutters having covering plates are secured between the joists of the roof or ceiling. They are closed at one end and fitted with nozzles at the other which connect them with a metal conduit running along inside the ceiling of each floor. Each of such conduits communicates with a vertical pipe, which is carried down the front of the building to the ground floor, where it is connected on the outside with a union or junction, which can be connected with the water main.

4344. Pianofortes, *H. Springmann, Berlin.—6th October*, 1881.—(*A communication from W. Fischer, Dresden.*)—(*Not proceeded with.*) 2*d*.

Metal or other forks similar to tuning forks are employed instead of strings.

4345. Transshipping or Removing Coal, Salt, &c., *J. Rigg, Chester.—6th October*, 1881. 10*d*.

Two or more scoops or boxes work along slides fitted with rollers to reduce friction, such slides connecting the two vessels or places, and being made adjustable when necessary. The scoops balance each other, and are raised and lowered by steam or hydraulic cylinders. The apparatus may be suspended from a pillar, so that it can be rotated horizontally.

4346. Checking, Receiving, Retaining, and Changing Coins or Notes, *J. T. R. Proctor, Dundee.—6th October*, 1881. 6*d*.

Circular chambers receive the coins which are brought into position to be operated upon by slides actuated by levers worked by the keys of an external keyboard. The coin to be changed is dropped into its receptacle, and when its key is depressed the coin is released, and at the same time the keys of the coins to be given in exchange are also set free, and on being depressed discharge such coins into a tray, on withdrawing which all the keys are again locked. Registering mechanism is provided to automatically register the moneys received and paid out.

4347. Fire-boxes of Steam Boilers or other Furnaces for the Purpose of Consuming Smoke, *J. Shepherd, Manchester.—6th October*, 1881. 6*d*.

Air boxes or heaters of cast iron or other suitable material are used in lieu or in combination with the ordinary fire bridge, and they may be of the same form and dimensions as the ordinary bridge.

4348. Looms for Weaving, *G. Kirk, Huddersfield.——6th October*, 1881. 6*d*.

This relates to apparatus for raising and lowering the shuttle boxes. The boxes are connected by a vertical rod to the shuttle box lever, and operated by a cam on the crank shaft, which lifts them at each revolution. To support the boxes during their descent a short lever is mounted on the same fulcrum as the shuttle box lever, and its end rests on an incline formed on a sliding box. The bar is caused to reciprocate at each revolution of the crank shaft by sliding tappets on the shaft and a bell-crank lever and a spiral spring acting in opposition to the tappets. When the boxes are raised the end of the lever rests on the incline, but when they are to be lowered the sliding bar and incline are drawn from under the lever, and the end travels gradually down the incline, so letting the boxes down without concussion. The boxes are received and held in the required position by one or other of a series of notches formed on the end of another sliding bar, caused to travel in one direction by the tappets and in the opposite direction by a spiral spring.

4349. Manufacture of Strings, Bands, and Belts from Animal Gut, &c., *J. Turner and C. McBride, Glasgow.—6th October*, 1881. 6*d*.

This consists principally in employing the outer skin of the intestines of oxen, which is split up into threads and treated in a bath of potash water changed daily for four or five days, after which it is treated with acid baths, alternating with alkaline carbonate of ammonia baths, and then steeped in water. These threads are then spun, and the string produced is subjected to the action of sulphur fumes to bleach it, after which it is steeped in a solution of acetic acid and gelatine, again sulphurised and finished off with gum-arabic and oil.

4350. Machinery Employed in the Manufacture of Shovels and other Metal Forms, *T. Titley, Leeds.—6th October*, 1881. 6*d*.

The frame of the machine is similar to that of the brick press described in patent No. 2658; A.D. 1875, and a vertical screw and nut are employed in combination on the same shaft with another screw of a different "hand" working into a nut formed in the cutter head, which is thus moved down by the first screw, while at the same time the second screw causes it to move down and shear the plates to the desired form. The screws are actuated through a worm and worm wheel.

4351. Sewing Machines, *H. Simon, Manchester.—6th October*, 1881.—(*A communication from F. B. Köhler, Chemnitz, Saxony*) 6*d*.

This relates to the construction of sewing machines for producing ornamental stitching by means of two or more needles, the mode of producing the stitches being such that the meshes formed by the two or more needles are, on the next following stitch, all transferred to the front needle.

4353. Preparing Wool, Cotton, &c., *J. Tatham, Rochdale.—6th October*, 1881. 6*d*.

This relates, First, to machinery for feeding wool, &c., to washing, scutching, carding, and other machines, and consists of a box to receive the wool, and within which are rollers with an apron moving over them and provided with teeth to take up the wool, the quantity being regulated by a vibrating comb. The wool is removed from the apron by a vibrating comb, which conveys it to a scale where it is weighed. The Second part relates to a "coiler," and consists in arrangements by which upon one can being filled another takes its place.

4354. Screw Propellers, *J. Carr, near Newcastle-on-Tyne.—6th October*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in forming a screw propeller of blades made separately, and so arranged as to be fitted together to form a screw propeller of two, three, four, or more blades, as desired.

4355. Boots and Shoes, *W. H. Stevens, Leicester.—6th October*, 1881. 4*d*.

This consists of forming toe caps of thick leather cut to the requisite shape and skived down around the edges thereof.

4356 Shelling, Cleaning, and Polishing Rice, Coffee, &c., *A. G. Fraser, G. Smith, and L. W. Harvey, London.—6th October*, 1881. 6*d*.

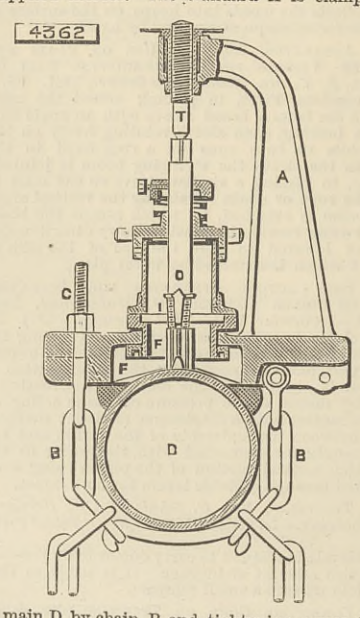
This relates to machines in which a cone or drum is caused to rotate within a hollow cone or drum, and consists in forming one or both of the rubbing surfaces of the cones or drums of a combination of wood and leather, arranged in alternate strips, the leather projecting slightly beyond the wood.

4358. Opening and Cleaning Cotton, *J. Bayley, Ashton, and T. Bayley, Stalybridge.—7th October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to improvements on patent No. 1111, dated 27th March, 1875, and consists in dividing or partitioning the compartment for droppings or dirt coming through the grid into two or more separate compartments, to which the draught is separately admitted and regulated, so that there is no contention between the draught at one part and that at another part of the grid, and the dirt from the cotton passing through the grid will thus drop and remain in each separate compartment until it is removed at intervals in the usual manner.

4362. Boring and Tapping Gas and Water Mains or other Vessels under Pressure, &c., *A. Upward, Westminster.—7th October*, 1881. 6*d*.

This relates to improvements in patent No. 145, A.D. 1867, for tapping mains, and also to cocks or nipples to be applied thereto. The standard A is clamped to



the main D by chain B and tightening screw C. A tube F is secured gas-tight to the standard by a nut and elastic washer, and is fitted with a valve I. The top is closed by a cap, and through it passes the drill and top spindle O, the top of which is square, so as to receive a key by which it is turned, the feeding being effected by screw T. The cock or nipple consists of a casing screwed at the bottom to fit the main, and provided with a side exit opening. The valve stem is screwed and works through a diaphragm in the casing, the top of which is closed by a cap.

4359. Apparatus for Indicating the Speed of Rotating Shafts, *D. Young, London.—7th October*, 1881. 6*d*.

An ordinary centrifugal ball governor in which the centripetal force is obtained by a spring, is fixed on a spindle and driven by being thrust against the end of the shaft, and the sleeve or sliding bush acts upon a second bush free to slide in a bearing, but prevented from revolving. A screwed spindle screws into the latter bush, and carries a pointer moving over a dial. The invention also relates to a similar apparatus to form a stationary speed indicator either permanently or detachably in gear with the shaft.

4361. Studs for Shirt-fronts, Collars, &c., *P. Allen, Bloomsbury.—7th October*, 1881. 6*d*.

This consists in making the body of the stud or fastener of an elastic material such as vulcanised india-rubber, the top and bottom being fitted with caps of metal or other suitable material.

4364. Velocipedes, *A. Phillips, Birmingham.—7th October*, 1881.—(*Not proceeded with.*) 4*d*.

This relates to improvements in the driving gear.

4365. Means and Apparatus for Assisting Vision, *P. Adie, Pall Mall.—7th October*, 1881.—(*Not proceeded with.*) 2*d*.

The lenses or glasses of spectacles are made into mirrors, by which means, for boating or driving, the wearer may see behind him.

4367. Dwelling Houses, &c., *S. E. Simpson, Birmingham.—7th October*, 1881.—(*Provisional protection not allowed.*) 2*d*.

This relates to a means of economising the front space.

4370. Ascertaining the Density of Various Bodies, *E. Jones, Southwark.—7th October*, 1881.—(*Not proceeded with*) 2*d*.

The apparatus consists essentially of a pillar or standard carrying at its upper end the bearings to receive the knife edge pivots of a beam. One arm of this beam is shorter than the other, and from the shorter arm is hung a vessel of a given capacity to contain the saccharine solution or other fluid to be tested. The longer arm is marked off with a scale denoting degrees of specific gravity, and if desired, pounds per gallon, or any other scale, and it is provided with a sliding weight.

4371. Fastenings for Brooches, &c., *E. S. Jones, Bridgwater.—7th October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the employment of a sliding catch worked by a spring.

4372. Cutting Shives, *E. J. Heal, London.—7th October*, 1881. 4*d*.

The machine fits on to the mandril of a lathe, and it consists of three or more cutters arranged horizontally in a small cylinder. This cylinder is fitted with a piston, against the back of which acts a spring. To the front of this piston is screwed or otherwise suitably fixed a disc having staple pieces on the periphery to hold the cutters in position. The aforesaid disc is made capable of being detached, so that either a larger or a smaller one may be fitted according to the size of shives it is desired to cut.

4373. Grinding Corn, &c., *W. R. Lake, London.—7th October*, 1881.—(*A communication from J. Fitz-Gerald, Brooklyn, U.S.*) 8*d*.

The object is to cool the upper stationary grinding stone and the lower moving stone either by means of air or water, and it consists in forming the casing of both stones, and also the stones themselves, with chambers on their outer faces, suitable pipes being provided to cause the cooling medium to circulate through such chambers.

4374. Holding and Exhibiting Photographs, &c., *R. Love, Hatton-garden.—8th October*, 1881. 6*d*.

A rod carries at one end a spring clip, into which the photograph is inserted, whilst the other end of the rod slides telescopically in a tubular rod, by which means its height can be adjusted, so that the rods may form a support to keep the photograph in an upright position.

4376. Constructing and Glazing Roofs, &c., *J. Carter, Uxbridge.—8th October*, 1881.—(*Not proceeded with.*) 2*d*.

The whole of the roof or structure is secured together by screws, and the panes are kept in place by screw hooks.

4378. Railway Signals, *H. Cuthbert and G. H. Smith, Manchester.—8th October*, 1881.—(*Not proceeded with.*) 2*d*.

The object is to indicate if a driver of a train has passed the signal when the signal was against him, and also in foggy weather to warn the driver on a train approaching the signal when the signal is against him.

4380. Measuring the Fermentative or Fermentable Power of Certain Substances, &c., *J. Watson, Southwark.—8th October*, 1881.—(*A communication from A. Champy, Antwerp.*)—(*Not proceeded with.*) 2*d*.

The invention is based upon the property which yeast possesses of decomposing glucose into two principal parts bearing a definite relation to each other, viz., alcohol and carbonic acid gas, and when the quantity produced of one of these is known the quantity of the other is calculable.

4381. Indigo Printing, *F. Wirth, Frankfort.—8th October*, 1881.—(*A communication from J. Ribbert, Hohenlineburg, Germany.*) 2*d*.

This consists in the process for printing with indigo wherein the indigo, after treatment with caustic soda, is printed on the fabric and subjected to the action of steam in the presence of sugar, the indigo being afterwards re-oxidised by passing through water.

4382. Perambulators, *C. H. Brassington, Manchester.—8th October*, 1881. 2*d*.

This consists in the employment of perforated, fluted, or embossed sheet metal, such as zinc, brass, copper, and galvanised iron, for the purpose of forming on suitable framework the bodies of the perambulators.

4383. Improvements in the Manufacture of Electric Bridges for Incandescent Lamps, and in the means Employed therein, *St. G. Lane-Fox, Westminster.—8th October*, 1881. 6*d*.

This relates to the inventor's process for manufacturing electric bridges for incandescent lamps by immersing baked threads or fibres in coal gas, and sending a current through them, raising them to a white heat, thus causing the carbon from the gas to be deposited on their surface, and thereby reducing them to a definite or specified resistance. It is an improvement on patent 3494, dated 28th August, 1880, taken out for the above process, and consists in a description of the method of carrying out the above process on a manufacturing scale.

4384. Basic Bricks, &c., *S. G. Thomas, London.—8th October*, 1881. 4*d*.

Good magnesia bricks are produced by burning magnesia or carbonate or hydrate of magnesia at an intense white heat. The magnesia is then ground with water, tar, or crude hydrocarbon oils, and made into bricks and burnt preferably at a white heat. The burnt magnesia may be used as moulders' sand. Magnesian bricks may be interposed between the courses of lime bricks when firing lime bricks in kilns.

4386. Utilising Compressed Air for Operating Machinery, &c., *A. M. Clark, London.—8th October*, 1881.—(*A communication from C. W. Cooper, New York.*) 8*d*.

This relates, First, to mechanism for using compressed air in the transmission of power by conveying it from a compressor to the place where it is to be utilised, and then exhausting it, first into a closed chamber, and then back into the compressor under pressure greater than that of the atmosphere, but less than that created by the compressor, so as to utilise the difference of pressure for operating machinery.

4385. Bicycles, &c., *J. S. Edge, jun., Birmingham.—8th October*, 1881.—(*Not proceeded with.*) 2*d*.

This relates, First, to improvements in ball bearings; Secondly, to making the ends of the fork separate from the body and interposing spiral springs; and Thirdly, in constructing rims to receive elastic tires in two parts, forming together more than a half circle.

4387. Regulating Healds and Warp Threads for Weaving, *R. Riley, Keighley.—8th October*, 1881.—(*Not proceeded with.*) 2*d*.

The apparatus is attached to the top rail, and is actuated by a rod connected by a crank on one of the shafts of the loom. Within a frame are mounted a number of L levers corresponding to the number of healds or the harness required to weave the pattern in the piece. These levers are actuated by the card or lag cylinder, and actuate sliding needles, which place hooked bars in such a position that the lifting bar in the upward portion of its traverse will raise the same and the healds connected therewith.

4389. Compounds for Dyeing and Printing, *R. H. C. Nevile, Lincolnshire.—8th October*, 1881. 4*d*.

This relates to the artificial production of orcine from toluol, or from such of its derivatives as contain in the two positions meta to methyl groups, which can by suitable methods be converted into hydroxyl groups.

4390. Trimming the Edges of Boot or Shoe Soles, &c., *W. R. Lake, London.—8th October*, 1881.—(*A communication from D. C. Knowlton, Boston, U.S.*) 6*d*.

This consists, First, in the combination of a stock carrying the knife, and an adjustable stock carrying the welt guide and gauge, the former being adjustable thereon; Secondly, in the use of a gauge narrower than the edge to be trimmed, and a bottom guard, both arranged on a slide, whereby the gauge is moved by the action of the bottom guard away from the welt guide when the tool passes from the thin edge at the shank of the sole to the thicker edge of the fore part: Thirdly, in a boot or shoe jack having the shaft passing through the body, and encircled by a spring in combination with a pinion and a rack of the heel piece, the shaft being fitted with a ratchet attached to its outer end and a pinion at its inner end, gearing with rack of the heel piece, so as to adjust the length. The foot of the jack may be loosened from the boot by revolving the shaft.

4391. Attaching Door Knobs to their Spindles, *B. W. Spittle, Wednesbury.—10th October*, 1881. 4*d*.

The centre rose has a square hole to fit tightly on the spindle, and is provided with a spring on its face to take into recesses formed in the face of the shoulder of the knob, which screws on to the spindle.

4392. Knitting Machinery, *S. Fingland, Roxburgh.—10th October*, 1881.—(*Not proceeded with.*) 2*d*.

The object is to render knitting machinery capable of producing a greater variety of ornamental effects, and it is applicable to machines with horizontal needles with curved hooks and grooves to receive the hook points when depressed, the ordinary sinkers being used in combination with such needles, as well as other well-known parts. The effects are obtained by using yarns of different colours, the parts acting on the sinkers being by preference arranged in the manner usually adopted with two colours. Depresser plates are formed with projections, which act on the needles, and press the points into the grooves, so that when one of the yarns is laid to form part of a course it is prevented from forming stitches except at the points where it is to appear on the right side of the fabric.

4393. Safety Valves for Domestic Boilers, &c., *C. Shields, Manchester.—10th October*, 1881. 6*d*.

This relates to a valve for preventing accidents to boilers by explosion or collapse, the same valve acting also for the emission of air during the filling of the boiler. The casing of the valve is of globular form in two halves screwed together, and inside it is a thin hollow copper ball with a valve on its upper side working against or reacting in the lower side of a spring piston which works in a tubular neck forming part of the upper half of the casing.

4394. Obtaining Bas-reliefs, Medals, Casts, and the Like by Photography, &c., *E. de Pass, London.—10th October*, 1881.—(*A communication from W. H. Guillebaud, Paris.*) 8*d*.

The object is to obtain by photography bas-reliefs, medals, casts, dies, matrices, and the like, the outlines of which may be in relief or rounded, and which may be made of any metal or suitable material; and it consists in producing such objects by means of the actinic action of diffused light passing through a plate of ground or translucent glass, on which is reproduced the photograph of the object to be reproduced in relief, and falling on sensitised gelatine, forms a mould of the object.

4395. Covers or Guards for Corkscrews, *A. J. Boult, London.—10th October*, 1881.—(*A communication from R. T. Dittert, Saxony.*)—(*Not proceeded with.*) 2*d*.

A cover or capsule open at one end has a screw thread formed inside, so as to screw on to and protect the corkscrew.

4396. Improvements in the Manufacture of Carbons for Electric Lamps and Apparatus for that Purpose, *J. James, Lambeth, and J. C. F. Lee, Beckenham.—10th October*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in the reduction of the carbonaceous material to a fine powder, which is subsequently subjected to great pressure in a mould.

4397. Magnesia, *T. Twynam, Kensington.—10th October*, 1881. 4*d*.

This relates to the production of magnesia for employment in metallurgical and other operations. In the Weldon process, in which manganese chloride is decomposed by milk of lime, so as to form chloride of calcium and a compound of manganese dioxide with lime, instead of using pure lime as at present dolomitic lime is employed, that is, the compound of lime and magnesia obtained by burning dolomite.

4399. Feeding Wool and other Fibres to Scribbling and Carding Machinery, *J. and A. Leadbeater, Morley, Yorks.—10th October*, 1881. 6*d*.

This relates to mechanism for feeding fibres more evenly and regularly to carding machinery by means of travelling sheets, creepers, or aprons placed preferably one above the other. The fibre is placed in a hopper, and rests on a creeper. It is taken by a revolving spiked roller, on the spikes of which it is distributed by a vibrating comb, and detached therefrom by a revolving fan, the fibre being then dropped upon the lower creeper, which conveys it to a second spiked roller, also provided with a vibrating comb and fan, whereby the fibre is distributed so as to lay in a perfectly even mass before reaching the "licker-in."

4401. Steam Kettles, Feed-water Heaters, &c., *W. B. Dewhirst and G. Barker, Manchester.—10th October*, 1881.—(*Not proceeded with.*) 2*d*.

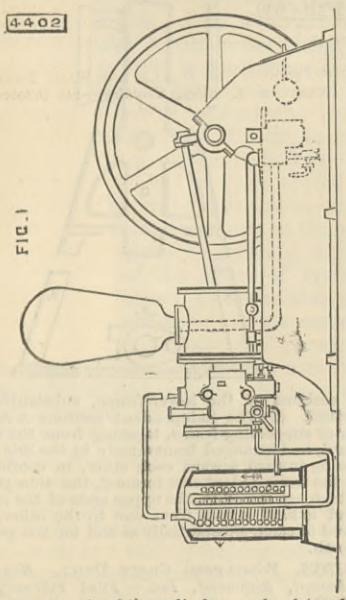
The heater consists of a series of open bottomed cast iron boxes placed one over the other on a base plate, so as to form enclosed chambers, the top one being surmounted by a cylindrical casing forming the heating chamber provided with inlet and draw-off taps. From the top chamber pipes project up into the heating chamber, and from the middle chamber other and smaller pipes project up and pass through them, steam being admitted to this chamber. The top and bottom chambers are connected by pipes and supplied with water.

4403. Fire-lighter, *A. G. Elliot, San Francisco.—10th October*, 1881. 6*d*.

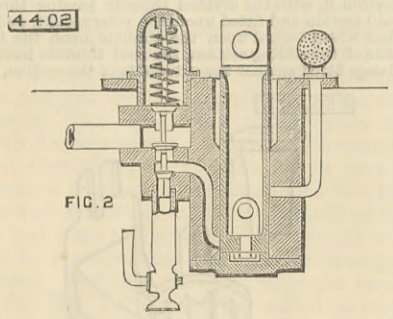
This relates to a lighter composed of a number of pieces of wood fitted together, so as to leave suitable air spaces between them.

4402. SINGLE AND DOUBLE-ACTING COMPOUND AIR AND GAS MOTOR ENGINES, *G. W. Weatherhogg, Birmingham.*—10*th October*, 1881. 8*d.*

The method upon which the engine works is by the reciprocating motion of two working pistons in sepa-



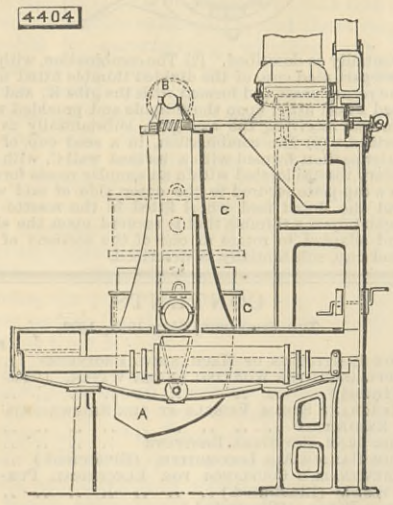
rate compartments of the cylinder, each piston being coupled together by rods or a trunk, whereby the compression and double expansion of the combustible charges are effected within the same cylinder, or within two parts of such cylinder placed end to end so as to work in line with each other, or placed alongside or concentrically around and within each other, the parts



of the cylinder being arranged so as to act conjointly and simultaneously with each other, irrespective of position. The drawing shows an elevation of a horizontal single-acting compound engine having two cylinders bolted end to end, and fitted with appliances for collecting and utilising the superabundant heat evolved by the explosions.

4404. BESSEMER CONVERTERS, *A. L. Holley, Brooklyn, U.S.*—10*th October*, 1881. 8*d.*

This relates to improvements on patent No. 2024, A.D. 1880, and consists in making the trunnion ring and the removable shell readily detachable. The converter A is connected to the trunnion ring C by cotter bolts, and when desired to remove the shell for repairs



a car is run under it and raised until it takes the weight of the shell off the trunnion ring, which is then disconnected by removing the cotter bolts, and the ring is lifted to the position shown by dotted lines by chains or ropes running over sheaves B.

4406. KNITTED OR LOOPED FABRICS, *T. Thorpe, Nottingham.*—11*th October*, 1881. 6*d.*

This relates to straight bar knitting frames for manufacturing knitted fabrics, and the object is to improve the construction and action of the "knocking over bits," so as to render such action more expeditious and certain. The invention also comprises the application of additional thread carriers to such frames, whereby bands or stripes may be formed in fashioned goods, as well as to perform what is known as "splicing."

4407. GAS ENGINES, *J. A. Drake and R. Muirhead, Maidstone.*—11*th October*, 1881—(*Not proceeded with.*) 4*d.*

This relates to a gas engine in which a piston moves in a cylinder and is coupled by a connecting-rod direct to a crank, being worked by the expansive force resulting from the rapid combustion of a mixture of inflammable gas and atmospheric air, and it consists in replacing the slide valve cover by a cross bar, between which and the valve is interposed a toothed sector-shaped rocking piece, the arc of which is next the valve and the centre against the bar, whereby the reciprocating motion of the slide is imparted to the sector and rolling substituted for sliding friction. The slide valve is worked by an excentric on a second motion shaft driven by spur gearing from the crank-shaft, so as to make one revolution for every four revolutions of the crank shaft.

4409. IMPROVEMENTS IN THE MANUFACTURE OF TELEGRAPH CONDUCTORS AND MATERIALS FOR COVERING AND INSULATING WIRE OR OTHER CONDUCTORS USED FOR TELEGRAPHIC OR OTHER PURPOSES, *W. O. Callender, London.*—11*th October*, 1881. 4*d.*

This invention consists in the use of bitumen combined with other hydrocarbons such as vegetable oil, so as to produce a compound material consisting of 80 to 40 parts bitumen to 20 to 60 parts hydrocarbons. The mixture when reduced to a liquid state is vulcanised by the addition of flowers of sulphur.

4408. COMPOUND MATERIALS INTENDED FOR USE IN THE MANUFACTURE OF WATERPROOF ARTICLES, &c., *W. O. Callender, London.*—11*th October*, 1881. 6*d.*

This consists in the combination of bitumen with other hydrocarbons or their equivalents, and using the material for the manufacture of waterproof articles.

4410. DRESSING OR PLANING WOODEN HOOPS FOR CASKS, *W. Morgan-Brown, London.*—11*th October*, 1881.—(*A communication from H. F. Campbell, Concord, U.S.*) 6*d.*

This relates to a machine for dressing the woody side of a hoop, and consists in the use of an elastic bed roll in combination with a knife cylinder and pressers, whereby the hoop is pressed on to the elastic roll and all projections embedded therein, so that the hoop may be dressed smoothly, independently of its irregularities.

4411. FALSE BOTTOMS FOR MASH TUNS, &c., *G. G. Cave, Bristol.*—11*th October*, 1881. 6*d.*

The false bottom consists of a cast iron plate with holes drilled through it, tapering on one side and countersunk on the other, and in which are inserted copper cylinders closed and perforated with a number of fine holes at one end and open at the other end.

4412. FOOD FOR ANIMALS, GAME, AND POULTRY, *E. Wylam, Southwark.*—11*th October*, 1881. 2*d.*

This consists of 1 part, by weight, of the fruit of the date palm, 13 parts wheat flour, 2 parts oatmeal, 1 part lentil flour, 3 parts animal matter, such as flesh of animals; a small quantity of sulphur and phosphate of lime, and a suitable preparation of iron, such as carbonate of iron and spice. With this compound about one-tenth of the whole weight of beetroot is added with sufficient water to form a paste, which is then made into biscuits and baked.

4413. WORT FILTER FOR MASH TUNS, *G. G. Cave, Bristol.*—11*th October*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent sediment passing from the tun into the wort copper, and it consists in the use of a filter composed of a copper or other vessel with an inlet pipe at bottom to supply the liquid to be filtered. The top of the inlet pipe is connected to a perforated chamber containing the filtering medium, and the fluid passes through it and fills the vessel, passing out through an outlet pipe near the top.

4414. REGISTERING THE STAND OF THERMOMETERS, *E. A. Brydges, Berlin.*—11*th October*, 1881.—(*A communication from Dr. H. Kronecker, Berlin.*)—(*Not proceeded with.*) 2*d.*

The thermometer is let into the dial plate of a clock, and behind it a sensitised piece of paper is caused to move continuously by the clock movement, so that the light passing through the empty parts of the thermometer tube will act on the paper, and so register the height of the mercury in the tube.

4416. STEAM GENERATOR FURNACES, &c., *T. Hudson, Manchester.*—11*th October*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to effect the more complete combustion of the gases evolved, and it consists in introducing heated air into the furnace at the point where the ordinary bridge is situated, the bridge itself being utilised to heat and conduct the air to the furnace.

4417. FOLDING AND TELESCOPIC MUSIC AND READING STAND, *J. J. Gilbert, New Romney.*—11*th October*, 1881. 6*d.*

The foot or pedestal is made with three arms which turn on pivots so as to close one on the other when not in use. The pillar is made up of a number of tubes placed one within the other, so as to be capable of extension when in use, and to slide one within the other and occupy but little space when not in use. The top of the inner tube receives the music stand or desk, which is made up of jointed bars so as also to close up in a small space.

4419. PAPER PULP, *D. O. Francke, Sweden.*—11*th October*, 1881. 6*d.*

A solution of acid calcium sulphite is charged along with fragments of wood or fibre to be converted into pulp into a strong boiler heated by a steam casing containing steam at from four to five atmospheres, the action being maintained for from twelve to fifteen hours, the whole being preferably continually agitated.

4422. SPINNING AND DOUBLING YARNS OR THREADS, *T. Briggs, Manchester.*—11*th October*, 1881. 6*d.*

The improvements consist in a peculiar construction of automatic centrifugal drag motion to be applied to the taking-up bobbin, whereby the amount of drag on the bobbin is caused to increase as the diameter of the bobbin increases.

4423. SLATES, *W. A. Barlow, London.*—11*th October*, 1881.—(*A communication from T. Finger, Germany.*) 6*d.*

This relates to slates for writing purposes, and consists in forming them in two halves, each enclosed in a frame, and so joined together as to be capable of being opened and closed.

4424. FASTENER FOR SECURING THE COVERINGS OF RAILWAY WAGONS, &c., *E. Pilbert and D. Sinclair, Dundee.*—11*th October*, 1881. 6*d.*

The fastener consists of a strong spike of iron or other metal, which in one modification is driven into the sides of the longitudinal beams of the wagon or other vehicle, and is formed with a fluke or feather projecting at a slight angle to the longitudinal centre of the spike from the head part or spike-head, preferably at the right-hand side to within an inch or so of the surface of the wagon beam. The cords of the tarpaulin or covering are each wound round the head of a spike of this form, and the end of the cord passed into the angular or wedge-shaped space between the spike and the fluke, or feather, and drawn tight, to be securely wedged therein, while also bearing hard on or over the part of the cord leading up from the spike to the usual eye in the tarpaulin or cover.

4426. KNITTING MACHINES, *H. J. Haddan, Kensington.*—11*th October*, 1881.—(*A communication from R. I. Creelman, Georgetown, Ontario.*) 10*d.*

The object of the invention is to produce a machine which will do general knitting, knit a sock or stocking with heel and toe complete, either plain, ribbed, or part plain and ribbed, and will be capable of producing Balmoral stripes or longitudinal stripes, and to shape a stocking in the ankle by the ribbing attachment.

4427. PIPE JOINTS, *E. G. Mawbey, Market Harborough.*—11*th October*, 1881. 6*d.*

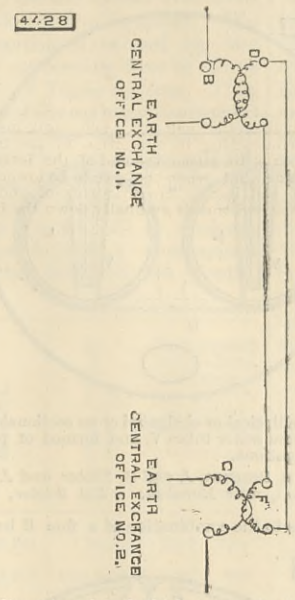
The pipes can be laid by lowering one pipe vertically into another directly into its intended position in work, instead of pushing the end of one pipe into the other, and by bedding it solidly into the jointing material previously placed around the invert of the socket.

4429. DESICCATING AND PRESERVING HAY CEREALS AND OTHER CROPS WHEN STACKED, &c., *G. W. F. Swarbrick, Tottenham.*—11*th October*, 1881.—(*Void.*) 2*d.*

In a central position in the body of the stack a chamber is formed during the building, at the bottom the open end of a pipe is introduced, which pipe extends outwards clear of the stack, and is there connected with an exhauster, ejector, or apparatus for producing either atmospheric pressure or vacuum in the pipe. This pipe, conveying the exhausted fluid from the internal chamber in the stack, is also provided with a coil immersed in a tank of cold water, or with other suitable apparatus for condensing the products evolved by and conveyed from the vegetable materials whilst subject to the process of drying.

4428. IMPROVEMENTS IN TELEPHONIC APPARATUS, *A. R. Bennett, London.*—11*th October*, 1881. 6*d.*

This relates to a means for enabling subscribers who are in communication with central exchange offices by single wires, the exchanges being connected by double wire, to converse; also for modifying the inductive effects on a single wire. The mode of carrying out the invention will be seen from the figure, B D and F G are layers of an induction coil, which transmit the currents from the single to the double lines by induction, a method by which each coil may be made to transmit signals between the central offices by the addition of a system of permanent magnets,



the alternate poles of which are revolved by a crank, as closely as possible without contact, to one end of the iron core of the coil, the other end of the core being fitted with an iron disc, in connection with battery and bell, &c., also described.

4431. TABLES AND CABINETS FOR SEWING AND OTHER MACHINES, &c., *H. E. Newton, London.*—11*th October*, 1881.—(*A communication from J. Jorgensen, Petersburg, U.S.*) 6*d.*

The object is to produce a table or cabinet which will serve as a support for a sewing machine or other machine or instrument, and which may nevertheless be used as an ordinary table.

4432. LOOMS, *J. Barbour, Belfast.*—11*th October*, 1881.—(*A communication from A. Coulter, Russia.*) 6*d.*

The object is to prevent shuttles of looms while at work from flying out of their course, and thereby retarding the weaving, and it consists in fitting to the front of the slay or batten a rock shaft extending across the loom, and furnished with a series of prongs or teeth, forming a shuttle guard in front of the batten, and serving to retain the shuttle in its course as it is propelled through the shed.

4436. CONTINUALLY LUBRICATING LOOSE PULLEYS, *G. Pitt, Sutton.*—11*th October*, 1881.—(*A communication from D. D. Coath, Rangoon, Burmah.*—(*Not proceeded with.*) 4*d.*

The lubricator being furnished with oil and adjusted, the oil passes through a tube into a hole in the middle of the spindle, and thence through holes into the bush of the loose pulley.

4438. HORSESHOES, *J. Welsby, near Liverpool.*—12*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in constructing the shoe with india-rubber, gum, wood, or like projecting material at the heel only, the toe being of any usual or desired construction.

4441. RECOVERING NITRIC, SULPHURIC, AND MURIATIC ACIDS FROM THE BYE-PRODUCTS OF THE MANUFACTURE OF NITRO-BENZOLE, &c., *J. Deucker, Manchester.*—12*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a method of recovering the acids from the bye-products of the manufacture of nitro-benzole, aniline dyes, or other manufactures wherein mixed acids are employed, such recovered acids being either used over again in the same process or manufacture, or otherwise utilised.

4443. MANUFACTURE OF A WORT FROM DATE FRUIT, *T. Webb, Clapton Park.*—12*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the manufacture from date fruit of a wort, by the employment of which alcoholic spirit, beer, and vinegar can be manufactured in an economical manner.

4444. COATING OR COVERING METAL SURFACES WITH OTHER METAL OR ALLOY, *H. H. Lake, London.*—12*th October*, 1881.—(*A communication from H. Reusch, Germany.*) 4*d.*

The surface to be coated is first cleaned and then covered with a thin film of tin or alloy of tin; and then placed in the metal with which it is to be coated.

4446. OBSERVING THE WORKING OF BOILER AND OTHER PUMPS, *S. Lees and T. Allison, Huddersfield.*—12*th October*, 1881. 4*d.*

A tube of transparent material, preferably glass, is employed, one end of which is closed, and the other end is in free communication with the barrel of the pump. The glass tube or gauge may be in close connection to the pump, or connected by means of a pipe, so that water or other liquid may pass freely from one to another.

4447. FOOD PREPARATIONS, *W. White, London.*—12*th October*, 1881.—(*Provisional protection not allowed.*) 2*d.*

Animal and vegetable foods when incorporated with granulated bread or biscuit are rapidly desiccated in dry air with the retention of their several savours and qualities. Food thus prepared is mixed with sugar or albumen, or sugar and albumen, and subjected to sufficient heat to fuse the sugar or coagulate and dry the albumen, and the resulting combination may be used as a biscuit or reserved as material for further processes in cookery.

4449. BRUSHING THE SURFACES OF POLYGONAL BOLTING OR DRESSING MACHINES, *F. Stansfield, Bradford.*—12*th October*, 1881. 6*d.*

This consists in the method of brushing the surfaces of a polygonal bolting or dressing machine by means of a brush fixed on a spindle parallel to the axis of the revolving polygon, the said spindle being situated at such distance from the axis of the polygon, and being caused to revolve at a speed so proportioned to that of the polygon, and in the same direction that the point of the brush which the spindle carries travels over the surface of the side of the polygon.

4456. FURNACES FOR THE EXTRACTION OF SULPHUR FROM ITS ORES, &c., *W. Black, South Shields, and T. Larkin, East Jarrow.*—13*th October*, 1881. 6*d.*

The furnace is provided with one or more chambers, so that whilst the under one is heated by the fireplace or fireplaces, the ore passing through the chamber or chambers above, and the ore on the top of the furnace is heated by the burning or calcination of the ore in the chamber beneath.

4457. BLEACHING JUTE, *T. G. Young, Penicuik, N.B.*—13*th October*, 1881. 2*d.*

This consists in treating jute in the bleaching process with a solution of the sulphuret, otherwise known as the sulphide of sodium, potassium, magnesium, calcium, or barium, and with a liquor composed of a solution of chlorine and an alkali, such as chlorine and soda, chlorine and potash, or chlorine and magnesia, or chlorine and alumina.

4462. PUMPING MACHINERY, *J. Gill, Edinburgh.*—13*th October*, 1881. 6*d.*

This consists essentially in the combination with alternately acting and vertically reciprocating pump rods or their equivalents, of pulleys having involute-shaped or similar peripheries, and journals or centres which roll or otherwise move horizontally.

4463. CORKSCREWS, *J. Pitt and J. F. Norgrove, Birmingham.*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

The worm which enters the cork is connected to a quick-threaded screwed stem, the thread of the worm and screwed stem respectively being inclined in opposite directions, the thread of the worm being right-handed, and the thread of the screwed stem being left-handed.

4467. PERAMBULATORS, *J. H. Miles, Birmingham.*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This consists, First, in the construction and arrangement of the handles, whereby the perambulator may readily be propelled either from the front or back; Secondly, in the construction and arrangement of parts for changing the position of the body with respect to the wheels, according as the perambulator is propelled from the front or from the back.

4468. CIGAR AND CIGARETTE HOLDERS, *H. L. Friedlander, London.*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in serrating, grooving, or channelling the interior surface of the mouth of the holder or tube.

4469. LOCKING SCREW NUTS, *C. E. Challis, Homerton.*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

The nut is tapped through the centre, and a part of the outside is turned down in the form of a cone. This cone is split up with one or more cuts. By the employment of a washer having a conical hole to receive the coned portion of the nut, the split part of the latter when screwed up tight into the washer is forced in upon the bolt.

4471. TROWELS, *T. Tyzack, Sheffield.*—13*th October*, 1881. 4*d.*

The upright part of the tang or handle is made of greater width than hitherto, and of such shape that when the handle of the trowel is grasped by the hand the finger next the upright lies in a recess formed therein.

4475. TOBACCO PIPES, *D. T. Powell, London.*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

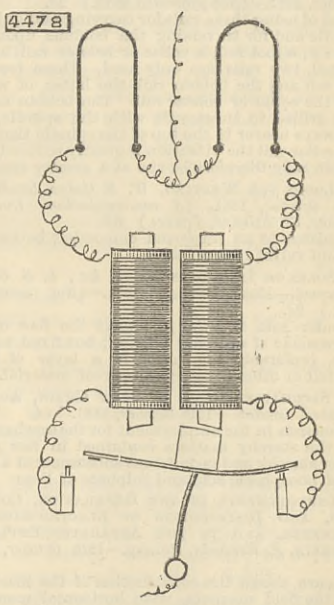
The pipe is filled from the top in the ordinary manner, but is furnished with a hole at the bottom for lighting.

4476. BOAT DETACHING GEAR, *A. Simey, Sunderland*—13*th October*, 1881.—(*Not proceeded with.*) 2*d.*

The gear is arranged so that when the boat is attached and the gear locked, the weighted levers are in the raised instead of the lowered position, and the weight of the boat as then attached prevents the said levers from falling; but on the boat being waterborne the gear is relieved of its weight and the levers fall, thus drawing back the sliding locking plates and detaching the boat.

4478. IMPROVEMENTS IN ELECTRIC LAMPS, *R. Harrison, Newcastle-on-Tyne.*—14*th October*, 1881. 6*d.*

This relates to incandescent lamps. The inventor punches his carbon filaments out of carbon using a V-shaped punch. The two ends are widened out and have eyelet holes punched in them, into which are inserted metallic eyelets. To these eyelets are attached



the metallic connections, after carbonisation, to which in turn the wires are attached. To provide for one light taking the place of another the inventor connects them with a shunting apparatus. This consists of a small electro-magnet for each light; in front of the poles of the two electro-magnets an armature is mounted free to be attracted by either; to this armature is attached a spring, which in the middle position of the armature bears slightly against two contacts, one for each light. When either has the greater part of the current passing through it, the electro-magnet in that circuit attracts the armature, so that its spring makes a firm contact for that circuit but is taken out of contact for the other. The figure explains the apparatus.

4479. ELLIPTICAL SPRINGS FOR VEHICLES, *F. Joynes, Sheffield.*—14*th October*, 1881. 4*d.*

This consists in the construction of elliptical springs for vehicles by curving the ends of the back or top plates, and combining therewith an elastic metallic clip and box or boxes, with bolt-and-nut or other equivalent appliance for securing the parts together, thus forming an elastic end joint for the said elliptical springs.

4480. UMBRELLAS, PARASOLS, OR SUNSHADES, *W. P. Thompson, London.*—14*th October*, 1881.—(*A communication from J. Ganith, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists in the combination with the runner of the umbrella of a spring, inclosed in a groove, and fixed in the handle, and of a movable ring upon the runner or slide, which disengages the spring by a simple push movement.

4482. FLYERS FOR SPINNING AND TWISTING FIBRES, *J. W. Naylor and T. Thompson, Keighley.*—14*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates principally to improvements in flyers employed in rovers or dandy rover frames.

4483. PUMPS, *R. Bosking and W. Blackwell, Dalton-in-Furness.*—14*th October*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in working sliding pipes with nozzles and pistons.

4484. SLEDGE RUNNERS FOR VEHICLES, *W. Barnard, Lord de Blaquiere, Crawley, Sussex.*—14*th October*, 1881. 6*d.*

This consists in converting wheeled carriages or vehicles into sledges by furnishing them with adjustable runners applied for their wheels, which, when requisite, are further locked by parallel and cross pieces or both, and the wheels, when desired, strengthened to resist strain.

4485. STEAM BOILERS, *G. Stevenson, Airdrie.*—14*th October*, 1881.—(*Not proceeded with.*) 4*d.*

This relates to improved modes of combining tubes having the water inside of them with other arts to

form boilers which have extensive heating surfaces of a very efficient character.

4486. OBTAINING THE OXIDES AND SALTS OF CERTAIN METALS, *J. B. Readman, Glasgow.*—*14th October*, 1881. 4*d.*

This consists principally in subjecting the ores to the action of a salt of sodium along with sulphuric acid at a high temperature, and also in subsequently preparing the oxides and salts in a very pure state by means of chemical processes.

4487. LAMPS, *J. A. B. Bennett, King's Heath, and J. Herd and B. P. Walker, Birmingham.*—*14th October*, 1881. 6*d.*

This consists in constructing the wicks of refractory materials so relatively arranged as to leave capillary spaces for the passage of the petroline, oil, or other fuel, to the part of the wick at which it is burned.

4488. INDICATING OR RECORDING THE STATE OF THE GAME OF LAWN TENNIS, *H. T. Bartlett, Exmouth.*—*14th October*, 1881.—(*Not proceeded with.*) 2*d.*

A disc is employed which is provided with four pairs of hands mounted on a common centre or axis, but so as to work independently one of the other.

4489. TREATING LIQUORS, &c., *J. Imray, London.*—*14th October*, 1881.—(*A communication from La Société Anonyme des Products Chimiques du Sud-Ouest, Paris.*)—(*Not proceeded with.*) 2*d.*

After the expulsion by heat as far as possible of carbonate of ammonia, and before adding lime, a small quantity of acid, preferably hydrochloric acid, is added until the last traces of carbonate of ammonia are decomposed, the lime being then added the operation is carried on with facility.

4490. ARTIFICIALLY PRODUCING SNOW, *D. Rae, London.*—*14th October*, 1881.—(*Not proceeded with.*) 2*d.*

A chamber is formed the walls of which are the sides of tanks or cells in which brine or other not readily congealable liquid, cooled to a very low temperature, is made to circulate. In the space between these cold walls water is dispersed in a fine spray, it being introduced under pressure by small nozzles arranged to jet it against checking surfaces. By means of an air pump the air is rarefied in the chamber so as to maintain nearly a vacuum therein.

4491. MANUFACTURING SODA BY THE AMMONIA METHOD, *J. Imray, London.*—*14th October*, 1881.—*A communication from la Société Anonyme des Products Chimiques du Sud Ouest, Paris.*) 6*d.*

This relates to the process of manufacturing soda by the ammonia method, wherein carbonic acid is caused to unite with ammonia or its volatile compounds in a gaseous condition.

4493. LUBRICATING STEAM AND GAS ENGINES, &c., *J. J. Royle, Manchester.*—*14th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates partly to improvements on patent 4909, A.D. 1879, and consists in employing a steam jet to exhaust or partially exhaust a vessel containing powdered graphite or other lubricant in powder, so inducing a current of air to act upon or through the graphite, and by thus agitating it a portion of the graphite is carried along with the air passing to the steam jet, and so fed into the cylinder. A valve is arranged to prevent the return of the powdered lubricant at the period of high pressure in the cylinder.

4494. SPINNING MACHINERY, *R. Scaife, Colne.*—*14th October*, 1881.—(*Not proceeded with.*) 2*d.*

Instead of using three rails for carrying and guiding the spindle and for traversing the bobbins upon the spindle, *i.e.*, a foot rail, a collar or bolster rail, and a bobbin rail, two rails are only used. These two are the foot rail and the bobbin rail, the latter of which replaces the collar or bolster rail. The bobbin rail is bored or drilled to an easy fit with the spindle, and being always nearer to the top of the spindle than the present collar rail the vibration is greatly reduced, and the bobbin may therefore be run at a greater speed.

4495. LOOMS FOR WEAVING, *W. E. Gedge, London.*—*15th October*, 1881.—(*A communication from J. Vacher, St. Etienne, France.*) 6*d.*

This relates to an improved embossing batten for ribbon and velvet ribbon looms.

4500. SOLES OR INSOLES OF BOOTS, &c., *L. S. Cohen, Liverpool.*—*15th October*, 1881.—(*Not proceeded with.*) 2*d.*

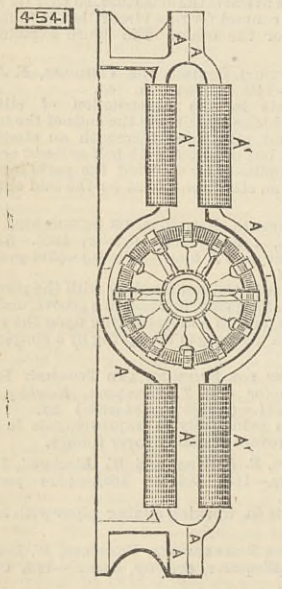
The outer sole and the part next the foot of the insole are made of ordinary leather; but fixed to one of these, preferably the insole, is a layer of bituminous felt or other flexible waterproof material.

4501. SACCHARIFICATION OF RAW GRAIN, &c., *A. Manbré, London.*—*15th October*, 1881. 4*d.*

This consists in the employment for the saccharification of the starchy matters contained in raw grain and other starchy and farinaceous substances of a compound of phosphoric acid and sulphate of lime.

4541. IMPROVEMENTS IN THE GENERATION, COLLECTION, AND DISTRIBUTION OF ELECTRO-MAGNETIC CURRENTS, AND IN THE APPARATUS EMPLOYED THEREIN, *R. Kennedy, Paisley.*—*18th October*, 1881. 6*d.*

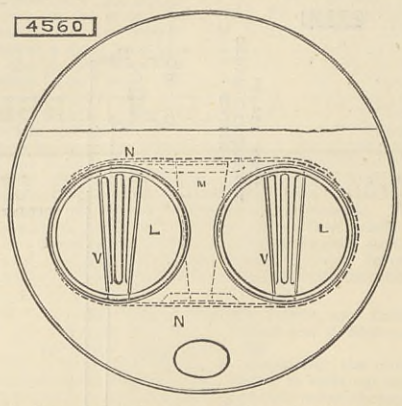
The figure shows the construction of the machine. A A are the field magnets, with horizontal members wound with coils A^1 A^1. The shaft driven by a pulley carries an exciting armature, and a number of separate armatures, which the inventor calls working or collecting armatures. These are of wheel form, having a number of projecting soft iron pieces secured to their peripheries, between which the wires are wound in coils, the wires between each two adjacent spaces being connected together, and a wire led from each connection to the commutator, which consists of a non-conducting barrel or series of discs. The barrel carries a series of rings separated from each other; the



said series carry plates equal in number to the total number of divisions on the armatures employed, together with a ring for the exciting armature to give a separate current for this armature. The wires of the armature coils are led one to each plate of a ring of the commutator, each ring receiving the wires from one armature. Collecting springs bear upon opposite sides of each ring, and collect a separate current from each, so that each current may be utilised separately, or they may be united and used collectively.

4560. STEAM BOILERS, *S. Fox, Leeds.*—*19th October*, 1881. 6*d.*

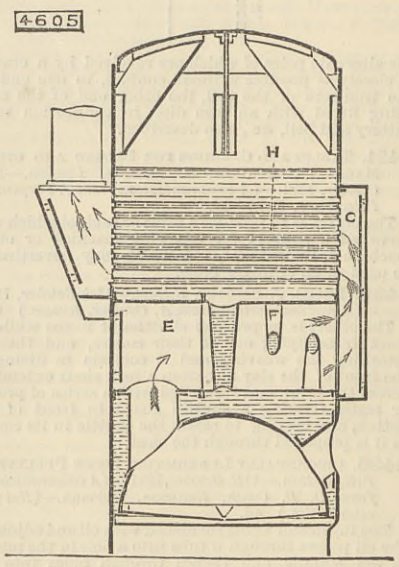
This relates to boilers of the "Galloway" type, and consists in providing such boilers with two circular corrugated fire-boxes L, connected to a single internal



flue M, of an elliptical or elongated cross sectional form containing cross water tubes V, and formed of plates N with corrugations.

4605. STEAM BOILERS, *J. and G. Tinker and J. and R. Shenton, near Manchester.*—*21st October*, 1881. 6*d.*

This relates to the combination of a flue E having



circulating tubes F, with the tubes H, and the combustion chamber G giving communication between them.

4686. MANUFACTURE OF LOOPED OR KNITTED FABRICS, *J. Imray, London.*—*26th October*, 1881.—(*A communication from O. Viett, Hamburg.*) 4*d.*

This relates to improvements on specification No. 1179 of 1879, for the manufacture of Scotch caps or bonnets.

4776. CARTRIDGE CASES, *G. Kynoch, Witton, near Birmingham.*—*1st November*, 1881. 4*d.*

The cartridge case is made in two parts, the tube and the head, the former being made with a complete bottom, which is recessed to receive the inwardly projecting percussion chamber of the head. A separate cup to form the head is provided with an inwardly projecting percussion cap chamber, and the tube is inserted in it, and the two subjected together to drawing and heading pressure, so as to unite them firmly. The complete case is thus provided with a double bottom.

5369. CAR TRUCKS AND AXLE-BOXES, &c., *J. N. Smith, New York.*—*8th December*, 1881.—(*Complete.*) 8*d.*

This relates partly to improvements in a truck for railway carriages, wherein the truck is pivotted to the carriage or car body at its end, instead of at its centre, and the springs are mounted in an evener.

5438. SPINDLES AND BOLSTERS FOR SPINNING AND DOUBLING, *J. Watson, Paisley.*—*13th December*, 1881. 6*d.*

This consists in the employment of two or more vertical split balloon-shaped springs.

5532. SOLVENTS FOR TREATING WOOD, &c., FOR THE PRODUCTION OF PULP, *D. O. Francke, Sweden.*—*17th December*, 1881. 2*d.*

This relates to the manufacture of solvents for treating vegetable fibre, as described in patent No. 4419, A.D. 1881, and consists in producing acid sulphites of alkalies by charging a tower with fragments of limestone on which a shower of water is caused to descend, while sulphurous acid fumes are caused to pass through the tower. The liquid which collects at the bottom of the tower is the acid sulphite required.

5543. BRICK-MOULDING MACHINES, *C. F. Schlickeysen, Berlin.*—*17th September*, 1881.—(*Complete.*) 6*d.*

This relates to a brick-moulding machine in which the pressing cover is lifted or shifted from the press-box by means of a direct movement of the hand, and is based upon the application of the said direct movement of the hand in lifting the said pressing cover and dropping the same at the proper times.

19. PUSHING INGOTS FROM THEIR MOULDS, *J. Imray, London.*—*3rd January*, 1882.—(*A communication from T. James Braddocks, U.S.*—(*Complete.*) 4*d.*

This consists, for pushing ingots from their moulds, in the use of a lever introduced in the hoisting tackle, this lever being so connected to the mould and to a plunger bearing on the ingot that the hoisting strain tends to move the mould and the ingot in opposite directions.

223. PUMPING LIQUIDS, &c., *A. M. Clark, London.*—*16th January*, 1882.—(*A communication from C. W. Cooper, New York.*)—(*Complete.*) 8*d.*

This relates to the combination of an air compressor with two or more chambers, one or more of said chambers constituting pump chambers, and with connecting pipes, all arranged so that the air after having entered the pump chamber at high pressure to force out the water is made to leave the chamber in attenuated condition by the action of the compressor, so that water may enter and leave the pump chamber without the necessity of a piston or plunger therein.

266. GRINDING AND SEPARATING, &c., *S. Pitt, Sutton.*—*19th January*, 1882.—(*A communication from H. A. Duc, jun., Charlestown, U.S.*)—(*Complete.*) 6*d.*

The current of air from the grinding apparatus is constantly used over again, whereby the material which is withdrawn from the mill is constantly presented to its settling chamber or chambers until it has been deposited from the flowing current and removed from the mill, thus preventing the escape of dust and also securing a greater uniformity in the selected material, which is removed from the apparatus when reduced. The material is reduced by contact and friction against itself, as distinguished from the method of reducing it against a grinding surface not formed of the material itself, the apparatus to effect this consisting of a rapidly revolving vessel, through a central opening in which a plough projects and acts on the revolving material.

226. PROTECTING BOTTLES, &c., FROM BREAKAGE IN PACKING OR HANDLING, *J. M. Thorpe and J. A. Belloli, California.*—*17th January*, 1882.—(*Complete.*) 4*d.*

This consists in forming the jars with circumferential grooves to receive rings or bands of india-rubber or other suitable elastic material which form cushions.

270. RIVETS, *H. J. Haddan, Kensington.*—*19th January*, 1882.—(*A communication from Q. E. Packard, Montreal.*)—(*Complete.*) 6*d.*

The rivet consists of a solid flanged head with fastening prongs which are passed through holes in the parts to be joined, and their ends then turned over and clenched. The invention also includes a punching apparatus and die for manufacturing such rivets.

335. VACUUM PAN APPARATUS, *H. H. Lake, London.*—*23rd January*, 1882.—(*A communication from A. R. Alexander and J. F. Maclaren, Mackay, Queensland.*)—(*Complete.*) 4*d.*

This consists in the combination of a steam ejector with a vacuum pan for the purpose of rapidly and economically removing the vapours arising from any liquid boiling in a partial vacuum therein, by drawing them rapidly into contact with condensing surfaces through sprays or films of water, and then removing the uncondensed portions of such vapours through the ejector direct.

345. WIND INSTRUMENTS, *L. Varicas, London.*—*24th January*, 1882.—(*A communication from the Autophone Company, Ithaca, U.S.*)—(*Complete.*) 6*d.*

This consists, in combination with a music sheet, of a differential feeding mechanism for mechanical musical instruments, consisting of a series of feeding hooks arranged in different planes and operating directly on such sheet.

384. ANILINE AND TOLUIDINE, &c., *W. R. Lake, London.*—*25th January*, 1882.—(*A communication from E. D. Kendall, Brooklyn, U.S.*)—(*Complete.*) 6*d.*

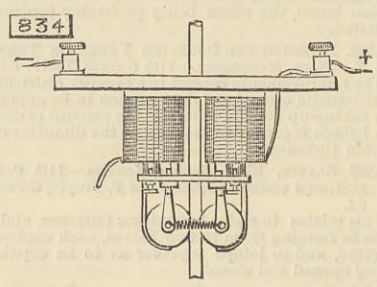
This consists, First, in the method of producing aniline or toluidine from the corresponding nitro derivatives of coal tar hydrocarbons by placing nitro-benzine or a mixture of nitro-benzine and nitro-toluine in a porous cup or cell and in a mixture of water and sulphuric acid, and connecting the same with the negative electrode of an electric circuit, whereby the conversion is effected; Secondly, the method of producing a colour-yielding product from aniline or a mixture of aniline and toluidine by placing it in contact with the positive electrode of an electric current, and in the presence of water and sulphuric acid; Thirdly, in the combination with a porous cell of a pendulous carbon plate and vibrating connections or their equivalents; and Fourthly, in the combination of a pendulous carbon and a textile covering for commingling the elements in the process of making aniline or toluidine.

741. URETHRAL SYRINGES, &c., *A. M. Clark, London.*—*15th February*, 1882.—(*A communication from F. Wilhöft, New York.*)—(*Complete.*) 4*d.*

The syringe is formed of a piece of soft rubber consisting of a bulb and a nozzle, the latter being formed with a central channel and having the bulb secured to one end, while the other end is made conical to enter the urethra without penetrating too far.

834. IMPROVEMENTS IN ELECTRIC LAMPS OR LIGHTING APPARATUS, *W. R. Lake, London.*—*21st February*, 1882.—(*A communication from B. Lande, New York.*) 6*d.*

This invention relates to a mode of regulating the upper carbon by the two pulleys shown. When the arc is to be established the brake arms shown clamp the pulleys. The action of the current on the cores



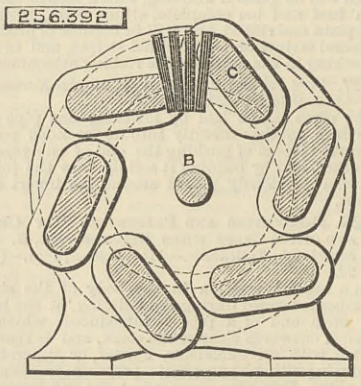
of the two electro-magnets which are attached to the brake arms lifts the upper carbon and establishes the arc. As the carbons are consumed, the current through the electro-magnets weakens, the brake arms and cores fall and release the pulleys, through which the carbons descend until the arc is the proper length.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

256,392. DYNAMO-ELECTRIC MACHINE, *Henry B. Sheridan, Cleveland, Ohio.*—*Filed August 22nd*, 1881.

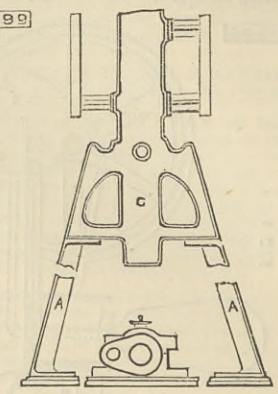
Brief.—The construction is clearly indicated in the drawing and claim. The purpose is to avoid wide breaks in the inductive action of the machine and



produce a nearly uniform current. *Claim.*—A dynamo-electric machine constructed substantially as herein shown and described, with its magnets C made oblong in cross section and arranged around the armature shaft B, with the side of each magnet in the series nearly overlapping the edge of the adjacent magnet, substantially as herein specified.

256,499. FRAME FOR GANG SAW MILLS, *De Witt C. Prescott, Marinette, Wis.*—*Filed February 19th*, 1881.

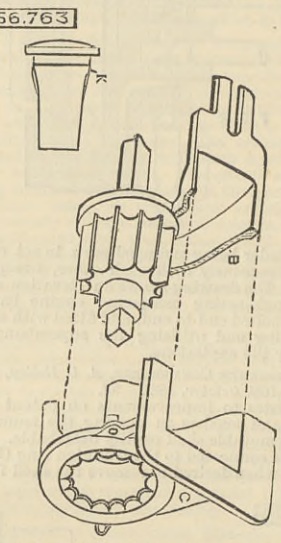
Claim.—(1) The lower or supporting frame composed of two independent sections A A arranged transversely to the line of cut and inclined toward each other, in combination with the upper or saw frame C, the side pieces of which, at their lower ends, rest on the lower frame and extend from one section to the other of the latter, and are secured thereto, thereby uniting the



said sections of the lower frame, substantially as described. (2) The independent sections A A of the lower or supporting frame, tapering from the bottom upward, and arranged transversely to the line of cut, inclining inward toward each other, in combination with the independent saw frame C, the side pieces C of which are seated on the upper ends of the sections A and extend across from one to the other, being secured to each, substantially as and for the purposes set forth.

256,763. FORGE-FEED GRAIN DRILL, *Hanson P. Tenant, Richmond, Ind.*—*Filed February 18th*, 1882.

Brief.—The feed cup is composed of two sections, one of which slides within the other. The movable section and the feed wheel are mounted on a divided thimble that is clasped to the laterally adjustable shaft, whereby said section and feed wheel are adjusted to graduate the amount of seed sown. *Claim.*—(1) The combination, in a seed cup, of the inner sliding section B, with the divided thimble passing through said section and fitted upon the rotary shaft, and the feed wheel locked upon the thimble upon the inner side of the sliding section, the said thimble having a flange fitted against the outer side of the section, sub-



stantially as described. (2) The combination, with the two-part seed cup, of the divided thimble fitted upon the rotary shaft and formed with the gibs K, and the feed wheel fitted upon the thimble and provided with recesses receiving the said gibs, substantially as described. (3) The combination, in a seed cup, of the outer section formed with a vertical wall C, with the rotary rosette located within an annular recess formed in a cap-plate secured to the outer side of said wall, and the fluted feed wheel fitted in the rosette and locked upon a thimble that is secured upon the shaft and adapted to rotate in one of the sections of the seed cup, substantially as described.

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THE Orient Steam Navigation Company has acquired, from the Mauritius Government, Diego Garcia and another island in the Chagos Archipelago, dependencies of Mauritius, in about 7 deg. S., and almost exactly midway between Aden and Melbourne, which are to be used as coaling stations for the Orient steamers on their voyages to and from Australia.