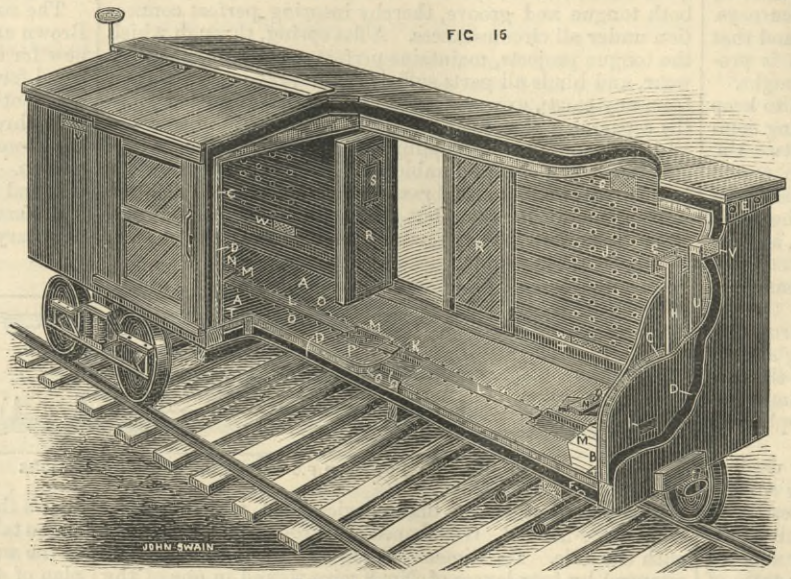
THE CHICAGO RAILWAY EXPOSITION.

No. IV.

Refrigerator cars are now coming into extensive use in the States for the conveyance by freight train of various perishable articles of food. The great distances, the extreme heat of the summer, and the slow speed of the trains combine to render necessary cars in which a dry, cold, and pure atmosphere can be maintained for several days together. The cars now in use leave something to be desired in these respects, and the Exposition contained many cars designed to deliver perishable articles in perfect condition after a long journey. In this country fresh fish, milk, yeast, &c., are generally carried by passenger train in trucks provided only with very rudimentary appliances for maintaining either an equable temperature or good ventilation, and it seems possible that the American system of transport, in properly constructed vehicles, by goods trains might prove both cheaper and more convenient, avoiding delays to passenger trains caused by the addition to their load of trucks of fish, and milk vans.

All the cars in the Exposition were cooled by ice, which is cheap, and is an article of universal and every-day use in the States. The system of refrigerating by cooling compressed air, which is afterwards allowed to expand, generally adopted on board ship, is hardly suitable for use on a railroad vehicle, though it would appear to give better results, the air being drier, the proper temperature more equably maintained, and the ventilation positive and certain. It is believed in America that warm air is sufficiently dried by passing over cold surfaces, the moisture being condensed on the ice or on the sides of the ice-box and led away, but on board ship and in our moister atmosphere it is possible that less favourable results may be attained. All the refrigerator cars exhibited were covered box cars about 30ft. in length, constructed with thick sides, roof, and floor, to serve as efficient non-conductors. The ice is placed in boxes or trays in the upper part of the car, and circulation of air is ensured by the ascent of the warm air to the ice, where it is cooled, and descends on the freight. None of the cars exhibited had fans, or any similar devices for promoting circulation of air.

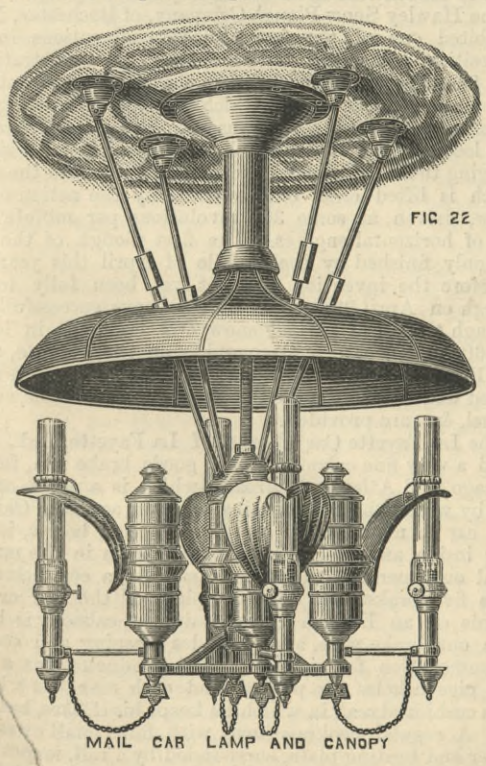
FIG 15



REFRIGERATOR CAR.

POST OFFICE CAR.

POST OFFICE CAR CLEARED.



MAIL CAR LAMP AND CANOPY

FIG 22

Experience has shown that perishable articles can best be carried in a refrigerator car possessing the following qualities:—The air must be not only cool but dry, and the freight and woodwork of the car must be carefully protected from contact with the ice or the ice-water. The foul air must be carried off, and fresh air, properly cooled, must be allowed to take its place. The ice-boxes should be arranged for large blocks of ice, which melt slowly and more evenly than small pieces. To secure economy in the use of the ice, the water should not be allowed to drain away at once, but should be utilised to assist the ice in cooling the air. The ice-boxes should occupy as little useful room as possible, and all fresh air admitted should be properly cooled before it comes into contact with the freight. The walls of the car must, of course, be efficient non-conductors; the doors must close tightly, and the ice-boxes must be easily accessible from the outside for refilling or examination. The method by which the various exhibitors sought to attain these objects is briefly described below.

The sides of the Ayer rubber car are formed of layers of planking and air spaces lined with india-rubber sheeting. The external air passes through the ice racks at each end of the car, and the condensed water falls into a trough and runs off by a pipe. The Lorenz car, illustrated by Fig. 16, also carries the ice at the ends of the car, but the ice-boxes, when not required, can be folded up, leaving the whole body of the car free for ordinary freight. The ice is put in either from the sides or top, but the ice-boxes and doors are not shown on our illustration, in which A shows the floor inclining to centre; B, same at ends of car; C, filling of non-conductor; D, air space; E, openings from outside air to air space; F, openings in car bottom from outer air to air spaces in floor; G, outlet strainers from inside of car to outlet pipes; H, outlet pipes built into non-conducting space; I, outlet pipe discharge orifices into air space of walls; J, perforations in car lining to allow pipes to be effected by the cold air in car; K, a central trough or reservoir into which the floor drains; L, iron cover strip over trough slot in floor; M, traps in floor at ends of trough K, and centre; N, trap-doors; O, notches in floor edges to form drains under strip L; P, a pipe from below, up into trough and curved down into water; Q, centre timbers of car frame each side of trough; R, doors opening inward; S, sub-door opening outward; T, sheet metal flashing around foot of side walls and end walls; U, inlet pipes built into non-conducting space; V, outer strainers of inlet pipes from outer air; W, inner strainers of inlet pipes to inside of car. The walls of the car are composed of three thicknesses of planking, an air space, a non-conducting composition sheeting, and a thickness of cork. All the air spaces, except those in the bottom, communicate with one another, and the external atmosphere circulates freely through the various air spaces. Inlet pipes, which are cooled by contact with the interior of the car, admit air at the bottom; the foul air rises, aids in cooling the incoming air, and passes off by outlet pipes to the air spaces in the sides of the car, whence it is carried off by the current of fresh air circulating there. The floor slopes to a central drain, covered with an iron grating, and empties into a trough beneath the floor of the car, where the ice water can be retained as long as its low temperature renders it useful. A galvanised iron flashing round the base of the sides of the car prevents the access of moisture. It is stated that this car is very well ventilated, and is economical in the use of ice. It is chiefly used for the conveyance of beer. The outside doors on either side are of the usual sliding pattern common in America. The inner door is hinged and opens inwards, but contains a small door opening outwards, allowing the interior to be examined, and the removal of any obstruction preventing the larger door from opening.

FIG. 18
FRONT ELEVATION

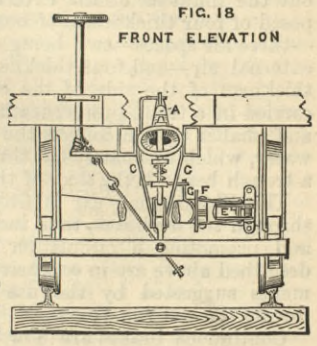


FIG 17
SECTIONAL ELEVATION

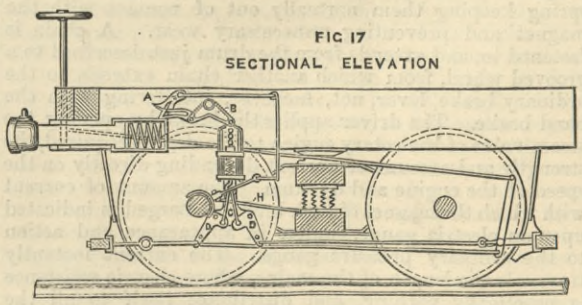
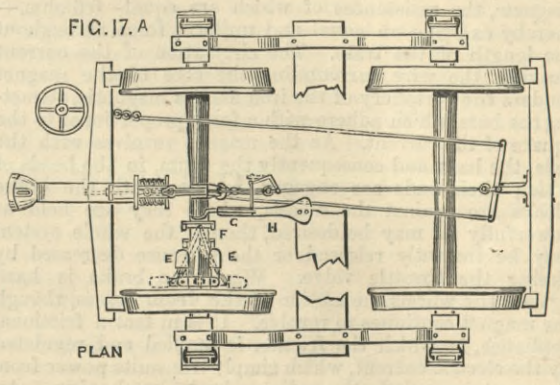
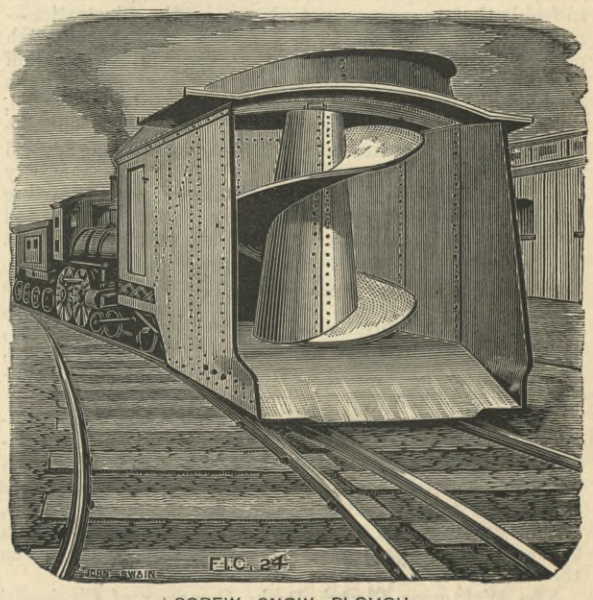


FIG. 17. A



PLAN



SCREW SNOW PLOUGH.

The Merchants' Dispatch Transportation Company car, Wicke's patent, is much used for the conveyance of milk, &c., and is fitted with ice pans at each end of the car filled from the roof. The condensed water falls into troughs which run across the ends of the car, and are drained by means of pipes. The air is cooled by contact with the galvanised ice pans and troughs. The Post Refrigerator Car Company retains the melted ice in an auxiliary tank, keeping the car cool after all the ice is melted, and saving

the ice and time used in cooling before commencing a journey. The air in the car circulates freely all round the ice chamber, giving a large cooling surface.

The Ridgeway car has ice boxes at the ends of the car, round which the warm air passes without coming in actual contact with the ice before being admitted to the body of the car. The condensed water runs along a series of troughs ranged one underneath another, and the cooling power of the water is used to promote a free circulation of air. Large sized blocks of ice are used, which, melting slowly and regularly, are well adapted for long journeys. It is stated that the air is well dried and purified, and that an unusually large space is left for freight, which is protected from contact with the ice boxes or water troughs.

The sides of the Tiffany car are well calculated to keep out the influence of the external atmosphere, being composed of four thicknesses of boards—two ¼in. and two 1in.—three air spaces—two being closed and one open to the external air—and four thicknesses of stout felt, the total thickness of the side of the car being 7½in. The ice is carried in a trough underneath the roof of the car, a lower and smaller trough collects the drippings of the condensed water, which ultimately fall through pipes at the ends into a trough beneath the floor of the car.

The Zimmerman car is fitted with air tubes running through the ice boxes, thus increasing the cooling surface and promoting a circulation of air. Most of the cars described above are in extensive use, and embody improvements suggested by the use of less perfect appliances during the last few years.

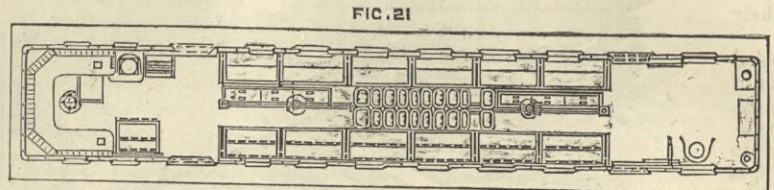
Continuous brakes are now almost universally used on passenger trains in the United States, and their equally widespread adoption on freight trains is only a question of time. The Westinghouse Brake Company exhibited a cheaper form of the well-known automatic brake adapted for freight trains. The brake was arranged for a train of fifty cars, and was equipped with the proper amount of piping, &c., and shown in operation. The reservoir, cylinder, and triple valve are attached to one another, saving some trouble and expense in placing the brake under a vehicle, and the fact that the Brake Company's large new works at Pittsburg are already working day and night would show that the brake gives satisfaction and is being largely adopted. Cheaper forms of brake operated by the action of the buffers also meet with favour, especially as the brake on each vehicle works independently, and no brake pipe or continuous connection through the train is required, thus permitting the brake to be worked on a train partly composed of unbraked vehicles.

The American Brake Company, of St. Louis, Mo., exhibited full-sized working models of a brake of this class, which is illustrated by Figs. 17 and 18. Between the centre longitudinals, and at the inner end of the central buffer or bar, is hung a bell-crank lever B, which carries in one of its jawed ends the push bar A, butting against a shoulder on the buffing rod, and in the other double pull rods carrying a spiral spring, transmitting the strain to bell-crank levers D D, suspended from the sills by hangers C C. The bell cranks, D D, are connected to the brake beams, and consequently compression on the draw head or buffer acting on the lever A, causes the brake blocks to be pressed on the wheels, the amount of pressure being regulated by its transmission through the spiral spring. But as a brake simply made as above described would not admit of a train being backed, a device is attached which removes this objection and, further, only allows the brake to be applied when the car is moving at a speed above six miles per hour. The push bar A can only come in possible contact with the buffer rod by the centrifugal force of governor balls attached to the axle. These balls, E E, are coupled by means of links to a collar F, sliding on the axle. One end of a lever G bears against the collar, and the other end is connected by means of rods, &c., to the push piece A. When the car is running at speed, the governor balls draw the sliding collar towards them, leaving the lever G free to follow it, and permitting the push bar A to drop behind the shoulder on the buffing and draw bar, when the brake is ready for action, going on directly the buffer is compressed. When the speed falls below six miles an hour, the centrifugal force of the governor weights becomes so feeble that a spring—not shown in the illustration—restores the collar to its former position, lifting the push piece A clear of the buffer rod. The brakes come off whenever the compression ceases, and the train can be backed from a state of rest without the brakes going on, the push piece A lying on the buffer rod, but being unable to fall behind the shoulder. The brake can be applied when the engine is pushing the train by momentarily applying the brake on the engine or tender, thereby putting the draw gear in tension, and letting the lever A fall behind the buffer rod shoulder. When steam is again put on, the consequent compression again applies the brake, which, of course, remain on until compression ceases. This brake has been in use for some time on about 1000 cars, and is said to be durable and work well. The first cost, £3 per set—exclusive of foundation brake, levers, blocks, and hangers—is low enough to allow of its extensive application to freight cars.

The freight car brake exhibited by the Tallman Automatic Brake Company of New York also acts by the compression of the buffers, which force together two friction wheels, one of which is keyed on the axle, and the other is geared to a drum winding up the brake chain. A ratchet, which can be shifted by hand to suit the direction in which the train is going, prevents the brake from acting when the train is backed.

The Waldumer Electric Brake Company of Cincinnati exhibited a working model of a very promising form of continuous brake, which is just emerging from the experimental stage. The instantaneous action of electricity and the simplicity of the means used for its transmission render an electric brake specially suitable for long freight trains. The following description is abridged from that furnished by the inventors. The system consists of a dynamo-electric generator driven by a small rotary engine mounted on the locomotive. The mains conducting the electric current extend in parallel lines from the dynamo throughout the length of the train, the system of circuiting being that known as the "multiple arc," by which the interruption of the current on one car affects no other car in the train. They consist of non-insulated copper wire, and are divided into car lengths, and fastened under the bodies. These separate lengths have, as terminals, flexible conductors of copper wire cable surrounded by rubber tubing. For electric connectors or couplings, a dovetail tongue and groove device is used, each member of the coupling having both tongue and groove, thereby insuring perfect connection under all circumstances. A flat spring, through which the tongue projects, maintains perfect contact, takes up all wear, and binds all parts sufficiently to prevent separation from any cause, except a strong direct pull resulting from the separation of the car from the balance of the train, in which event the uncoupling is automatic, the whole coupling being cheap, durable, and reliable. On each car branch wires extend to brass springs in contact with two brass discs fixed upon, but insulated from, the axle and from each other. They serve to conduct the current from

FIG. 21

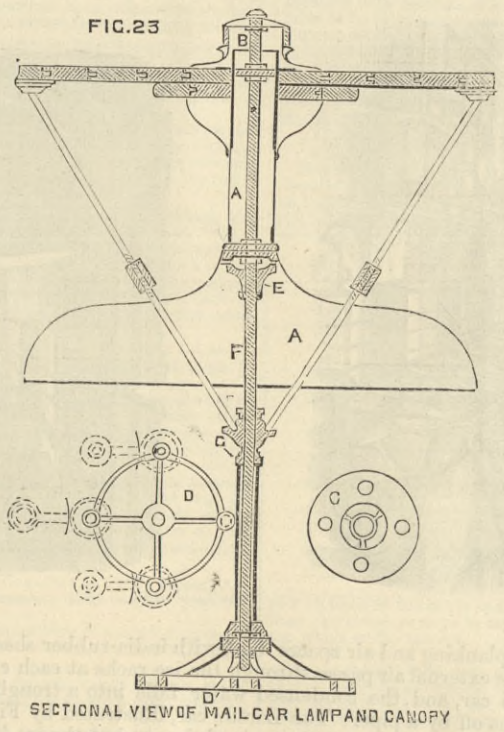


No. 1 GROUND PLAN 60 FT. R.P.O. CAR—236 PAPER SEPARATIONS

stationary wires to the brake device itself, which consists of a three-flanged, reel-shaped electro-magnet revolving with the axle. Its dimensions are 4in. by 15in., and it is wrapped by four layers of No. 8 wire wound in one of the spaces in a direction opposite to that in the other.

The electro-magnet has for an armature nine square wrought iron bars, 1in. by 16in. in size, which are used as delivered from the mill without finish of any kind. These extend over three poles of the electro-magnet, to whose cylindrical form they adjust themselves, and have their

FIG. 23



SECTIONAL VIEW OF MAIL CAR LAMP AND CANOPY

ends engaged in slots in the heads of the drum surrounding the whole. A false head, dust proof, covers these ends, keeps the bars in place, and also serves to hold a circular spring keeping them normally out of contact with the magnet and preventing unnecessary wear. A chain is fastened to, and extends from the drum just described to a grooved wheel, from which another chain extends to the ordinary brake lever, not, however, interfering with the hand brake. The driver applies the brake by opening the steam valve of the rotary engine to the degree required, the strength and amount of current depending directly on the speed of the engine and dynamo. The amount of current with which the magnet of each brake is charged is indicated upon an electric gauge, similar in appearance and action to the ordinary pressure gauge. The current instantly traverses the length of the mains, whose electric resistance is practically nothing, and distributes itself to all the magnets, the resistances of which are equal—0·6 ohm.—thereby exerting an equal and uniform force throughout the length of the train. The circulation of the current through the wire surrounding the core of the magnet renders the periphery of the iron flanges magnetic, attracting the bars, which adhere with a force proportional to the square of the current. As the magnet revolves with the axle, the bars, and consequently the drum, in the heads of which their ends are engaged, revolve until the brake blocks are against the wheels, where they are held as powerfully as may be desired, though the whole system may be instantly released or the pressure decreased by closing the throttle valve. When the brake is hard against the wheels the motion of the drum ceases, though the magnet continues to revolve. It is in fact a frictional appliance, in which the friction is applied and regulated by the electric current, which simply transmits power from the revolving axle to the ordinary brake mechanism. An economy in current is effected by the contact between armature and magnet, the power of the latter varying inversely as the square of the distance between it and the armature.

As above described the brake is virtually non-automatic, but the inventors render it automatic for passenger trains, by an additional system of wires conveying a constant weak battery current, which keeps an ordinary telegraphic relay on each car out of contact. When this current is interrupted the relay throws the strong low tension dynamo current into action, operating the brakes, storage batteries being placed on each car. On freight trains, this system is modified, and the fracture of a wire or coupling does not apply the brakes, but simply rings bells on the engine and in rear van or "caboose." The guard can then, if he sees fit, apply the brake on this portion of the train through the medium of a storage battery on his van.

The street car starter and brake, exhibited by Charles Brown and Co., Chicago, is an ingenious device though not new for storing the momentum which is destroyed by the usual form of brake, and utilising it for restarting the car. The motion of the car is not checked by friction but by the axle through suitable gearing winding up a spiral spring, the power of which is available to again put the car in motion. The mechanical details appear to be well worked out, and the car can be run in either direction, and stopped and started on either up or down grades. The heavy pull necessary to start a car is very severe on horses, and this invention would appear to be useful in saving much wear and tear in horse-flesh.

The Chicago, Milwaukee, and St. Paul Railroad, a corporation owning no less than 4528 miles of line, exhibited two travelling post-offices, built by the Harrison Postal Bag Rack Company, of Fond du Lac, Wis. The larger of these cars is illustrated in Figs. 19, 20, and 21. Fig. 19 shows the car in full working order for sorting. Fig. 20 shows tables and supports detached, and racks folded up out of the way, to provide for the storage of bags; and a ground plan of the car is given on Fig. 21. It will be seen that the car differs materially from those used by our post-office, being 60ft. long, 9ft. 6in. wide inside, self-contained, and not communicating with other cars in the train. It is fitted with a simple form of bag catching and dropping apparatus, and is entered by sliding doors at the sides. The mail bags are hung at their four corners from hinged cast iron frames, which can be taken off their hinges or hooks, and allowed to fold against the sides of the car. The sorting tables are similarly hung from removable stanchions, and thus the car can be wholly or partly cleared for the storage of mail bags, the contents of which do not require sorting, or the car can be in a few seconds transformed into a busy post-office, giving space to sort a large amount of correspondence. Briefly, the car is adapted, by means of its detachable racks and sorting tables, to very varied requirements, and therefore the same car can be used on any route, and can, in case of need, be converted into a parcel, or ordinary luggage van. A given number of sorters can accomplish more work in this car, as the tables and racks are in sections and portable and adjustable to any point or grouping desirable, and the mail matter for important places is thrown directly into the bags to be filled, instead of being sorted into boxes which are then emptied into bags. The car exhibited contained 236 letter boxes, all of which are removable, and are labelled by printed pieces of cardboard, the size of an ordinary railway ticket, slipped into spring catches. The English plan of horizontal revolving polygonal label carriers seems preferable, but is not used in America. It will be noticed that side windows are provided, rendering the car suitable for day use. The majority of the fittings are castings made from standard patterns, securing uniformity and enabling any breakages to be easily repaired, and new mail vans can be built in a shorter time than is possible with the usual method of building vans suitable for one particular route and no other. It is somewhat astonishing that these mail vans differ from those used in England in every detail but one, the entire absence of padding being the most striking of these differences. The lamps are shown on Figs. 22 and 23; each can be swung from a centre so as to concentrate the light on any desired point.

The Hawley Snow Plough Company, of Rochester, N.Y., exhibited one of the few Canadian inventions in the Exposition. As will be seen from the illustration—Fig. 24—a large vertical screw is placed at the front end of a large iron box wagon, which is driven as usual against the snow bank by the vigorous exertions of two, three, or four locomotives. This plough, however, instead of simply wedging the snow to either side, cuts its way into the snow, which is lifted clear of the track by the action of the screw, driven at some 300 revolutions per minute by a pair of horizontal engines. The first plough of the kind was only finished by the middle of April this year, and therefore the invention has not yet been fully tested; though on April 23rd it is said to have successfully cut through a mass of packed snow and ice, 150ft. in length and 6ft. in depth, near Orangeville, on the Toronto, Grey, and Bruce Railway. The engines driving the screw are placed underneath the floor of the car, and a boiler, supply of fuel, &c., are provided.

The La Fayette Car Works, of La Fayette, Ind., exhibited a very fine caboose car, or goods brake van, for the Chicago and Atlantic Railroad—which is a newly opened line by which the Erie obtains a better access to Chicago. The car is mounted on two four-wheeled bogies, is 30ft. long inside, and is entered from the ends in the manner usual on American passenger cars. As a conductor and some five brakesmen take the place of the one or two guards on an English goods train, the caboose is larger than our brake vans, and provides sleeping and cooking accommodation for six men. The conductor has a desk and pigeon-holes for papers, and each man has a locker with cushioned seat, in which he keeps his clothes, bedding, &c. A regular cooking stove, with four small ovens and boiler and heating plate, surrounded by a rail, is provided, and a little cupboard, with racks for plates and dishes, and a larder which can be kept cool by ice. Meals are eaten on folding tables which let down from the walls. A water-closet, washing basin, and sink for washing dishes, are also among the equipments of this comfortable car. A large imperial is placed in the centre of the roof, provided

with four very comfortable seats so arranged that a man can keep a good look out without standing up. Three brake-wheels in all are provided, one in the imperial and one on each platform. Coal and spare couplings, &c., are carried in boxes under the car, and suitable zinc-lined cupboards are provided for the oil and lamps.

THE VIENNA ELECTRICAL EXHIBITION.

No. III.

The most important exhibit of accumulators is that of Messrs. Sellon and Volckmar, or as the company is entitled, the Electrical Power Storage Company, Limited. In the North-west Court, between the Rotunda and the Art Gallery, they have a wooden house fitted up with shelves, on which accumulators are ranged sufficient to feed 200 ordinary incandescent lamps. Fifty of these lamps are in the Emperor's pavilion, and 150 in one of the "interiors." An arc lamp in the theatre is also fed from this battery. It consists of 115 boxes of 2-horse power hour capacity; 190 of 1-horse power hour, and forty of ½-horse power hour. For the charging of these there are provided three dynamo machines by Ganz and Co., two being coupled in series, and the third exciting the field magnets of the other two. Each of these machines generates an electro-motive force of 60 volts. There are two ordinary sizes of these accumulators, one rated at 1-horse power hour, or 350 ampère hours, the other 2-horse power hour, or 700 ampère hours. Thus the smaller may be used to give a current of 350 ampères, in which case it will be exhausted in one hour, or if drawn upon for a current of 35 ampères, it will last ten hours. They may be used down to a current of 15 or 16 ampères without appreciable loss of efficiency, that is, down to this current the number of hours throughout which the accumulator will furnish a steady undiminishing current of this amount will be $\frac{350}{\text{current}}$. The 350 ampère hour boxes contain seven pairs of plates measuring 10in. by 9in., and ⅛in. thick; and the 700 ampère hour boxes contain twelve pairs of the same plates, and for larger sizes six pairs of plates are used per horse-power hour. These plates are cast of pure lead. They are in the form of a grating, the square perforations having ⅜in. side, and the thickness of the lead between them being about ⅛in. All these perforations are plastered up with oxide of lead—minium—the plates are then placed in the boxes, and dilute sulphuric acid filled in, and the battery is then ready to be "formed." In the Sellon-Volckmar batteries, the "forming" consists simply in the first charging; this taking a longer time than the subsequent chargings. In forming and charging it is found most economical to couple all the boxes in series, if sufficient dynamo power for the whole number of boxes desired to be charged is procurable; but if this is not to be had, they may be arranged in parallel groups, only so many being arranged in series as will require the potential obtainable from the charging dynamos. In each box or cell all the plates are coupled in multiple arc. At the upper edges of each plate are two horns of unequal length, by means of which the plate hangs on the opposite edges of the glass box. The long horn of every alternate plate is placed say to the left hand, and all these alternate plates are coupled by a copper bar, through which the current flows in in charging, and out when the batteries are working. The long horns of the other half of the plates, which again occur alternately with those first mentioned, between which they hang, are connected by a similar copper bar on the right hand of the cell. From this bar the current flows to the next cell in the series. Each cell requires at least rather more than 2·2 volts to charge it in order to overcome the contrary electro-motive force, which is 2·2, and also the resistance, which is small. Thus if 100 such cells were to be charged in series, the dynamos would need to supply a current of more than 220 volts electro-motive force. In this case the "forming" would occupy about fifty hours, and subsequent chargings from twelve to thirteen hours. If the dynamos were able to give only say 110 volts, then the 100 cells could be arranged in fifty groups, in each of which two cells would be coupled in parallel, the fifty pairs being arranged in series. The forming and charging would now take a correspondingly longer time, because the current is divided between two cells. By the pairing in parallel, the resistance of the whole compound battery is halved, and the electro-motive force being also halved, the whole current remains theoretically the same; and each cell receiving only half of it, the charging will theoretically occupy double the time. Practically, it is found that it is always desirable to couple all the cells in series, otherwise they are found not to be well and equably formed. In charging, a current of from 20 to 25 ampères per horse-power hour of the single cell is used. When the batteries are working, each cell gives at first an electro-motive force of 2·2 volts, but this very quickly falls to 2·15 volts, at which it keeps very steadily until the battery is almost completely exhausted. In working, the battery cannot be coupled in any manner for high or low tension with a number of cells in parallel arc, because if this is done, one becomes exhausted more rapidly than the other, and creates a contrary electro-motive force. During the charging the minium on the positive plates is completely converted into peroxide of lead, and on the negative plates it is reduced to spongy lead, but only a very thin surface layer of the pure lead plate is oxidised. The plates so plastered with minium are *said* to last for four or five years without need of re-making. Smaller cells rated at ½-horse power hour have nine pairs of plates 7½in. by 6in. In the larger boxes the plates are kept apart about ¼in. by small blocks of india-rubber stuck through several of the grating holes. In the smaller boxes two india-rubber bands are stretched over every alternate plate, and serve the same purpose as the blocks. The resistance of the ½-horse power hour box is found to be $\frac{1}{600}$ ohm only, and that of the box used in the launch to be presently mentioned is $\frac{1}{1200}$ ohm. The resistances of the larger boxes have not yet been accurately measured. The above figures apply to all different sizes of cells. The company also exhibits a tricycle in the Rotunda to be driven by two or four similar cells; two are sufficient for an ordinary ride of two hours, and the four will carry one a correspondingly longer time or up correspondingly steeper gradients. A small electro-motor designed by this company and termed by them a "storage motor" runs on a shaft immediately beneath the wheel axle. An intermediate shaft lies in front near the footboard. The three shafts are coupled by chain gearing, the gearing ratio being $\frac{17\frac{1}{2}\text{in.}}{6\frac{1}{4}\text{in.}}$, these sizes being the diameters of the chain wheels. The two driving wheels are 44in. diameter and 42in. apart. One box to hold two accumulator cells lies behind the dynamo, and another to hold two others immediately in front of the same. There are four brushes on the commutator, but only one pair—of opposite—brushes is in contact at one time. By means of a reversing lever one or other pair may be brought in contact, and the machine is thus driven forwards or backwards. At the right hand of the rider is fixed the rod governing, by a worm gear, the steering wheel in front, and at his left hand stands a switch, by which he may either cut off the current altogether, or else cut out one or more cells according to the gradient of the road and the speed desired. The cells for this tricycle are each divided into seven compartments, each compartment containing three pairs of plates 7½in. by 6in. Each box has a capacity of ½-horse power hour. In use they furnish a current of from 30 to 40 ampères, with an electro-motive force of 15 volts.

Messrs. Volckmar, Messrs. Siemens Bros., and Messrs. Yarrow and Co. have combined to produce an interesting exhibit in connection with the Exhibition. This is a launch built by Messrs. Yarrow and Co., 40ft. long and 6ft. beam, with from 2ft. to 3ft. draught, and already described in The Engineer. This is to be run on the Danube Canal through the city. It is driven by a two-bladed propeller 18in. diameter, with blades 6in. wide. The shaft is rotated by a D2 Siemens Brothers' continuous current dynamo, and the current to this is supplied by 80 Sellon-Volckmar accumulator cells of 1-horse power hour each. Thus the whole battery has a capacity of 80 × 350 = 28,000 ampère hours. This battery is charged by a Brush shunt dynamo fixed on shore. At first sixty cells are used, then seventy, and then eighty, as the battery approaches exhaustion. The switch for cutting out portions of the battery is close to the steering wheel. The cells of the battery each contain eighteen pairs of plates 7½in. by 6in. The battery gives about 170 volts electro-motive force, and the dynamo is supplied at the rate of about 10 electrical horse-power. Probably it transmits 6 or 7 mechanical horse-power to the propeller shaft. The boat has been run at 11 knots per hour, but 8 knots is the ordinarily attained speed. This speed is fairly kept up for five or six hours. The dynamo is provided with two pairs of brushes, and can be reversed in the same manner as the tricycle machine. The electrical energy efficiency of these batteries is stated by Mr. Volckmar to be about 90 per cent.; that is, they can give out 90 per cent. of the energy delivered to them by the charging dynamos, without the electro-motive force falling off more than 10 per cent. It should be understood, however, that in order to keep the battery in good working order, they should never be exhausted below about 20 per cent. of their capacity. The weights of the different batteries may be calculated at the rate of 50 lb. of lead per horse-power hour.

There is another exhibit of accumulators, designed for industrial purposes by L. Kornblüch, of Vienna. These are confessedly Faure accumulators, and are exactly similar to those described above, differing only from them in dimensions. There is only one size exhibited by this firm. In it the cast lead plate is also in the form of a grating. It measures 9½in. by 7½in. in surface, and rather more than ¼in. thick, the spacing of the square holes being ¼in. Minium is plastered on to the full thickness of ¼in., and the plates are kept separate from each other by small glass tubes, such as beads are made from, which are kept in place by light india-rubber bands. Five pairs of such plates are inserted in a rectangular box, and the box thus made up and filled with sulphuric acid weighs 30 kilogs., or 66 lb. The capacity of this cell is said to be 400 ampère hours. The efficiency appears to be very low, as it is said to require 1500 ampère hours to charge it. It is formed in the way mentioned above, that is, by a continuous current in one direction in sixty hours, and after forming it requires ten to fifteen hours to charge it. The electro-motive force furnished is stated to be 2·25 volts, but this is probably slightly in excess of the accurate figure. The resistance of the cell has not yet been accurately measured. It can be economically exhausted by a current as low as 7 ampères. The chief difference between this storage cell and the Faure-Sellon-Volckmar, as described above, is simply in the greater—double—thickness of the minium plates. This is believed by Herr Kornblüh to increase the efficiency of the cell; but so far as experiment has yet shown, his expectation does not seem to have been realised. Herr Kornblüh feared at first that the thick layer of minium, when it became dry, might crumble to some extent off portions of the surface, and therefore he lays the minium on under a heavy pressure. This has, at any rate, accomplished the object of preventing cracking and crumbling of the surfaces. The exhibit consists of sixty or seventy of these boxes, used for the most part for incandescent lamps. Since the confessed electrical efficiency of this battery is very low as compared with that claimed by other makers of similar secondary cells, it is but fair to say that Herr Kornblüh maintains very positively that the measurements made of these other cells are entirely fallacious.

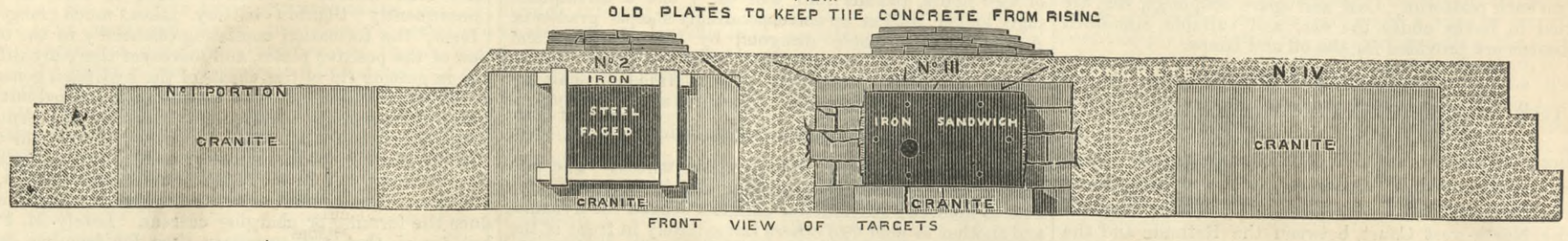
M. Gaston Planté makes a third exhibition of secondary batteries, but as these have long been well known, and as they are made only for laboratory purposes, we need say little about them. Two plates of sheet lead are wrapped up together into a double cylindrical spiral, the two sheets being kept separate by two or more narrow strips of india-rubber, which cover only a very small portion of the surfaces. This roll of sheet lead is placed in a cylindrical vessel of glass or other material, which is then filled to the proper depth with dilute sulphuric acid. The difference between this and the Faure battery is, therefore, that pure lead instead of minium—oxide of lead—is used. Consequently Planté's battery takes much longer to "form," the formation consisting essentially in the oxidation of the positive plates, and moreover there are difficulties in getting rid of the effects of the hydrogen generated at the negative plates. The formation is carried out by a series of reversals of the charging current. It is sent first in one direction for a quarter of an hour; then in the opposite direction for half an hour; and then in alternating directions for 1, 2, 4, 10, 24, 48 hours, 8 and 15 days, and 1 month. The current of two Bunsen cells suffices to produce the forming or charging current. Lately M. Planté has found that the necessary time for forming can be diminished by one-half by first filling the jar with dilute nitric acid, and sending a current through for twenty-four hours. The nitric acid is then poured out, the plates washed with water, and the dilute sulphuric acid added. The electro-motive force given per cell is 2·4 volts at first, which rapidly decreases to 2·2 volts, at which it remains steadily until it begins to sink rapidly, indicating the approach of complete exhaustion. It is a general rule for all such secondary batteries that they should not be exhausted so far as to bring them to this stage of rapid sinking of the electro-motive force. The capacity of the Planté cell per kilog. of lead used is 57,000 coulombs, which is equivalent to about 16 ampère hours. The thickness of the lead sheet used is about 1 mm. A cell containing 3 kilogs. of lead is 4in. diameter by 10in. high. The electrical efficiency is 92 per cent., and the ratio of the mechanical work obtainable by the discharge of the cell to the electrical energy put into it is about 45 per cent. We find also in the French section a secondary battery which has at least a solid, substantial form to recommend it. This is by J. J. Barrier, of Paris; but, unfortunately, neither M. Barrier nor any representative is at Vienna to give information regarding his exhibit. The cell is composed of four cylinders of lead, one inside the other, which form two pairs of opposed plates. The thickness of the cylinders is from ¼in. to ⅜in. Their outside diameters are 5in., 3¼in., 2½in., and 1in., and they are each about 12in. long. These are deeply grooved on their surfaces, either in rolling or in the turning lathe, the grooves leaving high, square teeth, pitched ⅛in. apart. These cylinders of lead are separated by glass tubes, and the whole is set in a glass jar where the dilute acid is added. As no minium is used, these are simple Planté cells of a peculiar mechanical construction. There is a wooden lid to the jar on which are fixed two binding screws, with which the two pairs of cylinders are put in electrical connection.

In some respects the most interesting secondary battery exhibited at Vienna is that of N. de Kabath, which is shown in connection with the United States Electric Lighting Company. Its action is the same as that of Planté's cells, it being composed of a number of thin lead plates plunged in dilute sulphuric acid. No minium is used, and the principle on which the cell is designed is that, since the oxidation penetrates slowly into the interior of the lead plate, the thinner these plates are the better. If this principle is a correct one, the manner in which it is carried out in this design shows a high degree of ingenuity and mechanical skill. The plates are contained in shallow earthenware trays or boxes. These contain each eleven pairs of "compound" plates, each measuring 15in. by 3½in. depth by ½in. thickness. The plate is composed of a hollow rectangular box or envelope made of $\frac{1}{10}$in. thick sheet lead. The vertical sides of each envelope are perforated with round holes $\frac{7}{10}$in. in diameter and placed close beside each other. These permit the acid to enter the interior of the envelope. This interior is filled by narrow strips of very thin sheet lead lying horizontally, their width being the same as that of the inside of the envelope, namely, ⅜in. These thin plates are alternately flat and "rippled" or corrugated, the corrugations being produced in a rolling mill. The acid has thus free access to all the surfaces. There are about 150 of these thin plates in the depth of 3½in. From one of the upper corners of the envelope bars of lead of ⅜in. by ⅛in. square sections lead upward, and thus all the thin plates enclosed in one envelope form one compound plate, which may be either positive or negative. The plates are separated from each other by glass tubes kept in place by rubber bands. Each box containing eleven pairs of such plates is said to give 180 ampère hours without appreciable fall of electro-motive force. Such a box when charged weighs about 115 lb., of which about 80 lb. are lead. The electro-motive force is at first 2·5 volts, but rapidly falls to 2·2 volts, at which it remains constant, Such a battery is usually formed in sixty hours by a 60 ampère current, and for re-charging requires only four hours of a 60 ampère current. If it is discharged immediately after charging, 88 to 90 per cent. of the electric energy put in is obtained; but if the discharging is delayed several days or weeks, as much as 18 to 20 per cent. is lost. The loss depends much on the insulation of the box, but there is also internal loss, which goes on at a slow rate, that has not yet been measured. This internal loss is believed to be due to the formation of sulphate of lead. In the Kabath battery special attention has been paid to the good insulation of the plates from each other and of the box containing them. Also it is peculiar in the use of a much stronger acid solution being used than is ordinary in such batteries, 25 per cent. of acid being used in charging and 30 per cent. in forming. The resistance of each box is approximately ·005 ohms. It is found that the forming effect can be continuously increased by continuing the current for much longer than the above-stated period. In fact, the increase continues for months; but the rate of increase becomes so slow that sixty hours has been decided as the most economical period to keep up the current. The battery exhibited consists of 100 of the above size of cell.

Naval Engineer Appointments.—The following have been made at the Admiralty:—George Whitting, chief engineer, to the Inflexible, vice Jones; and James Jack, chief engineer, to the Asia, additional, for service in the Devastation, vice Whitting.

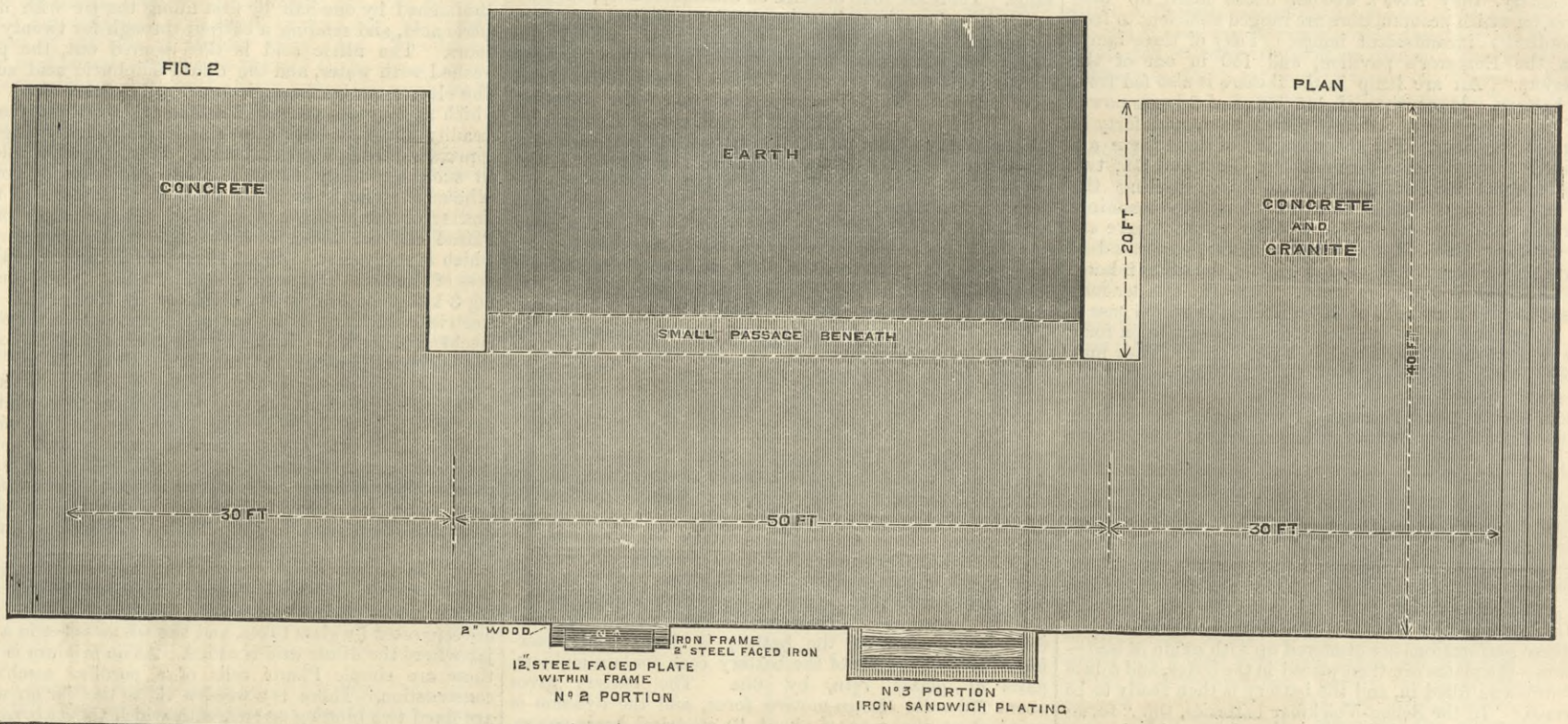
ARMOUR PLATE FORT AT SHOEBURYNESS.

FIG. 1.
OLD PLATES TO KEEP THE CONCRETE FROM RISING



FRONT VIEW OF TARGETS

FIG. 2



PLAN

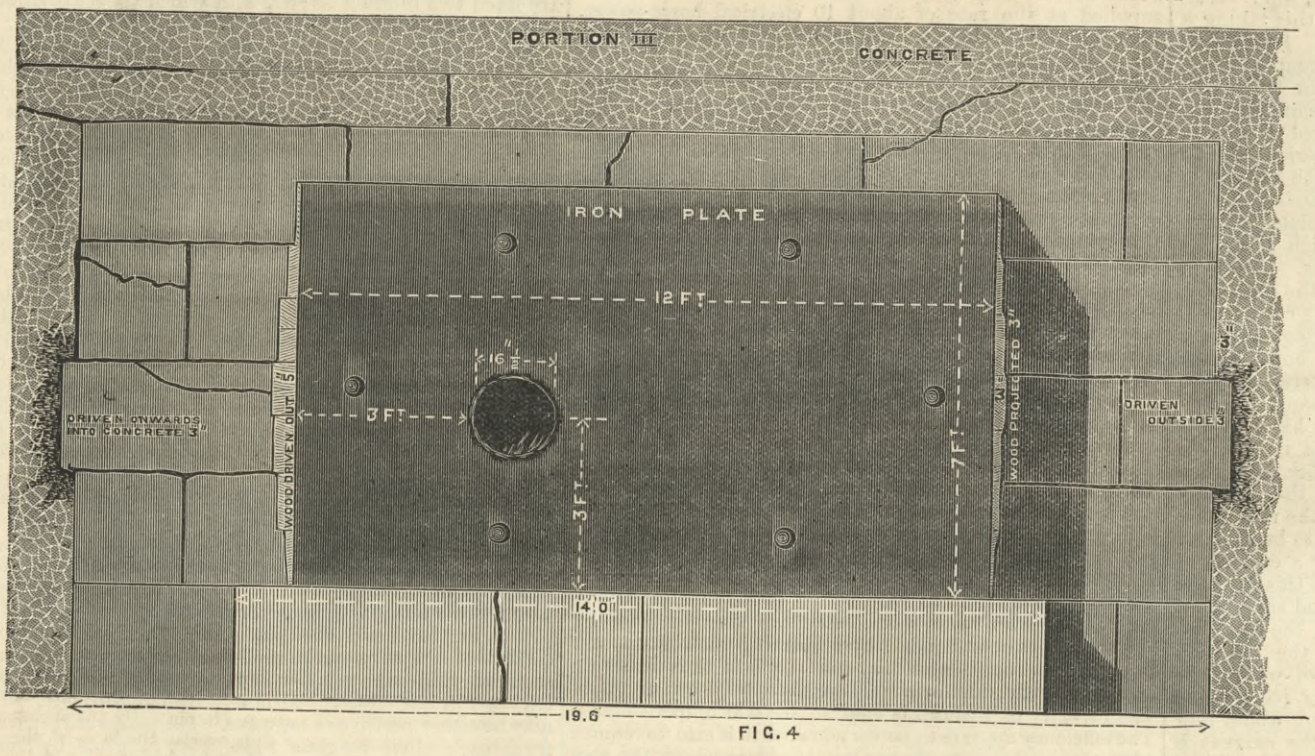
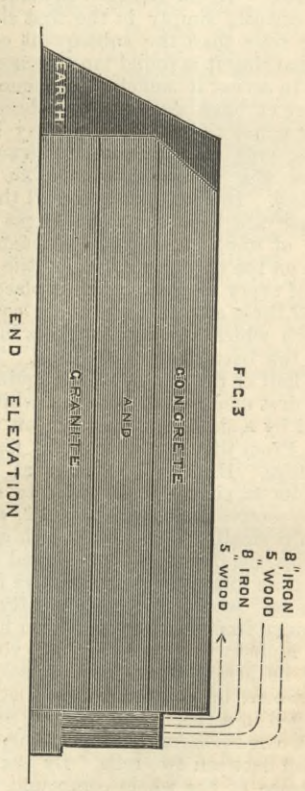


FIG. 4



END ELEVATION

FIG. 3

EXPERIMENTS ON PLATED FORTS AT SHOEBURYNESS.

On Tuesday, August 22nd last, an experiment of great interest, especially to England, took place at Shoeburyness. It was carried out by the Royal Engineers with a view to testing the amount of protection afforded to granite forts by iron plates. The nature of the work tested is shown in the accompanying sketches. Fig. 1 shows the front, which is divided in four portions, the thickness of each being shown roughly in Figs. 2 and 3; that is, the plan and end elevation of the work. Reading from left to right, No. I. consists of 40ft. thickness of granite and concrete; Nos. II. and III. of 20ft. of granite and concrete, backed by about 20ft. of earth, but strengthened in front by iron shields, seen in Figs. 1, 2, and 3, hereafter to be described; and No. IV. consists of 40ft. of granite and concrete. A small passage, of sufficient size to enable a man to creep through it, is pierced through the work parallel to the face and 20ft. from it, opposite portions II. and III., which would enable the effect of the fire to be better seen—so it was supposed, and so it proved. The shields fixed on the face of portions II. and III. are as follows: that on No. III., against which the first shot was to be fired, consists of two plates of 8in. thickness each, of wrought iron, sandwiched with 5in. of wood behind each, made up of two thicknesses, that is, 2½in. planks laid horizontally, next behind each plate, and 2½in. planks behind them placed vertically. The dimensions of each plate were as follows: length 12ft., height 7ft., and thickness 8in. They were supplied by Messrs. Cammell. They are held in their place by six bolts, on the Palliser English system.

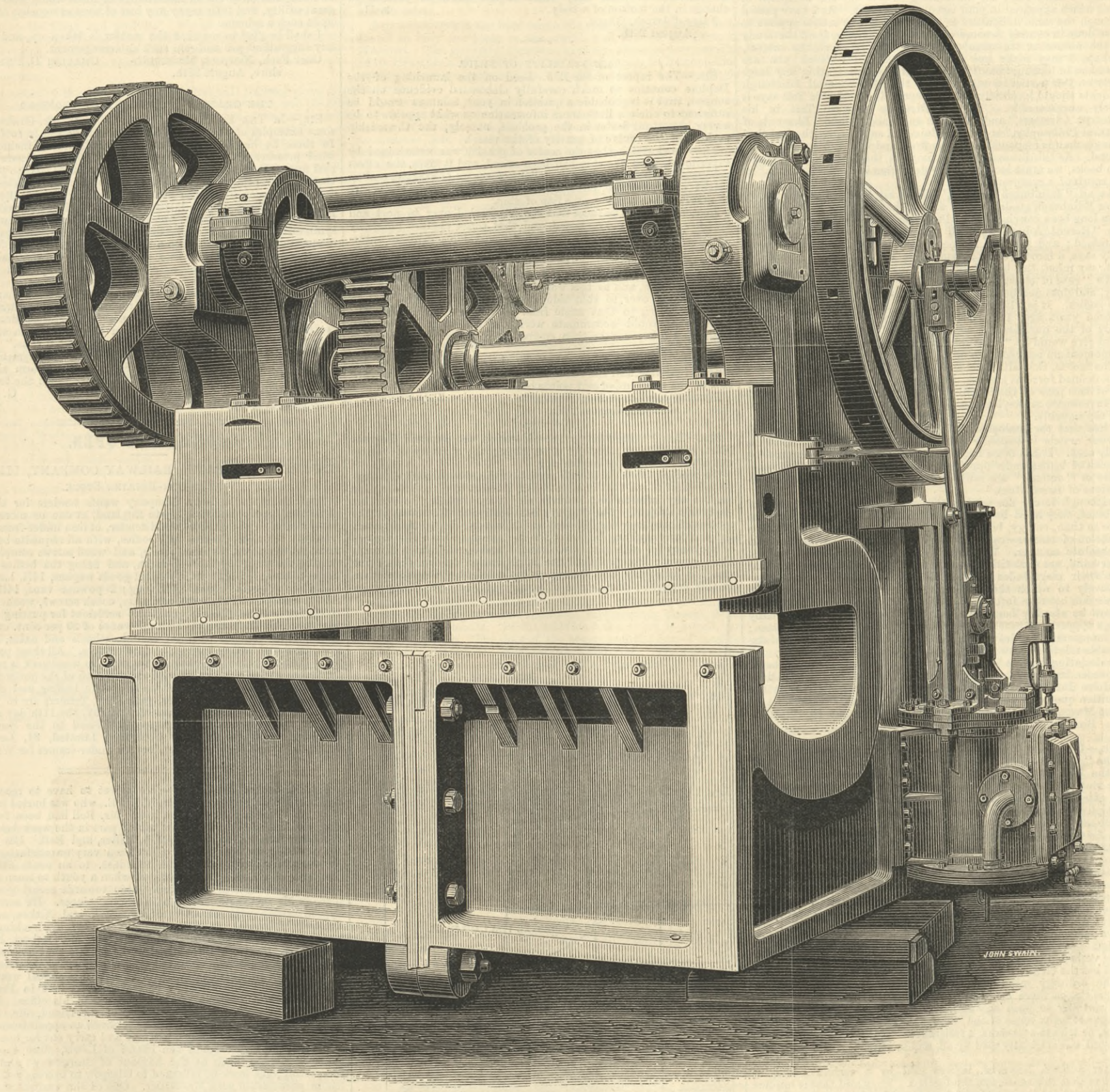
The shield on portion II. consists of 12in. of Wilson's compound or other steel-faced iron, in a plate 7ft. by 7ft., fixed inside an iron frame, as shown in Figs. 1 and 2. In the top of the work was laid a quantity of old broken plating, to keep the masonry and concrete from rising under the force of the blow—*vide* Fig. 1, at portions II. and III. We can hardly think that structures of granite and concrete would attain their full strength for many months, perhaps years to come, and must allow for this in this trial, which it will be seen is a very severe one.

The gun employed is the 80-ton gun, M.L., which is mounted at 200 yards distance. One round was fired from it on Tuesday at portion III.—iron sandwich on granite. A brief report of this appeared in the *Standard*, by which it was stated that a projectile weighing 1700 lb. was fired with a charge of 450 lb. of pebble powder, with a velocity of 1588ft. This implies a total amount of stored-up work of about 29,730 foot-tons, or 594·4 foot-tons per inch circumference, representing a power of perforating about 25in. of iron. The shot was a service Palliser, chilled iron projectile, of about 3ft. 8½in. long, fired without bursting charge, the radius of the head being about 1½in. diameter. The shot struck a point 3ft. from the bottom of the plate, and 3ft. 8in. from the left end looking at it. The effects were as follows: The shot cut a clean hole, passing through both plates, and breaking up during penetration, turned rather to the left, the point reaching a depth of nearly 10ft., measuring from the front face of the iron. The plates behaved admirably, the hole being cut almost without any apparent effect in the surrounding portion of the plate. The wood was driven outwards, 5in. of the ends of the horizontal plates being thrust out beyond the plate at the left end, and 3in. on the right. The granite was pulverised all round the projectile for some distance. Cracks were visible in the granite in front, as shown in Fig. 4. They will be observed to radiate from the point of impact, speaking generally. The stones of the course through which the shot passed are, like the layers of wood, forced longitudinally, left and right, projecting 3in. beyond the other at each end of the squares of masonry. One or two cracks also were visible in the brickwork lining of the small cross passage behind the part struck. The bolts do not appear to have suffered, and the general structure shows little effect beyond what is here mentioned.

The experiment must be looked upon as highly satisfactory. A velocity of 1100ft. ought to be sufficient to enable this projectile to perforate 16in. of iron alone. Backed with granite, the resistance would be considerably greater. Suppose we guess that of the iron itself thus backed to equal even to 18in. of iron, the velocity for that would only be about 1200ft., involving about 16,970 foot-tons of energy, leaving the shot to attack the granite behind with 12,760 foot-tons left in it. It is difficult to conceive of iron plates acting better than these on this occasion. The shot having passed rather to the left, has left the right hand portion of the plate as fit to receive another blow as could be expected. It will be interesting to see how the steel-faced plates behave. In armour trials it is dangerous to give opinions beforehand, but we may expect more effect on the harder plate and less penetration in the masonry behind it, than in the case of the wrought iron. Plate and shot are both likely to suffer more under the increased sudden

LARGE PLATE-SHEARING MACHINE.

MESSRS. DE BERGUE AND CO., MANCHESTER.



ness of the shock against the hard steel, though the degree in which so comparatively thin a steel face tells on so big a shot may not be very great. We should expect the wrought iron covered portion under these precise conditions to do better than that with the steel-faced plate even supported as it is, because the latter plate itself is more likely to suffer and leave the target weaker for future blows. If filled shell are fired the case may be different. A shell has a better chance of getting its charge to act behind the plates of the sandwich shield than the thick steel faced one, but we do not know enough results of experiments with live shell to hazard an opinion as to whether either will suffer in this way. With first-rate steel shell we should be inclined to back the steel-faced plate.

The trial is satisfactory in more than one way. England is the only power that has employed wrought iron to any considerable extent in coast forts, chilled cast iron having come in generally abroad. An experiment therefore that shows that wrought iron behaves well is specially satisfactory to us as a nation, and in our judgment this is the case here. The iron has offered a great resistance, and it has suffered only locally. The latter is of course important as affecting the further powers of resistance of the fort. A shield to resist repeated blows of the 80-ton gun shot must of course be exceptionally strong. When it yields it is desirable to yield locally, and to leave still a good front protection.

We question if this plate has lost much in resisting power except in close proximity to the hole made in it. As we have before now pointed out, the plate-upon-plate system admits of being added to indefinitely, and thus it can be made to grow as it were in proportion to the increasing powers of guns. How chilled iron would behave under similar conditions is a question to which we can only form a reply on conjecture. It is supposed generally that it would suffer but little for a long time from the impact of shot that do not outmatch it, but it is thought that when completely outmatched it would be shattered *en masse*, instead of allowing a projectile to pass through it as wrought iron does, leaving a perforated, but in other respects a sound front plate, as illustrated in the experiment before us. Then comes the question again of steel shells carrying bursting charges, and whether such projectiles, if developed successfully, will not have the effect of bringing in the harder classes of armour. Once more we would urge the desirability of firing against chilled iron in this country in order that we may know something about it for ourselves. If our ships ever engage a foreign iron fort, it can hardly fail to be one of chilled iron. We need experiments to learn even the relative effects of shot from small bore new type guns, and of those from old-fashioned ones with less penetrative power but more stored-up work in their shot. At present all this is matter of conjecture. About the value of the experiments now being conducted at Shoeburyness, there cannot, at all events, be two opinions.

LARGE PLATE-SHEARING MACHINE.

The accompanying illustration is from a photograph of a plate-shearing machine of exceptional size and power recently constructed by Messrs. De Bergue and Co., Strangeways Ironworks, Manchester, for a foreign Government dockyard. The machine, though simple in its construction, presents several features of interest. In machines of this class the ordinary arrangement is to cast the main standards separately and to bolt between them the bottom cutter block, the whole being then either mounted upon a separate cast iron base plate, or the bolted frame bedded upon massive masonry foundations, but in the machine of which we give an illustration all foundations may be dispensed with, as each half of the bottom cutter block and base behind is cast with its corresponding side standard in one piece. The two halves of the machine are united by turned bolts at the front, as shown, as well as behind the block where the flanges are widened out, so as to fill in the angle formed by the junction of the vertical block with the base plate. The back flanges thus serve as struts, imparting to the bottom cutter block additional rigidity, which is of so much importance in machines of extra width. In this case the cutters are 10ft. 7in. long and the clear distance between the standards is 7ft. 6in. By the arrangement shown, of making the cutter slide overlap the faces of the main standards, large wearing surfaces, and a firm bearing of the slide against the standards are secured, and at the same time the machine is enabled to effect the cross-cutting of a plate the maximum width between the standards with a minimum of distance between the standards themselves. In other words, the full length and stroke of the cutters are available whilst the main standards are placed the minimum distance apart. The gap or distance from the face of the cutters to the main frame is in this machine 36in. The main excentric shaft is of steel, and has a throw of 8in., the wheel on this shaft having a 4in. pitch.

By a simple wedge adjustment the bearings of this shaft can be readily tightened at any time, so that wear is provided against, and the certainty of the top cutter always descending true and square upon its work is practically secured. A simple stop motion is also provided, so that the shearing action can be instantly arrested when required without stopping the machine; the handle for working this motion is shown on the illustration. The steam cylinder is 18in. diameter, with 20in. stroke, and is constructed of extra capacity to enable the machine to shear 1¼in. plates, the longest and heaviest cut within the compass of the machine at one stroke. The total weight of the machine is thirty-three tons, and no little difficulty was experienced by the makers in delivering it at the destination, as none of the French railways could undertake the transport of the large castings. The machine had, in consequence, to be sent by sea, and this could only be effected by trans-shipment at an intermediate port.

The Calcutta Exhibition.—Great progress is being made with the preparations for the opening of the Calcutta Exhibition. Up to the 24th June last considerably over 100,000 square feet of space had been taken, and arrangements are being made for electric lighting.

LETTERS TO THE EDITOR.

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

THE DEFINITION OF FORCE.

Sir,—I have read the interesting article on the definition of force which appeared in your issue of 17th inst. As I have passed through the same difficulties as the writer of the article appears to have done in coming to some consistent conclusion from the study of the numerous statements of great authorities on the subject, perhaps I may make one or two remarks. I think you are mistaken in looking upon Professor Tait as representing any large party on this particular subject, and the idea that all Edinburgh students should implicitly believe everything Professor Tait says is surely unreasonable. The inconsistency between Tait in his "Recent Advances," and Thomson and Tait in their "Elements of Natural Philosophy," is to be explained, I suppose, by the fact that a single man is responsible for the first, and that two are so for the second. As this inconsistency remains in the latest edition of the two books, we must look upon the definition in the "Elements" as the result of a compromise.

As an "Edinburgh student," I may say that I, like nearly all other Edinburgh students with whom I have spoken on the subject, have long been convinced that Professor Tait's definition of force in the "Recent Advances" will not hold water when critically examined; and for this reason, namely, that, as Rankine most truly says, a force is an "action between two bodies." Rankine's is, to my mind, the best definition I have seen in any text-book. Tait's "rate of change of momentum," is a function of one body only, and does not necessarily imply any mutual action between two bodies. It is, therefore, faulty as a definition of force. Half-a-dozen years ago, I explained in *Nature* the result of my own study of the question. I concluded that the best definition one could give would be "the time-rate of transmission or transference of momentum between two or more bodies."

The fact is, that although many great authors in physical science have defined force as a cause, they have never made any practical use of this part of their definition, because physical science does not investigate causes, but merely the relations between antecedents and consequents.

I fear that the analogical *reductio ad absurdum* given at the end of your article is logically entirely fallacious, and the fallacy is easily seen. It has often been shown how to reconcile the motion balance of bodies under opposing forces with the idea that these forces or "actions" are still continuously in activity as "transmissions of momentum."

Although forces are continually coming into and going out of existence, they must be regarded as as objectively real as, or even more so than, energy, because they are invariably connected with a condition of matter—called "strain"—which can be measured in an absolute manner. Velocity, momentum, and energy, on the other hand, are quantities measured only by relative motions, so that their magnitudes entirely depend on the axes or bodies relatively to which the motions are measured. This invariable connection between force and stress and strain is a fact which should always be steadily borne in mind. If it is so, it will make many things appear very much simpler than they do if this is forgotten; and moreover, this idea will be found perpetually suggestive of the probable relations between different physical phenomena.

In declaring "force" to have no objective reality, and to be of only secondary importance as a mathematical aid in investigation, I believe Professor Tait was as wrong as he was in giving it the definition quoted in your article from his "Recent Advances."

The Mason Science College, Birmingham, August 21st. Robert H. Smith.

Sir,—I have read with much care and some pleasure the article on the "Definition of Force," which appeared in The Engineer for the 17th of August. I can say this, although I differ from your views in certain respects; but I am pleased to see that you call attention to the fact that there are in physical science a multiplicity of creeds which distract the student.

I do not propose at present to take up much of your space, but I wish for permission to point out certain things which you have apparently overlooked.

You give the various meanings applied to the word force by Tait, Spencer, Rankine, Newton, &c. Now to me it seems quite clear that these men formed different conceptions. Thus, for example, Spencer and Rankine had different things in their minds when they wrote. In Walker's Dictionary we have the word Force thus defined: "Strength, vigour, might; violence, virtue, efficacy, validness, power of law; armament, warlike preparation, destiny, necessity, fatal compulsion.' Webster says all words denoting force, power, strength, are from verbs which express straining, driving, or rushing, and this word has the elements of the Saxon *faran* and Latin *vireo*. Force to the ordinary mind is the complement of resistance; without resistance there could be no force. We cannot push if we have nothing to push against, and this is, no doubt, the first, obvious orthodox sense of the word. A force is that which overcomes, or tries to overcome, a resistance. This is the sense in which the word was originally used by all, and in which it is still popularly used.

After a time, however, it was said by a certain school of thinkers that this sense was too limited. They said that it implied the necessity for the complementary idea of resistance, but they at least admitted at the same time that a force might exist without a resistance, and they started a new definition of the meaning of the word, which is very well given by Weisbach, "Force is the cause of the motion, or of the change in the motion, of material bodies." Here we have no mention of resistance.

Now if we examine the definitions you quote we see that they really convey nothing. They are definitions of the meaning of a word, but they are not explanations. In short, they are translations, so to speak. If I turn to a French-English dictionary for the meaning of the word *maison* I find house, but a man who did not know what a house was would not rest satisfied with this. He would turn to an English dictionary and look up the definition of house, and would find, to quote Walker once more, "House: a place wherein a man lives, any place of human abode, &c." The definitions of Newton, Rankine, &c., are simply translations, and leave us just as wise as we were before. The student wants to know what causes motion and is told that it is force, and if he asks the meaning of force, he is told that it is that which causes motion, and thus we go round and round in a vicious circle.

Tait, Spencer, and others have tried to get out of this circle, and instead of giving a bare definition of force, to explain what it is that changes or causes motion. Herbert Spencer takes one view of the matter which is in a sense quite intelligible, but is not, I think, to the point, being not only extremely metaphysical, but very unpractical, or rather unphysical. Tait's views you have not, I think, stated quite fairly. He may be said to take the popular or Walker's definition of force, and to say very properly, as I think, that there is no such thing in physical science. Every credit is to be given to both Spencer and Tait for their effort, but I do not think they have been successful. Tait in particular only gives a new definition of the word; after all he has not explained it.

The fact that such a great diversity of opinion exists among able men forces one irresistibly to the conclusion that the word is quite out of place in the stated connection, and should not be used at all. Let it retain its popular meaning and its popular use, and let it be abandoned altogether by physicists. As it is, it only does mischief, because Newton and others have attached to it a meaning it was never intended to convey. Nothing will put in a stronger light the real absurdity of regarding Newton's definition as an explanation than to take a different word. Let us suppose that the student comes across the word "Kaglenko" in a text book. He asks what it means, and finds "kaglenko—anything that causes motion or change of motion in a body." Would he be the least atom nearer to understanding what it is changes motion in a body? What the true explanation of the cause of motion or change of motion in a body is has already been stated in your pages by Professor Oliver Lodge. I will state it again because it is my own explanation in other words; but before doing so I should like to elicit from your readers, and especially from students, a definite utterance as to what they think is the cause of motion or change in the motion of a body. Φ. Π.

Place d'Armes, Ghent, August 26th.

THE STABILITY OF SHIPS.

Sir,—The report of Sir E. J. Reed on the launching of the Daphne contains so much carefully elaborated evidence on the subject, that it is probable a question in your columns would be sufficient to elicit a little more information on what appears to be a very important factor in the problem, namely, the thwartship position of the centre of gravity of the vessel.

The report states that the centre of gravity was ascertained by experiment, after the ship had been raised, and it gives the effect produced by the engines on the height of centre of gravity, and on height of metacentre, but does not state whether or no the centre of gravity was in the centre line of ship.

Reasoning from the facts that the ship heeled over to port and that her engines were on board, and that screw engines generally have their condensers and pumps on the port side, one would naturally conclude that the accident was due entirely to the engines. For if the engines were of the usual type, the weight of condenser and pumps might easily shift the centre of gravity an inch or more to the port side, and as this would require that the ship at rest would incline over to that side at a considerable angle, and of course in falling to that angle from the vertical, on leaving the ways, she would accumulate work and roll to a much larger angle, and other causes then co-operating, the whole accident is accounted for.

It therefore seems to me that the thwartship position of the centre of gravity, and the effect of the engines on that position, are two of the most important points connected with the subject.

Printing-court-buildings, Newcastle-on-Tyne, August 28th. J. C. Spence.

Sir,—May I submit to your consideration the annexed diagram illustrative of a method for ascertaining the stability of vessels under the condition of launching?

On reading Sir E. J. Reed's report on the above disaster, it suggested itself to me that it might be of interest to place before your readers any information, however slight, appertaining to such an important subject. The diagram is indicative of the curves of the centres of buoyancy for different and increasing draughts of water, and the corresponding height of the metacentre above the centres of buoyancy for each successive draught, and curves drawn through those points; the probable line of floatation or draught of the vessel on launching, and the approximate height of the metacentre at this draught; the centre of gravity of hull, &c., being then

found or approximated to and set up on the same lines as the intended draught, from which may be seen the relative heights or position of the metacentre and centre of gravity. If the centre of gravity falls below the height of the metacentre, the vessel will be stable and stand upright; but if the centre of gravity comes above the point of the metacentre, the vessel will be unstable and liable to capsize. If this system were adopted, the stability and probable element of righting power the vessel would have upon launching to resist any power or force tending to overturn would at once be seen. The operation would not involve a serious amount of time in calculation, and would at once place all information in the hands of the builder for his guidance.

I trust your readers who may be interested in the subject will fully understand the method involved. J. Andrews.

Charlton, August 27th.

DATES OF AGRICULTURAL MEETINGS.

Sir,—I trust you may consider the subject I venture to touch upon of sufficient importance to insert this letter in your valuable paper, so that it may receive the attention of those interested who are also in a position to discuss and deal with the matter. It has occurred to me it would prove very beneficial to all interested in the above if the dates of these exhibitions could be so arranged as not to clash with one another, as they do at present. Take, for an instance, the 26th of last month, when three shows in almost adjoining counties were fixed for the same date, viz., the Gloucestershire meeting at Berkeley, the Glamorganshire meeting at Pontypridd, and the Shropshire meeting at Whitchurch; and, in addition to these, the Leicestershire, Highland and Agricultural of Scotland, the Cambridgeshire and Isle of Ely, Barnsley, Cleveland, and Tyneside, and other societies held their meetings within a day or so. Now I know that, in the former instance at any rate, it would have been far better if the exhibitions had been fixed for different dates, as both the attendance and entries must have suffered. As a beneficial remedy, I would respectfully hint that a meeting of the secretaries or officials representing the various societies might be arranged to be held in London, or at some central point, early in each year, when the dates of meetings could be fixed, and no doubt an interchange of ideas would also prove of great utility, and fully repay any loss of time or expense attendant upon such a scheme.

I shall be glad to see that the matter is taken up, and to hear any suggestions *pro* and *con.* such an arrangement.

Gaer Fach, Newport, Monmouthshire, August 28th. Charles D. Phillips.

THE GRAPHIC TREATMENT OF STRESSES.

Sir,—In The Engineer of the 17th inst., Mr. Graham gives some examples of the graphic treatment of stresses in roof-frames. In these he has lumped up the accidental loading, including the wind pressure, estimating the whole at 45 lb. per square foot of roof area. It should be hardly necessary in these days to point out that this treatment of wind pressure is practically useless. The danger to a roof from wind pressure is mainly due to the unsymmetrical incidence of the latter. Of course the effect will be less felt in roofs of low pitch, but it is never safe to treat wind as a symmetrically distributed vertical load. Let Mr. Graham try a diagram of Didcot roof, with a nominal wind pressure of 56 lb. on one side only, and the stresses will probably be greatly altered—some of them, possibly, changing from tension to pressure, or *vice versâ*.

In treating the goods shed roof at Weymouth, Mr. Graham, after noticing that the stresses in the tie-bars decrease towards the centre of the span, states: "If, therefore, it were decided to design these tie-rods round in section and uniform in strength, they would assume the form of a long truncated cone." This is misleading. The stress is uniform throughout each segment of the tie-bar, and the section should, therefore, be uniform also. In place of "a long truncated cone," the tie-bar takes the form of a series of cylinders of different diameters. G. S. C.

London, August 27th.

CONTRACTS OPEN.

SOUTHERN MAHRATTA RAILWAY COMPANY, LIMITED.

Tender for Rolling Stock.

The Mahratta Railway Company wants tenders for the construction, supply, and delivery in England, at one or more of the ports named in the condition and tender, of iron under-frames, and ironwork for under-frames, and bodies, with all requisite bolts and nuts, coach screws, washers, rivets, and wood screws complete, for putting the work together in India, and fixing the bodies to the under-frames, for 112 iron low-sided goods wagons, 14ft. long; 200 iron covered goods wagon, 14ft. long; 2 powder vans, 14ft. long. All fastenings, screws, bolts, and nuts, coach screws, washers, and rivets are to be supplied in quantities sufficient for putting all the work together in India, with an allowance of 20 per cent. extra for waste. The contract does not include wheels and axles, bearing and draw and buffing springs, and axle boxes. All these parts will form the subjects of separate contracts. No woodwork is required to be sent to India. The general construction of the under-frames, iron-work for under-frames and bodies, brake, buffing, and drawing gear is shown on the engravings, page 170. Tenders are to be sent not later than 12 o'clock at noon on Tuesday, the 11th day of September next, in sealed envelopes, addressed to the Secretary, Southern Mahratta Railway Company, Limited, 31, Lombard-street, E.C., and endorsed "Tenders for Under-frames for Wagons."

Mr. R. Bruce Bell, C.E.—We regret to have to record the death of Mr. Robert Bruce Bell, M.I.C.E., who was buried in West Croydon Cemetery on the 17th inst. Mr. Bell had been for some time resident at West Croydon, taking part in the work being carried on by his London firm of Bell, Miller, and Bell. His health had for the past two or three years been very unsatisfactory, and he eventually succumbed on the 13th inst. to an acute attack of pleurisy. Mr. Bell went to Glasgow when a youth to learn mechanical engineering as a preliminary step towards securing a high place in his future profession as a civil engineer. He served his apprenticeship with the firm of Murdoch and Aitken, and he finished his course of mechanical engineering by working as a journeyman at Lancefield, under the late Mr. Robert Napier. Under Mr. Lewis D. B. Gordon, who was the first professor of civil engineering in the University of Glasgow, Mr. Bell began to devote all his energies to the theoretical and practical work connected with his profession by becoming a student in Professor Gordon's classes and one of the assistants in his office. It was there that he made the acquaintance of his friend, Mr. Daniel Miller. While with Mr. Gordon he received an appointment from the late Sir James Matheson to design and carry out for him some important improvements in the island of Lewis, more especially the dock and sea walls at the harbour of Stornoway; and after completing that work he returned to Glasgow to become settled for life in partnership with Mr. Miller. One of the earliest works of any importance undertaken by Mr. Bell's firm was the construction of a slip dock for the late Mr. Black, of Kelvinhaugh, and where there was first brought into use his partner's patent hydraulic purchase machinery for hauling up ships. The same machinery was subsequently laid down at docks at Cronstadt, Alexandria, Williamstown—Melbourne—and at a number of other ports at home and abroad. About five-and-twenty years ago the firm took in hand the construction of the first graving dock made at Glasgow, namely, that of Tod and Macgregor, at Meadowside, and some years afterwards they designed and superintended the construction of the slip dock alongside of it, and entered from the river Kelvin. About twenty years ago the firm received a commission from the Greenock Harbour Trust to make the surveys which eventually resulted in the construction of the Albert Harbour and of the Esplanade, which was designed as a public improvement, to be carried out by the use of the spoil obtained on the site of the Albert Harbour. They also took in hand the building of Princes Pier, using greenheart piles, which had to be driven to a depth frequently of 100ft. They subsequently designed plans for a graving dock at Singapore, and at Port-Glasgow they were entrusted with some very important harbour improvements; and after the lapse of some years, their services were again called into requisition at the "Port," where they practically made a new dock on the site of James Watt's Dock—the first graving dock made in Scotland. They also designed and had professional charge of the Saltersgroft Graving Dock, one of the largest works of the kind in the kingdom. For Messrs. A. Lopez and Co., the Spanish steamship owners, they constructed at Cadiz a large graving dock and deep-water basin. In the year 1868 Mr. Bell was occupied with surveys at Buenos Ayres in view of an important dock scheme and a new channel to the harbour; and from time to time his firm had various other dock and harbour schemes in hand. One of the most honourable positions in which Mr. Bell was ever placed was that of commissioner for the examination of the St. Lawrence, with the view of carrying out an improvement in the harbour of Montreal. In that capacity he was associated with an eminent American engineer—General Newton—and with Mr.—now Sir—Sandford Fleming, then engineer-in-chief of the International and of the Canadian Pacific Railways. The Albert Bridge, Glasgow, was built from designs by Mr. Bell's firm about a dozen years ago. Mr. Bell was unmarried, and was sixty years of age. Three of his brothers are alive, one Mr. Imrie Bell, the well-known engineer. The late Mr. Bell was two years president of the Institution of Engineers and Shipbuilders in Scotland.

RAILWAY MATTERS.

Mr. Alfred Langley, chief engineer to the Great Eastern Railway Company, has been appointed engineer to the Midland Railway Company in place of Mr. A. Johnstone, resigned.

According to the *Boston Transcript*, Mr. Edison says he has sold his electric locomotive to a railroad company "who are going to take up the thing and push it." We had always supposed that a locomotive was able to carry itself along; but Edison is original in everything, though for the life of us we can't see where the money is in a locomotive that has to be pushed by an entire railroad company.

The report of the directors for the Cornwall Railway gives the total train mileage as 147,649 miles by passenger trains, and 132,909 by goods and mineral trains. The maintenance of way and works cost £14,842 18s. 4d., which is 20·01 per cent. of the receipts, or at the rate of 1s. 0¾d. per train mile, and £226 12s. 2d. per mile open. The locomotive power cost £9826 12s. 7d., equal to 13·25 per cent. of the receipts, 8¼d. per train mile, and £150 6d. per mile open. The total working expenses were 55·19 per cent. of receipts, 2s. 11d. per train mile, and £624 19s. 5¼d. per mile open.

There have been great festivities at Caracas, in Venuezla, over the opening of the line from the capital to the port of La Guaira. In many respects this bit of railroading in a most extraordinary one. Its total length is only twenty-three miles, and in twenty-one miles of this distance it rises over 3100ft. It is simply a shelf cut on the sides of a series of mountain gorges. At one spot a stone will fall over the edge of the cliff—at 5ft. from the rails—1700 yards without stopping. The work was done in eighteen months, which is a very short time indeed considering the difficulties which the English engineers who made the line had to encounter.

The Patent Shaft and Axle-tree Company is busy with the construction of the gigantic steel bridge over the Ganges at Benares for the Oude and Rohilkund Railway Company. The spans are sixteen in number, many of them 350ft. in length, and upwards of 7000 tons will be employed in the superstructure. The length of the bridge when completed will be nearly a mile, and it will cost nearly one million sterling. In the language of Mr. Thomas E. Walker, deputy chairman of the company, the bridge when erected "will be a permanent monument of the skill and industry of South Staffordshire." The company has also in hand the roof of the new railway station at Brighton.

The contract with the City of Dublin Steam Packet Company for the conveyance of the Irish mails is dated the 20th of August, and will commence from the 1st of October next. It will be in force for twelve years, and thenceforward till terminated by a year's notice from either side. The service will be the same as at present for two years, after which there will be an acceleration of twenty minutes on the outward and ten minutes on the homeward vessel. The amount of the subsidy is £84,000 a year, and this will also cover the conveyance of postal parcels. The Government is to receive one-half of the surplus passenger receipts above £35,000 a year as at present. The contract provides for improved accommodation both for mails and passengers, at the same time as a higher rate of speed.

It is useful to remember that if the number of seconds spent in running a quarter of a mile be divided into 900, the quotient is the speed in miles per hour. The following table can be easily committed to memory :—

			miles an hour.				miles an hour.
One mile in	51	secs. is	70·6	One mile in	61	secs. is	59
,,	52	,,	69·2	,,	62	,,	58
,,	53	,,	68	,,	63	,,	57·3
,,	54	,,	66·6	,,	64	,,	56·25
,,	55	,,	65·4	,,	65	,,	55·4
,,	56	,,	64·2	,,	66	,,	54·5
,,	57	,,	63 1	,,	67	,,	53·7
,,	58	,,	62	,,	68	,,	52 9
,,	59	,,	61	,,	69	,,	52
,,	60	,,	60	,,	70	,,	51 4

Speaking of the new Pike's Peak Railway, the *Railway Review* says Mr. W. F. Ellis, jun., present chief engineer of Colorado Springs, Col., is locating the Pike's Peak Railroad. He is keeping the line down to a maximum grade of 300ft. per mile, and maximum curves of 30 deg. The length is 27 miles. Greatest elevation 14,146ft., or by about 2000ft. the highest railroad elevation in the world. The route is not fully decided upon, and surveyors are still working busily. The road will be narrow gauge. Trains of three cars will be run, each carrying forty persons. The officers are making a point of running the road where the finest views can be obtained—views which will be new to the tourist, not seen from any of the old trails. The first twelve miles of the route will be of surpassing beauty. New camping-grounds will be opened, high up among the mountains, where people can live in tents, enjoying the pure air and the wild grandeur of the Rockies No road, in America or abroad, has ever been laid through such wonderful and beautiful scenery.

According to the *American Journal of Railway Appliances* the engines of the Pennsylvania Railroad and branches made mileages in 1882 as follows :—Passenger, 5,097,229; freight, 15,236,589; distributing, 674,590; total, 21,008,408. On the United Railway of New Jersey :—Passenger, 3,698,249; freight, 3,949,097; distributing, 285,322; total, 7,932,668. On the Philadelphia and Eric :—Passenger, 492,360; freight, 1,912,138; distributing, 90,852; total, 2,495,350. Entire Pennsylvania line, east of Pittsburg and Erie cities :—Passenger, 9,287,838; freight, 21,097,824; distributing, 1,050,764; total, 31,436,426. The greatest average mileage for 1882, with passenger trains on the Pennsylvania Railroad, was engine No. 95, 79,258 miles; on the United Railroads of New Jersey, No. 603, 60,945 miles; and on the Philadelphia and Erie, No. 2051, 52,671 miles. The general average mileage with passenger trains was 32,760 miles on the Pennsylvania Railroad Division, 28,017 on the United Railroad of New Jersey, and 44,506 on the Philadelphia and Erie Railroad. The greatest mileage with freight trains on the Pennsylvania Railroad Division was engine No. 881, 50,169 miles; on the United Railroad of New Jersey, No. 612, with 45,730 miles; and on the Philadelphia and Erie, No. 2002, with 34,160 miles. The general average mileage with freight trains, on the Pennsylvania Railroad Division, was 25,977 miles; on the United Railroad of New Jersey, 21,462; and on the Philadelphia and Erie, 22,889 miles.

During the past few years there has been not only a remarkable growth in the extent of the passenger traffic on railways, but there has been a remarkable variation in the classes in which the passengers travel. The growth has been in the volume of traffic, as a whole, but the passengers have gravitated to the lowest class. The London and North-Western Railway is the chief of the great passenger lines in the kingdom. In the first half of the year 1882 it carried 1,199,068 first-class passengers; in the first half of the present year it carried 1,186,134, so that there was a fall of nearly 13,000 in the year. In the first of these two periods it carried 1,964,212 second-class passengers; but in the last half-year it carried 1,962,244 only. Concurrently, however, the third-class passengers on this line rose from 21,244,402 in the first half-year named to 22,347,872, so that the lowest class made up for the loss in the two upper classes, and gave an increase of about a million passengers in six months. In the first half of last year the Lancashire and Yorkshire Railway Company carried 875,347 first-class passengers—the season-ticket holders being excluded from all these comparisons—but in the corresponding six months this year that number had fallen to 771,568, so that there was the enormous decrease of over 100,000. Of second-class, the numbers were 1,301,838 in the first half of the past year, and nearly 150,000 less in the first half of the present year; while the third-class passenger traffic showed the substantial increase of 312,000 in the same period.

NOTES AND MEMORANDA.

The annual rate of mortality in London during the week ending the 25th August declined to 17·9 per 1000.

In New York City there are 486 miles of water pipe, 391 of sewer pipe, 824 of gas pipe, 14½ of steam pipe, and 15 of underground electric wire.

Adamascobite is the local name of a mineral which is said to be found in only one place in the world, and that is the State of Missouri. The *Scientific American* says the stone is very peculiar in its structure and properties. Its cutting power is diamond-like, cutting away steel very rapidly, and still retaining an exceedingly fine edge.

The American *Granite Cutters' Journal* says :—"From surveys and calculations made by Mr. J. A. Farrington, civil engineer, the famous Washington boulder, near Conway Corner, N.H., is found to measure 30ft. in height, 46ft. in length, 35ft. in width, and to weigh 3867 tons. This is the largest known isolated piece of granite in the world."

The annual rate of mortality for the week ending August 25th, in twenty-eight great towns of England and Wales, averaged 19·1 per 1000 of their aggregate population, which is estimated at 8,620,975 persons in the middle of this year. The six healthiest places were Huddersfield, Bristol, Bradford, Plymouth, Halifax, and Birkenhead. In London 2500 births and 1356 deaths were registered.

The most successful makers of malleable castings in the United States use pig that is very free from phosphorus or sulphur, as either hot shortness or cold shortness will spoil the castings. The metal is melted in crucibles of 50 lb. to 100 lb. capacity, keeping the air out. The metal should be hot enough for a drop, withdrawn on an iron bar to burn on exposure to the air. The cementation is done in iron boxes, the castings being bedded in powdered hematite or in iron peroxide, and kept from three to fifteen days, according to thickness. This is a greater length of time than is found necessary in this country.

The death rate in New York during the week ending August 4th, was 28·1 per 1000, the rate in thirty-one United States cities being 26·3. In the North Atlantic cities the rate was 25·0; in the Eastern cities, 25·1; in the lake cities, 30·1; in the river cities, 22·2; and in the southern cities, for the whites, 24·5, and for the coloured, 39·1 per 1000; 50·3 per cent. of all deaths were of children under five years of age. Accidents caused 3·8 per cent. of all deaths. Consumption caused 11·0 per cent. of all deaths, the proportion being highest in the North Atlantic cities, 13·5 per cent., and lowest among the lake cities 6 per cent. of the deaths.

Letters from Athens announce an interesting discovery, brought to light in the course of some excavations which are being carried out in the island of Delos by the pupils of the French School at Athens. In the neighbourhood of the Theatre of Apollo they came upon the remains of a private house, which apparently belonged to the Alexandrine epoch. A court surrounded by pillars and twelve chambers has been opened out. The floor is composed of mosaic, which is a fine specimen, representing flowers, fishes, and other ornaments. In the middle of the court is a well, now quite choked up. The door of the house, and the line of roadway or street leading to it, have also been discovered. The excavations will be continued, and it is hoped that a large portion of the old town will be brought to light.

The Washington correspondent of the Cleveland *Leader* writes :—"The Washington monument is the wonder of Washington, and its beauty the admiration of both Americans and foreigners. Already over 350ft. high, it rises from the banks of the Potomac a great white marble shaft, piercing the clouds, and backed against the blue of the sky. It is already the grandest obelisk the world has ever seen, and in the æons of the future, should the nations of the day pass away, leaving no more records of their progress than the mighty ones of the Egyptian past, it will surpass the Pyramids in the wonder of its construction. It is already higher than the Third Pyramid, and within 100ft. of the size of the second. It is taller than St. Paul's Cathedral, and when finished it will be the highest structure in the world."

M. Reynaud has found means for utilising for paper making the whole of the dwarf palm, the fibrous properties of which have long been known to the Arabs, while they have been unable to turn the palm to account, except the root which serves for firing. The plants are placed in a kind of cage, which is immersed in a boiler filled with a special lye, and heated. The substance being thus retted, becomes soft, so that the fibre may be readily separated. It is withdrawn from the bath, and drained, the lye being saved for use over again. It is then passed between rollers, while at the same time being made cold by quantities of water. The number of rollings, rinsings, and combings depend upon the degree of fineness required. At last, the product is allowed to fall into a receptacle containing pure water, whence it is withdrawn to be tied up in bundles for transport. As the whole of the tannin which it contains is not extracted, this plant is not liable to decay.

The iron and coal production of France up to the end of 1881, a report upon which has recently appeared, shows some increase. The total yield of iron ore for 1881 was 5,689,000 tons; an increase of 5 per cent. over that of 1880, which was less by 158,000 tons. The production of Algeria was 657,000 tons for 1881, an increase of 43,000 tons. Iron ore is worked in France in thirty-three departments, half of the whole amount—1,796,000 tons—being furnished by the department of Meurthe et Moselle. Next comes Ardèche, with 197,000; Haute Marne, 169,000; Saône et Loire, 162,000; Pyrénées Orientales, 133,000. Besides the increase in production, there has been a similar increase of importation from Algeria, Spain, Germany, Italy, and Belgium, the total amount being 1,287,000 tons; 119,000 more than in the previous year. The consumption of iron ore during 1881 in the various smelting works was 4,231,000 tons, of which 6 per cent. came from Algeria, and 24 per cent. from foreign sources.

The sea-going German merchant navy comprised on January 1st, 1883, 4370 vessels, having a registered tonnage of 1,226,650 tons. Of these 3855 were sailing vessels, having registered tonnage 915,446 tons, and 515 were steamers, with 311,204 registered tonnage. As compared with the figures of January 1st, 1882, there was a decrease of 139 vessels, but an increase of 32,243 in the tonnage. The number of sailing vessels had decreased by 196, while the steamers had increased by 53. The total number of sailors in the German mercantile marine amounted on January 1st, 1883, to 39,031, against 39,109 the previous year, being a falling off of 78. Classifying the vessels as to size, there were on January 1st, 1883, 1366, or over 31 per cent. of the whole number of vessels, which were of less than 50 tons; 21 were of more than 2000 tons register, of which three were sailing ships and 18 steamers. The largest German sailing vessel is registered as of 2287 tons, and the largest German steamer as of 2937 tons.

A comparison of the rates charged by the London and other water companies gives the following results for a £50 house with one closet, excluding, in London, any extra charges for either altitude or high service :—Birmingham, £2 18s.; Bradford, £3 14s. (taking the closet at 4s.); Leeds, £2; Liverpool (rateable value), £2 10s.; Manchester (rateable value), £2 10s.: Chelsea, £2 4s.; East London, £2 14s.; Grand Junction, £2 4s.; Kent, £2 10s.; Lambeth, £3 17s.; New River, £2 4s.; Southwark and Vauxhall, £2 14s.; and West Middlesex, £2 4s. As in Manchester and Liverpool rateable value is the basis of charge, the £2 10s. in each case is reducible by the difference between rent and assessment; and it must always be remembered that there are no extra charges for altitude, high service, closets, or baths, and baths are found in nearly all houses that have been built since the present charges for water were adopted. A second closet, or a bath or a high service would raise the London charges, but would not raise the charge on the rateable value in Manchester or Liverpool.

MISCELLANEA.

It has been decided that none of the awards for the Fisheries Exhibition shall be announced till the date of the closing ceremony—the 31st of October.

The number of visitors to the Fisheries Exhibition on Saturday was 23,163; making a total for last week of 106,892, and the total number from the opening of the Exhibition 1,444,515.

The Wednesbury Local Board has had the sewerage question under consideration again, and has adopted the proposition brought forward by Mr. Trow at the last meeting, that the sewage should be purified by precipitation, overflowing tanks, and, if required, by filtration. Mr. Pritchard, C.E., was selected to advise the surveyor as to the best means of carrying out the work.

A course of about thirty lectures on the "Manufacture of Iron and Steel" will be delivered by Mr. George Chaloner, F.C.S., on Saturday evenings, at seven o'clock, commencing October 6th, at the Birkbeck Institution. The City and Guilds Institute offers prizes, to be competed for in May, 1884, to the extent of £19 in money, two silver medals, and five bronze medals.

A northern contemporary dilates upon a new metal or alloy, but does not describe it, which it is said has the properties of great hardness, strength, homogeneity, and resistance to the corrosive action of salt water. It has been invented by a Mr. Henry Young, and is to be made by the Redheugh Steel and Metal Company. It is supposed to be specially applicable for rolling-mill rolls, dock gate rollers, bearings, and so on.

On Wednesday morning the water main connecting Gravelly Hill and Aston, near Birmingham, burst at a point about 100 yards from the Birmingham and Fazeley Canal. The water spurted into the air a height of over 20ft. The traffic was entirely stopped for nearly two hours. Considerable damage was done to the adjacent houses, and much inconvenience was felt in different parts of Birmingham, owing to the temporary failure of the water supply. This is the second time within twelve months the main has broken within a distance of 100 yards.

A meeting of the subscribers to the parliamentary fund of the Manchester Ship Canal was held on Tuesday at Manchester. It was reported that the committee had received from subscribers £46,778, and that the expenditure amounted to £47,510. The committee were of opinion that another application to Parliament would be successful. A motion was passed expressing regret at the action of the Committee of the House of Lords in stopping the Bill. The provisional committee was empowered to promote the Bill in the ensuing session of Parliament, in such manner as might be found expedient or desirable. It was stated that promises of £5000 had been received towards the cost of the second application to Parliament.

A large and influential meeting, representative of the agricultural interest of Cheshire and North Wales, and of the commercial interests of Chester, was held on Monday, when it was resolved : "That the Royal Agricultural Society of England having decided that the show of 1885 is to be held in the district comprising Cheshire, North Wales, and Lancashire, this meeting pledges itself earnestly to press the claims of Chester as the most fitting place for holding the show, urging the fact that it has not been held in Cheshire since 1858; that while Chester is conveniently situated with regard to Lancashire—in which county the show has been twice held since 1858—it is the natural centre for the large and important agricultural area embraced by North Wales and Cheshire, and special advantages are offered in the way of general accommodation and railway service."

The Gilchrist Engineering Entrance Scholarship at University College, London, will be open to competition at the end of September. The conditions of examination are this year somewhat altered, in a direction which places the scholarship better within the reach of those for whose benefit it was founded. The detailed regulations can be obtained on application to the secretary of University College. The following is a summary of them :—Candidates must be under nineteen years of age, and must send in notice to compete by the 23rd of September. The subjects of examination are—(1) Elementary mathematics, and (2) any two or more of the following five subjects :—Mechanics, mechanical drawing, essay on one of three given subjects in connection with mechanics or engineering, French or German, the use of tools, either carpenters' tools, or the lathe—wood or metal—or the file. The scholarship is of the value of £35 per annum, and is tenable for two years. There is also at University College a Senior Engineering Scholarship, awarded at the close of the session, of £80 value.

In the *Times* of August 22nd last was reported a trial of some Ellis compound armour supplied by Sir J. Brown and Co., Sheffield, for the Russian Government, on board the Nettle at Portsmouth. The plate is intended for the bows of the Dmeitri Donsky, and is about 6ft. square and 4½in. thick. It was tested by the 7in. shot, 113 lb. weight, with a charge of 8 lb. Two rounds made indentations of 4in. deep, and 6¾in. diameter without cracks. The third round remained embedded in the plate, and produced several cracks, but none extending to the edge of the plate. The plate was held up by six bolts instead of the four previously employed. The German Government are reported by *Truth*—and we have reason to believe correctly reported—to have just completed an elaborate and important series of experiments with Wilson compound armour supplied by Messrs. Cammell, at Kummersdorf. The plates were found superior to any hitherto tried, the resistance being 40 per cent. better than that of iron of similar thickness. The plates were 10in. thick, and were attacked by the 11in.—28 c.m.—gun.

One of the largest contracts for ship electric lighting up to the present was on Saturday concluded in Glasgow between the owners of the New Zealand Shipping Company's fleet and the Edison Company's branch in Scotland, under the management of Mr. Charles T. Grant. Three fine steamers, two of which are sister ships to the s.s. Tongariro, launched on Thursday at Messrs. John Elder and Co.'s yard, are to be lighted throughout with the incandescent light, and fitted with a duplicate set of Edison's marine dynamos and engines, one set being for reserve in case of emergency. The Tongariro and the two sister ships now in course of construction are built of steel, and have cutwater stems, with figure-heads. They are to be barque-rigged, having masts and yards of steel, with a large spread of canvas. Each vessel is divided into eight water-tight compartments. Five divisions are carried up between main and upper decks, and fitted with water-tight fireproof doors. By this arrangement the danger of fire spreading, should it break out in any part of the ship, is obviated, and greater safety ensured by being able to isolate any one compartment in case of damage to the hull and the compartment being flooded.

The official report of Colonel Frank Bolton upon the water supplied by the several metropolitan water companies during July last, appears in a different and much better form than these reports have hitherto. It has been materially extended, and occupies nineteen pages of the ordinary Parliamentary paper size. From it it appears that just one-half of the water supplied is from the Thames; 38 per cent. is from the Lea and springs in the Lea valley; from the eight wells in the North of London, 6 per cent.; and from the ten chalk wells in the South of London, 6 per cent. Some new information is given with reference to storage and filtration, and it is remarked that, no matter how well the work of purification is performed by the water companies, "the purest water in England would be poisoned by such a system of storage" as is common in the house cisterns employed in London houses to meet the exigencies of the intermittent supply. Colonel Bolton says the water supply was good, and Dr. Frankland is again forced to admit that the Thames water was "unusually free from organic matter." The analytical table, by Professor Wanklyn and J. W. Cooper, shows that the albumencid ammonia—which is the real test for dangerous impurity—is as high in the boasted Kent well water as in the Chelsea and other Thames waters.

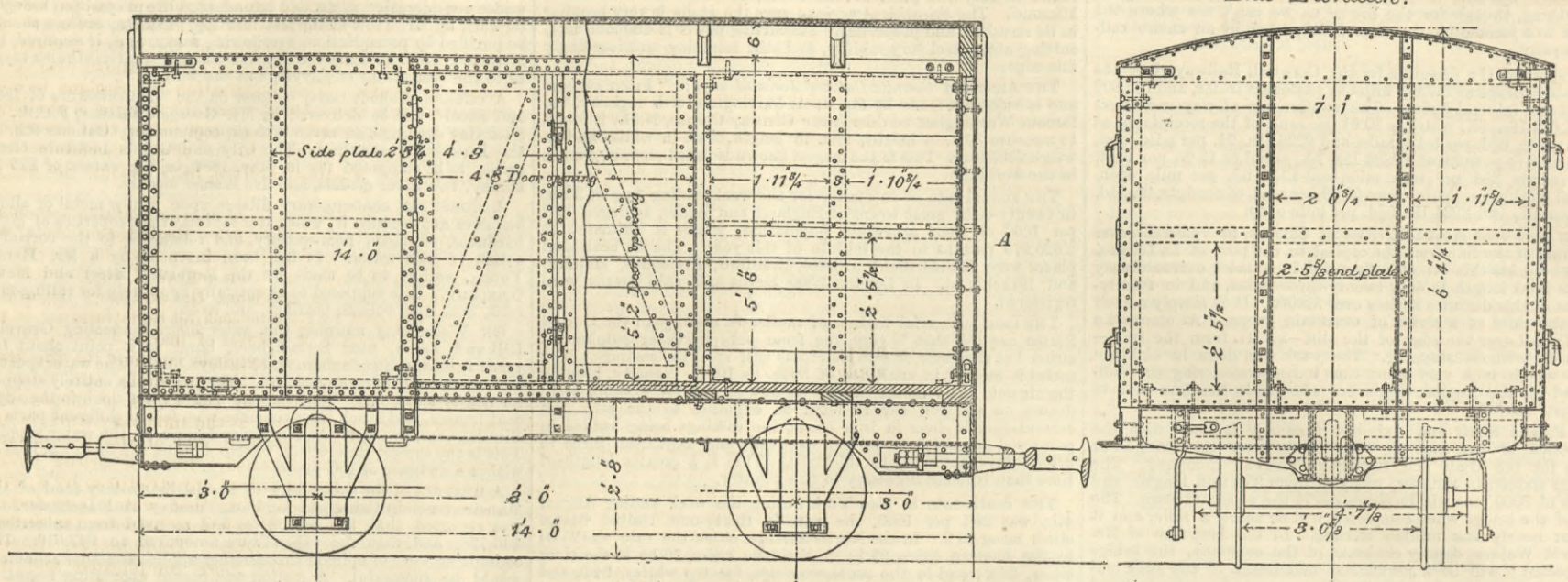
CONTRACTS OPEN.—ROLLING STOCK FOR SOUTHERN MAHRATTA RAILWAY.

(For description see page 168.)

Side elevation

Section on D.D.

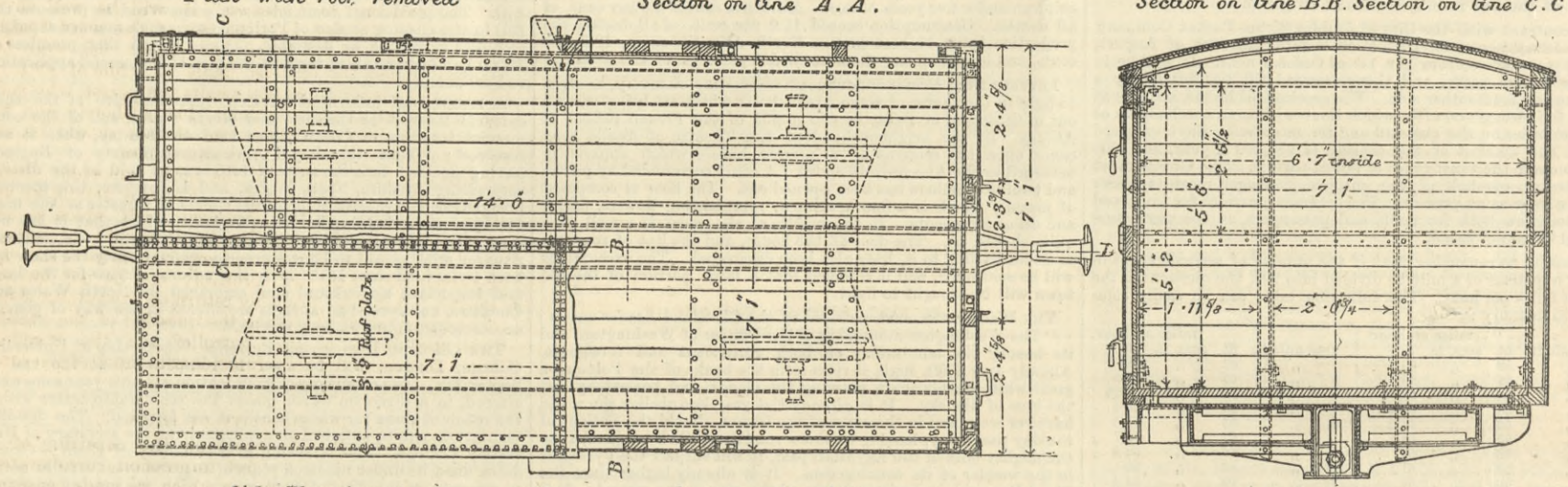
End Elevation.



Plan with roof removed

Section on line A.A.

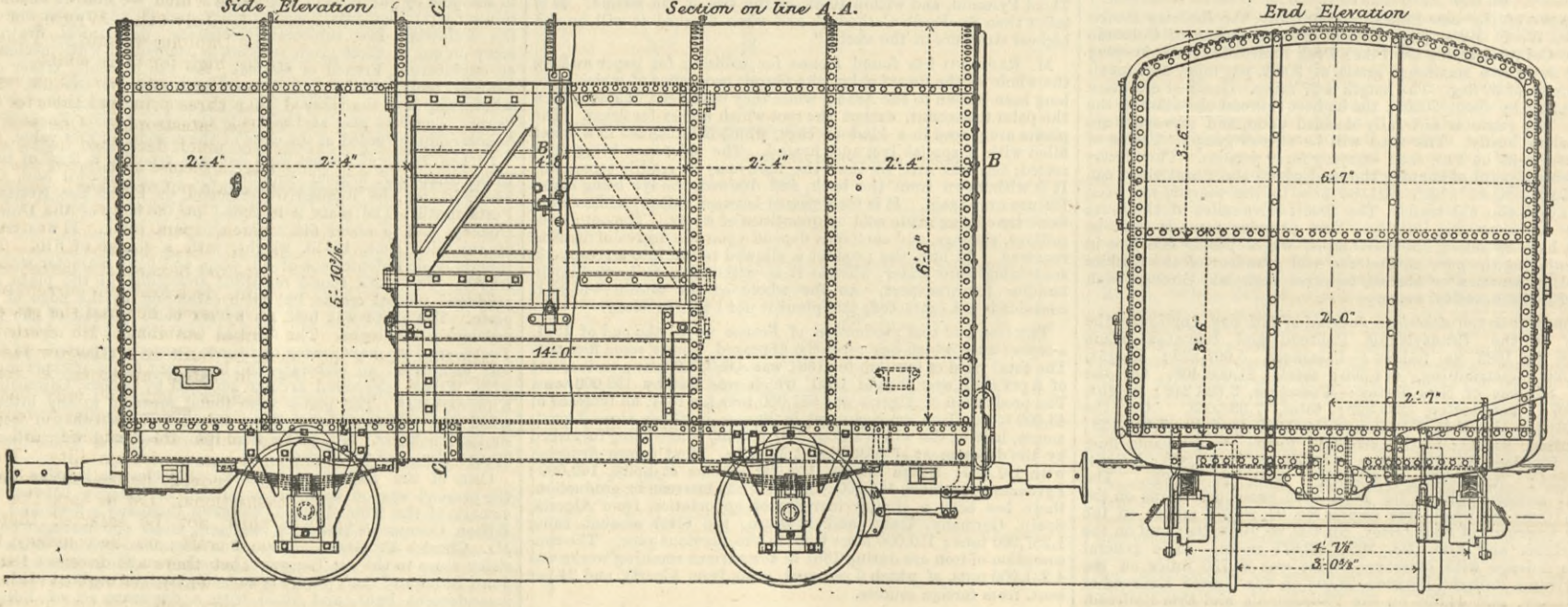
Section on line B.B. Section on line C.C



Side Elevation

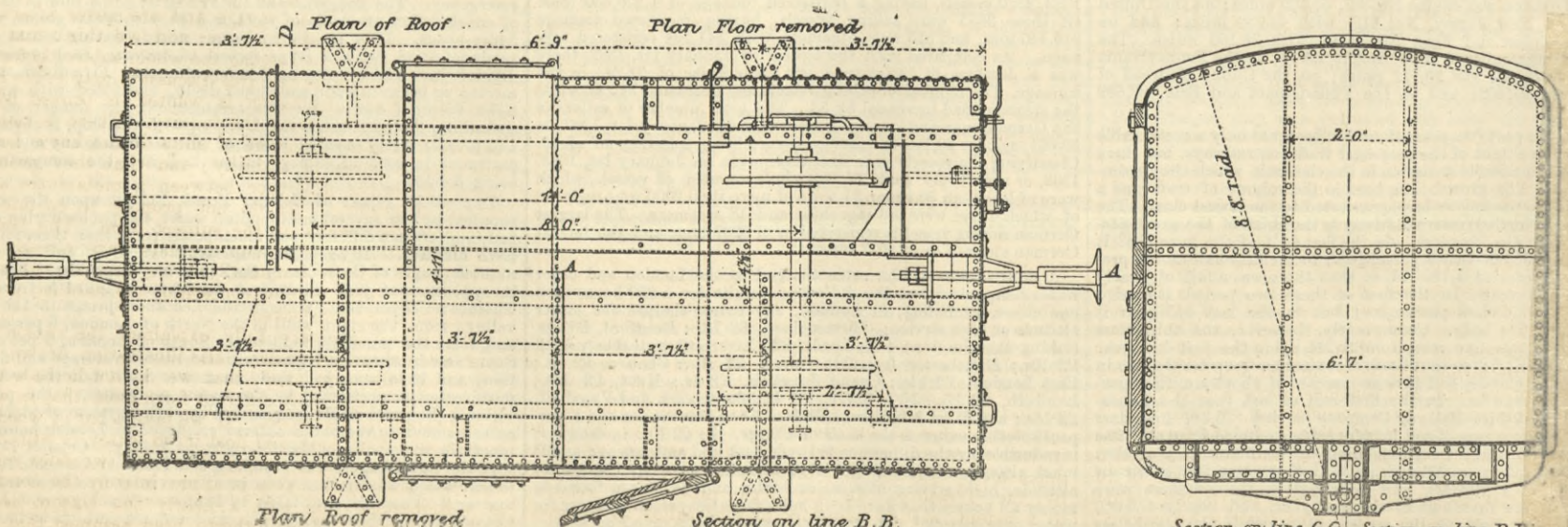
Section on line A.A.

End Elevation



Plan of Roof

Plan Floor removed



Plan Roof removed

Section on line B.B.

Section on line C.C. Section on line D.D.

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TO CORRESPONDENTS.

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

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

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

R S. (Widnes).—*We will endeavour to obtain the information you require.*

W. A. (Blackburn).—*It is an error in the wood-cutting. The shaft is in one piece.*

BOMBAZEEN.—*A properly made slate cistern joined with red and white lead putty will not leak. You may use it without fear.*

N. S. (St. Petersburgh).—*We would willingly assist you if it lay in our power, but it is beyond our sphere, and we are pretty sure that you will not get any adequate support for your scheme in this country.*

A. B. G.—*We do not think you could transmit anything like* 30*-horse power with a single rope in the way you propose unless you used some modification of Fowler's clip drum for the small pulley. You cannot do better than consult Messrs. Fowler and Co., Steam Plough Works, Leeds.*

E. G. P.—*It would be useless to insert your letter, as the authorities of the Fisheries Exhibition would not for a moment entertain such a scheme. The general public care nothing at all about inventors or inventions, and the attendance at such an exhibition as you propose would not pay for the lighting alone of the department.*

OIL GAS PLANT.

(To the Editor of The Engineer.)

SIR,—I shall be much obliged to any of your readers who will give me address of makers of oil gas plant, suitable for a large establishment.

August 29th. W. P. O.

RIDEALGH'S INDICATOR.

(To the Editor of The Engineer.)

SIR,—Can any of your correspondents tell me where I can get one of the steam indicators made by Charles Ridealgh, of Newcastle-upon-Tyne, in 1859?

South Shields, August 27th. CHIEF.

MILLING MACHINE FOR CUTTING CAMS.

(To the Editor of The Engineer.)

SIR,—Can any of your numerous readers furnish me with the maker's name of a first-class reliable self-acting milling machine for milling cams off a former? The cams to be milled are 2in. on face, and the largest rise of cam, say, 6in. from centre of boss.

Nottingham, August 27th. CAM.

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DEATH.

On the 25th inst., at Les Plans, Bex, Switzerland, CHARLES BERGERON, C.E.

THE ENGINEER.

AUGUST 31, 1883.

THE PATENT ACT.

THE Patent Bill received the Royal Assent on Saturday last, and is now part of the law of the land, though it does not come into operation until the 1st of January next. The Act is not yet printed, but a careful collation of the measure in its various stages with the notices of amendments proposed, enables us to state accurately what the enactments are. We assume our readers to be familiar with the provisions of the present law, so that we shall only notice the changes which the new Act introduces. The procedure is much simplified, the applicant being only required to deposit at the office, or send through the post, a document declaring that he is the first and true inventor of some improvement, and that he desires a patent for it. This is accompanied by a specification, which may be either "provisional" or "complete." In the former case the fee is £1, and in the latter £4, and for this sum he has a patent lasting for four years. In the case of the filing of a complete specification after a provisional, which may be done at any time within nine months, he pays £3, so that in either case the fee is the same, viz., £4.

A patent may be granted to several persons, one only of whom need necessarily declare himself to be an inventor. The specification, whether provisional or complete, must describe the invention, and in the case of a complete specification it must, in addition, "end with a distinct statement of the invention claimed." The application will be referred to an examiner, whose duty it will be to report to the "Controller," as the new head of the department is to be called, whether "the nature of the invention has been fairly described," whether the documents are in the proper official form, and also whether the "title" sufficiently indicates the subject-matter. If everything be satisfactory, the patent passes on to the next stage, but if not, the Controller will require the applicant to amend the specification, but from his decision an appeal lies to the law officer, whose judgment is final. The Act contains provisions for dealing with conflicting applications pending at the same time, thus introducing, in a modified form, the vicious principle of preliminary examination as to priority. The examiner is expected to keep his eyes open in this direction and to report to the Controller accordingly. The decision of that functionary is, as before, subject to review by the law officer. The same procedure obtains when a complete specification is left after a provisional, and unless the applicant follows the ruling of the Controller or law officer he loses his patent. When at length the differences between the applicant and the authorities have been amicably settled, the specification is made public, and it remains open for two months for all the world to come and see if they have any objection to make. It would appear that the documents are to be printed at this stage, but there is nothing more than an incidental provision which secures this. Section 100 of the Act directs that "copies of all specifications, drawings, and amendments, left at the Patent-office after the commencement of this Act, printed for and sealed with the seal of the Patent-office, shall be transmitted to the Edinburgh Museum of Science and Art within twenty-one days after the same shall respectively have been accepted or allowed at the Patent-office." This language is obscure. A document may be said to be "accepted" when it has been received by the clerk in attendance, and the word "allowed" is not used in any other part of the Act in connection with the rejection or acceptance of specifications.

The grounds on which an application may be opposed are: (1) fraud; (2) the existence of a prior patent; and (3) similarity to a previous application then pending in the office. Oppositions will be heard by the Controller in the first instance, and then, if one of the parties desire it, by the law officer, whose decision is final. We have already expressed our fears that this opposition on open documents will give rise to grave injustice. It is not at all improbable that powerful syndicates or committees will be formed by the various trades, for the purpose of opposing every meritorious invention on the ground of want of novelty. It will not be at all difficult to select, from the thousands of specifications which have been published, something which looks likes an anticipation. The unfortunate inventor will then find himself face to face with a powerful body of persons, to whom a few hundreds or even thousands of pounds are of no moment whatever. Nor will they be deterred by the fear of having to pay costs, which the law officer is empowered to award at his discretion. It must be remembered, too, that there is no question of "damages," and, further, the unfortunate inventor is placed in the inferior position of defendant. Supposing, however, that there be no opposition, or that the opposition should be unsucessful, the patent is sealed, such sealing not to take place after the expiration of fifteen months from the date of application, unless a delay has been caused by appeal to the law officer or by proceedings on opposition. Should the applicant die during the fifteen months, the patent may be granted to his representatives at any time within a year from his death. It would appear that a person may freely use and publish his invention immediately after filing his application without prejudice to his patent, but he cannot institute proceedings for infringements until it is sealed.

The patent, when sealed, will be good for four years, but it may be extended by periodical payments as at present. These payments may be made in instalments as follows: Before the expiration of the fourth, fifth, sixth, and seventh years respectively, an annual sum of £10; before the expiration of the eighth and ninth years, an annual sum of £15; and before the expiration of the tenth, eleventh, twelfth, and thirteenth years, £20. Or these fees may be paid in two lump sums of £50 and £100, before the end of the fourth and seventh years from the date of the patent. These provisions are, as far as possible, applicable to patents already existing. The total amount payable for a full patent of fourteen years is the same whichever mode of payment be adopted; but for a seven years' patent there is a saving of £10 by adopting the method of payment by instalments. Should the patentee fail to keep up his payments, a period of grace is allowed, not, however, exceeding six months. A specification may be amended at any time either by way of disclaimer, correction, or explanation, and the application to amend will be treated very much as if it were an original application, any person interested being allowed to enter notice of opposition. When an action for infringement is pending, the judge is empowered to postpone the case in order to give an opportunity to the plaintiff to apply to the Patent-office for permission to amend. The Board of Trade may order patentees to grant licences on certain conditions named in the Act. Considerable facilities are given as regards the revocation of a patent, the old proceeding by *scire facias* being abolished. A patent may be revoked on the ground of fraud, that the patentee was not the inventor, and also on the ground of prior user. A patent is good against the Crown, but the officers of any department may make use of an invention when required for the service of that department, paying the inventor a sum to be settled by the Treasury. In any legal proceedings relating to a patent, skilled assessors may be called in to assist the court. Facilities are also given for restraining the issue of circulars containing groundless threats of legal proceedings against persons using a particular article. *A patent must contain one invention only*, but it may include more than one claim. Amongst the miscellaneous provisions of the Act there is one for securing the publication of an illustrated journal of patented inventions, reports of patent cases, and other information of a similar character. The Patent-office Museum is to be transferred to the Department of Science and Art, which is empowered to require models of any patented invention on payment of the costs. The Commissioners of Patents, who are now charged with the administration of the patent system, are abolished, the entire department being handed over to the Board of Trade. The registration of designs is much simplified, and the class of "useful" designs is abolished. It has been the practice to protect under that description many "designs" which are in effect mechanical contrivances, and should, therefore, have become the subject of a patent.

The section devoted to trade-marks contains a re-enactment of the present Trade-marks Registration Acts, with certain alterations in detail which we need not specify. It allows the registration as trade-marks of single letters and fancy words, and it abolishes the statutory declaration hitherto required by persons seeking registration. It permits the registration of a series of marks differing only by the addition of words or symbols common to the trade, thus distinctly reversing the principle laid down in "Barrow's Case" decided by the Court of Appeal some years ago. We commented at the time very strongly upon the hardships of that decision, and of the circumstances under which it was obtained. The authorities have at length recognised the justice of our strictures by a formal enactment directing them to do that which they declared they never would do. The relations between the Sheffield Cutlers' Company and the Trade-marks Registry seem to have been made more complicated and difficult to understand than they were before. In the section relating to "offences," it will be well to call attention to the fact that the use of the word "patent" upon any article for which no patent has ever been granted renders the offender liable to a fine of £20. By Clause 106 a similar penalty awaits the person who makes use of the royal arms without due authority and with intention to deceive. These two clauses should be carefully studied by manufacturers and others.

Such is a brief outline of the most important changes brought about by the new Act. For the details we must refer our readers to the document itself, which we shall print as soon as it is published. It should be borne in mind that a series of rules and regulations have still to be prepared, but these will probably not be out for some months. We shall probably return to the subject shortly for the purpose of discussing the question of the qualifications and duties of the Controller and the examiners. Upon the capacity of these functionaries much of the success of the measure depends.

THE STABILITY OF SHIPS.

SIR EDWARD REED'S report on the capsizing of the Daphne, published in our last impression, corroborates in every particular the statements which we made concerning that ship in our impression for July 6th. Writing of such ships as the Thames and the Daphne, we said: "They are unstable because they are too high for their width." This is precisely what Sir Edward Reed and Mr. Elgar repeat. It must be remembered that three principal theories were advanced to account for the catastrophe. One was that the ship had a great deal too much deck load in the shape of men, tools, and materials; a second attributed the overturning of the vessel to the strain put upon her by her check chains; and a third asserted that she was caught by an under tow or current, which, operating on her bottom, overset her. We rejected all these theories as untenable, asserting that the ship capsized because she lacked initial stability. Neither the chains, deck load, nor current could, separately or combined, have overset her had she possessed a sufficient amount of initial stability. No doubt the assertion that a ship could be built in a Glasgow yard too tender to be launched in safety appeared in certain quarters sufficiently audacious; but not only has Sir Edward Reed arrived at a conclusion similar to ours, he has elicited the fact that ships are designed and built without any consideration whatever for stability. That is left to take care of itself. Indeed, he has elicited statements which are almost sensational. Let us hope that they will prove useful. It must not be inferred that the Daphne was an exceptional craft; on the contrary, there is every reason to believe that there are dozens of steamships afloat—small and large—which are very little better. It is an open secret that in very well-informed quarters it is assumed that a large proportion of the steamers which start on a given voyage and are never afterwards heard of, have capsized at sea; and we think that some good may be done by keeping the whole subject before the public for a while, so that free discussion may evoke information. That information is wanted is proved by the statements made during the inquiry. There is cause to believe that many designers of ships do not know how to calculate a curve of stability; and that they probably hardly know the difference between a metacentre and a centre of gravity. We do not propose to go into any mathematical details on the subject here. The laws on which the stability of a ship depends have already been fully stated in our columns, but we desire to call attention to some considerations concerning the stability of ships which are often overlooked.

Mr. Elgar has very fully explained the reason why high-sided ships are tender. His illustration, drawn from a floating cube, is so happy that we do not hesitate to reproduce it in a slightly different form from that in which it appeared in his report. If we take a bar of wood 2in. square and 20in. long, and float it on water, it will, if the wood be of the right density, float with two sides vertical and two horizontal. This is approximately the condition of a high-sided ship with a nearly flat bottom and no ballast or cargo. It has hitherto been assumed that such a bar of wood is in very stable equilibrium; but Mr. Elgar

points out that, if it be heeled over a little way, its stability vanishes, and it is then quite ready to take up a new position, and float on another of its sides. This is just the case of the Daphne. It was a matter of indifference to her whether she floated on her bottom or on her beam-ends; and if the water had not got into her when she heeled over, through hatches and open ports, she would not have sunk at all, and might have floated quietly down the Clyde with her crew standing on her side instead of her deck. A comparison may be drawn here between the case of a low-sided and a high-sided craft, the former being represented by H.M.S. Captain. She was, it will be remembered, upset off the coast of Spain in a heavy gale. The high-sided Daphne, when she rolled beyond her limit of stability, took up a new position on her side; but the low-sided Captain could not do this any more than a board can float on its edge. She turned clean over, and one of the survivors actually ran along her bottom, which remained high out of the water until the enclosed air escaped and she sank. We have here two extremes, and the comparison we have drawn is interesting and suggestive. The question here presents itself, Why should ships be built with either very low or very high sides? With the former we need not deal. The latter is very much to the point, and can be readily answered. High sided ships are built in order that the maximum amount of cargo may be carried for the minimum expenditure of power and first cost. To make this clear we must repeat an old school-boy puzzle. A farmer had fifty-two hurdles, and with these he constructed a pen which held two hundred sheep. He bought two hundred more sheep and two more hurdles, and with these two he doubled the size of the pen, and this provided the requisite accommodation. How was this done? The answer is that the original pen was a long parallelogram, with twenty-five hurdles at each side and one at each end. By putting two hurdles at each end and shifting one side, the breadth of the pen was doubled. If we apply this to a ship it will be seen that the capacity of a given hull can be more cheaply increased—other things being equal—by augmenting her beam than in any other way. Thus, a ship 300ft. long and 30ft. beam would have about half the capacity of a ship 300ft. long and 60ft. beam, but the latter ship would not cost twice as much as the former. Of course we cite an imaginary case, but it will serve our purpose. But unfortunately increasing the beam of a ship entails additional expense in a way which does not appear at first sight. It is obvious that the wide hull will not require much more plating for the shell than the narrow hull. But this is not the case with the decks and the beams. These last to be equally strong in both cases must be of much heavier sections, or much more numerous than in the case of the narrow ship. Furthermore, the power required to propel the broad ship will be much greater than that demanded by the narrow ship. A ship, like everything else, has, however, three dimensions, breadth, depth, and length; and although it is not economical to augment beam much, it is economical to augment depth. For in that case we retain deck beams as they were in the smaller ship; the area of deck plating is not increased, and the only addition is in the side plating, about the cheapest work in the hull. Besides this it is held in many quarters that a given speed can be imparted to a given tonnage, with less power in the case of a long, deep, narrow ship, than in the case of a long, shallow, wide ship. The naval architect, bearing these things in mind, and giving here and taking there, arrives at last at the all-round most economical hull for a given trade, and this in the case of certain trades is a high-sided narrow ship, such, for example, as the Austral, the Thames, and the Daphne.

Now, although such ships may have little or practically no initial stability when empty, it by no means follows that they are bad and dangerous vessels, which ought not to be built. On the contrary, we are disposed to believe that they are pre-eminently safe ships in proper hands. Everything depends, however, on the way in which they are loaded, and the quantity of load they are sent to sea with. It is evident that the terms high-sided and low-sided are merely relative. If we sink a deep ship far enough, she ceases to have high sides, and becomes remarkably stable. If we lighten a low-sided ship enough, she will carry her sides high out of the water, and may become extremely tender. The best ship, of course, will be a mean between the two, for such vessels can hardly be so loaded that their safety will be endangered; but the fact remains, as we have said, that hulls of the Daphne type may prove excellent sea boats if properly dealt with; but this is a serious qualification. They can be launched in safety by putting a little ballast on board, in the first place; but when plying their calling, unless unusual precautions are taken, very great risks may be run. Thus, the Austral foundered in port on very small provocation. A valuable cargo of light bulky goods may present itself, and the ship will be filled, but she will not be brought down to her proper bearings. Again a cargo of railroad iron may be taken; with this the ship will be safe enough from capsizing, but on the other hand she will roll so fast that she will almost jerk herself to pieces, and render the life of everyone on board miserable. Nevertheless, as we have said, the use of high-sided ships in certain trades and under certain conditions is to be commended. But such vessels as the Daphne should always be looked upon as exceptional. Their curves of stability for various loads ought to be calculated with great care, and the Board of Trade should see that the captains are provided with copies of these curves; and the owners would do well to remember that it is not every captain who is fit to have charge of such craft.

The universal calculation of the curves of stability is to be recommended for reasons which have nothing specially to do with high-sided ships. With such curves, and drawings of the ship, it becomes possible to form some idea concerning the amount to which she will roll; and it appears to be highly desirable that rolling should be kept within the smallest practical limits. If a ship has a high range of stability quickly reached, she is almost certain to be a lively roller, because every ship will roll under sufficient provocation to just that point where her own momentum and the push of the sea are balanced by her moment of stability. Thus, for example, if we have two ships, one of which attains her maximum stability at 30 deg., and the other at 60 deg., it will be safe to assume, other things being equal, that the latter will roll through about twice as great an angle as the former. We say this while we are fully aware that the rolling of ships is affected materially by the nature of the waves with which they have to contend, the influence of periodic impulses, the form of the hull, and many other points which render the investigation of the rolling of ships in a sea-way a very abstruse problem. But what we have said may be taken as approaching the truth, and a deep ship, if properly loaded, may roll much less than a shallow ship; indeed, some shallow and extremely stable ships are awful rollers. Now, generally speaking, a ship which rolls heavily is in one sense an easy ship. Each roll is made leisurely and occupies a considerable time; but the ships rolling through small angles, because of excess of stability—among other causes—are so lively that they are extremely uncomfortable and even dangerous. As a rule, attempts are made to secure easy rolling ships, and this statement brings us to the last point to which, for the present, we wish to call attention, namely, that the further a ship rolls the more likely she is to shift her cargo. We are not aware that attention has ever before been prominently called to this most important point, although it is very obvious. No matter how badly a ship was loaded, say, with grain, she would run no risk if she had to traverse a calm sea. The moment she begins so roll her cargo tends to shift, and if the point is reached where the resistance to shifting is overcome, the cargo will shift. If we place a penny on the cover of a book and lift one end, an angle will be reached when the coin will slide off. In just the same way, if a ship rolls to a sufficient angle, her cargo must move. We have not the least doubt but that this fact is almost always overlooked, and that ships are built without any special regard to their rolling. As the whole subject of stability is to be fully dealt with, no doubt, in every shipyard in the kingdom, we trust that this matter of rolling may not be overlooked.

THE BOARD OF TRADE AND ELECTRIC LIGHTING.

There is only too much reason to conclude that Parliament and the Board of Trade have together done a good deal of mischief in the matter of electric lighting. As things stand, any electric lighting company may apply for a licence to light a town or district, which will be granted by the Board of Trade provided there is no opposition, or, in case of opposition, the company can apply for a provisional order, which will be granted or refused after a committee has heard evidence and arguments on both sides. In fact a Provisional Order is another name for an Act of Parliament empowering the company to do certain things. It thus appears that a particular system of lighting may be forced on a town or corporation against their will; and to guard against abuses, certain rules have been laid down by the Board of Trade and the Electric Lighting Act which must be complied with by the company. It is clear that these rules ought to have been prepared with great care, in order that injustice should be done neither to the company nor the consumer. But it requires nothing more than a little attention to facts to prove that the rules are, in many respects, extremely unsatisfactory. Attention has already been called to this on several occasions; but the Board of Trade appears to have been quite incompetent to prepare proper regulations, and it will, of course, be difficult to make alterations now. It is not too much to say that the rules err for the most part in favour of the companies, and do not do the consumer justice.

In 1882 eighty-three applications were made to the Board of Trade by companies, and not one was made for a licence. This goes far to show that in no case had the companies the cordial support of the towns. They were either regarded with apathy or resisted, and where the resistance was strong the companies gave way and withdrew. If the inhabitants of a town are not satisfied with the proposals made to them, they can demand an enquiry by the Board of Trade. Such a demand was made in the case of Edinburgh, but the scientific advisers of the company did not appear to support the case, and it fell through. It would be impossible within the limits at our disposal to show how and where the rules are wrong, unjust, or inept. Those who wish to go further into the matter may consult with advantage a pamphlet by Mr. T. H. Blakesley, M.A., just published by Sampson Low and Co., where they will find details. But although we cannot go fully into the matter, we can point out a few of the weak points. It has been said that it is possible to drive a coach and six through any Act of Parliament. There is certainly no trouble in driving an electric current through one. The existing Act has ludicrous flaws in it. In a certain Dutch town it once became a bye-law that every citizen should carry a lantern after dark. A citizen was shortly afterwards taken up by the watch and brought before the authorities for breaking this rule; but the man proved that at the time of his arrest he was carrying a lantern, to which it was replied by the watch that that was quite true, but there was no candle in it. Nevertheless, it was held that he had complied with the law and must be discharged; but the law was altered, and every citizen was instructed to carry a lantern with a candle in it. The original delinquent was again caught without a light, but he proved in his defence that there was not a syllable about a light in the bye-law, and that he had with him a lantern with a candle in it, unlighted it is true, but a sufficiently legal candle; therefore he was again discharged, and the law was altered once more, and every citizen was told to carry after dark a lantern with a lighted candle in it. Now Parliament apparently had not heard this story when it passed the Electric Lighting Act. We will suppose that Mr. Apsley Jorkin, living in Matilda Villa, Crowthorpe-street, Herdsbush, wants to light the said villa by electricity, the Positive Rectilinear Electric Current Company being at work in his district. But the company does not care to light Matilda Villa and one or two others alongside it. Mr. Jorkin, however, stands upon his rights, and demands that a distributing main shall be laid in Crowthorpe-street. The company gives way, and the main is laid, and at one end of the street Mr. Jorkin finds a distributing box. Now, Matilda Villa is a great deal more than 30ft. from the distributing box, and Mr. Jorkin will have to pay for all the service save 30ft.; and the service line may be made of any length the company thinks proper. In order to put this clearly let us suppose that a gas company put down at the end of a street a mile long a large box, which was kept full of gas; from this box the householders might draw but they would have to lay down their own services pipes at their own cost, or rather at any price the gas company thought proper to charge. Of course, Parliament did not contemplate this; but instead of saying that electric mains shall be laid down *along* a street or *throughout* a street the drawer of the provisional orders wrote *in* the street, and this the company has done. It has laid a service main *in* the street, and Mr. Jorkin may go and fetch the electricity thence at his own cost. It may be urged that such a course is impossible, but it is well known that it is not impossible; and in any case the Board of Trade has done nothing to render it impossible. Another very important matter is that any company may supply an intermittent current if it thinks proper. Such currents are useless either for driving motors or charging secondary batteries. They are extremely dangerous, and ought, in point of fact, never to be used for domestic purposes. They suit, however, certain systems of lighting, and certain forms of dynamo, and for this reason they may be forced on the public.

The Board of Trade is at this moment, and has been for some time past, in this difficulty, that none of its responsible officers have any special acquaintance with electric lighting. A few of them know something of the theory of the subject, and at least one gentleman is very well versed in telegraphic electrical work; but this is of practically no use in lighting operations. The country is therefore, so far, at the mercy of a Government body which has virtually to legislate concerning things about which it knows nothing. Its difficulties will increase. We understand, for example, that certain fittings, such as safety switches, cut outs, keys, &c., must comply with certain conditions laid down by the Board of Trade, but it is a fact that as late as last week there were no patterns or standards approved by the Board. What action will be taken in the matter remains to be seen; but we anticipate a reign of confusion and turmoil in the autumn and winter, which will, on the one hand, tell against the progress of electric lighting, while on the other it will be a disgrace to the Board. Government would do well, while there is time, to appoint some gentleman above suspicion and fully competent to deal with the subject. Such an appointment would be popular at once with the public and with all honest lighting companies. It is not fair to expect both to be made the subject of legislative and other experiments by men who have no practical experience in dealing either with the electric light, or with those who undertake to supply it.

SHIPBUILDING IN THE NORTH.

A careful tabulation of the numbers of the vessels now in course of construction in the north-eastern district, between Whitby and Blyth, both inclusive, shows that there are about 155 on the stocks; but there is not quite that pressure in the demand for the vessels that there was, and that and another circumstance will probably prevent the tonnage launched being quite so large as in the past year, when the maximum was reached. The launches this year on the river Wear are being retarded by the long strike of a number of the engineers; for when the engines are not likely to be had, builders retain the vessels on their own stocks instead of launching them and risking them in the river and increasing the river dues. Apart from the strike on the Wear the production has been tolerably steady, but there is less pressure in the yards. There seems ground for the belief that the orders on hand by the builders will keep most of the shipyards well employed till next spring; but beyond that the prospect is rather doubtful. Vessels are far less profitable than they were; and though the tendency of freights is just now upwards again, there is no probability that the earnings will be sufficient to pay the large dividends that have been paid, and thus capital will not be so readily turned into shipping as it has been. Hence, the prospect before the shipbuilders is not so bright as it was, but there must always be a number of orders for new ships for purposes of replacement. These will give partial employment to the shipyards; but it is probable that there will be a reduction in the cost of production before there is another large series of orders given out for new vessels. In the running of steamers, with working expenses generally in a fixed ratio, it is the cost of the steamer that determines the extent of remuneration of the owner. Freights having fallen, it is probable that the first cost of vessels will have to fall to some extent before capital enters as freely as before into the trade. The prospect before the shipbuilders is one that is more checquered, then, than it has been; but as the North of England has facilities for very cheap construction, through its cheap materials near to the shipyards, it should receive a full share of the orders for new vessels that are in the market in any period of dulness, and be prepared for the time of full work in the more distant future.

LITERATURE.

The Concepts and Theories of Modern Physics. By J. B. Stallo. Second Edition. London: Kegan Paul, Trench, and Co. 1882.

[First Notice.]

Mr. Stallo has succeeded in writing the most remarkable scientific book that has appeared for years. It is doubtful indeed if any single work has ever been published which demands so much consideration from those who have to instruct the rising generation in the principles of physics; to deal with the laws of nature; or to make advances in natural science. It is a noteworthy fact that so far as we are aware Mr. Stallo's book has never yet been reviewed. Notices of it have appeared in several journals, and Mr. W. R. Browne has said a good deal concerning it in The Engineer for January 19th, 1883. But nothing like an

adequate criticism of the book has ever yet appeared in print. The reason seems to us to be that those who have read it have either failed to understand it—and it is tough reading—or having understood it, they have not known what to say. It is said that Professor Tait having read it, said that "he could not answer it, but he did not believe it." We fancy that Professor Tait is incorrectly reported, but no doubt the utterance adequately represents the state of mind which must be produced in thoughtful men who peruse it with care.

"The following pages," says Mr. Stallo in his preface, "are designed as a contribution, not to physics, nor, certainly, to metaphysics, but to the Theory of Cognition." The work may be read with advantage by any one who has been fairly trained to think clearly; but some of the words and phrases used will not be understood by those who are not more or less familiar with the style of Bain, Sir W. Hamilton, and others who have dealt with metaphysical questions. What, they may ask, for example, is meant by the words "Theory of Cognition?" The answer is that the theory of cognition explains how we know things. This is the key or centre on which the whole work turns. All knowledge is based on an acquaintance with things, phenomena, circumstances, events—and the further we extend this acquaintance the greater is our knowledge. The uneducated savage knows that the sun rises. The educated man knows more than this; he can tell why the sun rises. The savage knows that the sun is hot, but he does not know or care to know why it is hot. The philosopher, like the savage, knows that the sun is hot; unlike him, he wants to know the reason why; but it is not too much to say that at this moment he cannot tell any more than a Kaffir or a Hottentot. The philosopher of another kind watches the mental processes going on in both, and proceeds to consider why knowledge on a given subject may up to a certain point be common to all men, and why beyond this point it may be confined to a few. With such questions as these the theory of cognition deals, and it has been laid down as a principle that certain things never can be known in physical science, while on the other hand, metaphysicians of no mean order have maintained that there is no limit to the mental power of man. Now, Mr. Stallo to a large extent preaches the first doctrine. He maintains that there are certain phenomena concerning the nature of which we not only know nothing, but never can know anything. It would be impossible to make such a thesis either interesting or instructive, unless it was based on special and powerful arguments; and it is these arguments, and not Mr. Stallo's theory, which lend weight and importance to the volume before us.

Before advancing another step, we must here stop to explain that Mr. Stallo scarcely theorises at all. All his conclusions, or nearly all, are compressed into one short chapter of fourteen octavo pages, at the very end of the book; what these conclusions are we shall show presently. Mr. Stallo to a very large extent leaves his readers to draw their own deductions, and on the whole the method which he has adopted in dealing with his subject is eminently satisfactory and scientific. We may add that Mr. Stallo's reading has obviously been immense, and he is very careful to quote his authorities on almost every page.

We have said that Mr. Stallo has written a most remarkable book. It is well known that the bigotry and dogmatism of science are intense above and beyond all other bigotries and dogmatisms, not excluding those of religion. The tendency is now and always has been for the man of science to say "I know," when he ought to say, "I think I know." Of course there are honourable exceptions, but they are exceptions. The most recondite and elaborate theories and hypotheses have been put forward from time to time by men of science in one generation as absolutely final; and they have been disproved and shown to be wholly untenable in the next generation. Things have been taught, and are taught now, as true in our colleges, which are not true. As an example of the first statement, we may cite the doctrine of potential energy, which asserted that when work was done in lifting a weight the work was stored up in the weight, only to be given out when the weight fell to the ground again. No one having any pretensions to be a man of science teaches such a doctrine now. Instead of "potential energy" we have "energy of position," which is quite a different thing. At every turn the thoughtful student encounters difficulties, even in the best modern text books, which he cannot solve himself, and which no one will solve for him. We had recently to call attention to one of these difficulties, namely, that met with in defining the term Force, and the letters which will be found on another page show that the question cannot be easily settled. But the average teacher or lecturer has neither the time nor the inclination to deal with matters of this kind. Force is defined in a particular way in text books, and students are compelled to accept this definition or go without any. The student asks for bread and is supplied with stones. On this point there can be no room for doubt. Mr. Stallo shows how large is the supply of stones, and how general is their use. His purpose is to prove that nearly all that has been laid down as certain in physical science is uncertain; and that to all intents and purposes we have hitherto been unable to form accurate or truthful conceptions of things passing around us. Thus of the real nature of Time and Space we know nothing at all, and the same kind of ignorance extends all round. If we accepted this as true little harm would be done, but those who ought to act most wisely, dogmatise and speak as though they were infallible concerning subjects about which they have only one set of conceptions, while other and very different conceptions may pertain to them. Mr. Stallo bears much the same relation to the scientific world that an agnostic does to the religious community. He neither believes the statements made nor disbelieves, as a whole. Concerning some things he points out obvious and essential contradictions which prove that both of two hypotheses cannot be true. Concerning other matters, he suspends his judgment, contenting himself, with saying: "Neither you nor I really know anything at all about these matters with certainty. What you say, represents a convenient hypothesis to work with; but you do not know that it embodies the truth, and you should not assert that it does." Need we say that such a man must be eminently antagonistic to a very large class? What he has written must have been largely read, and we know that it has caused a good deal of commotion; but no attempt at an answer has yet been made. No one has tried to refute his propositions as a whole. A few insignificant joints in his armour have been assailed, and the assailant, having dealt a blow, has apparently fled for his life. Why is it that Mr. Stallo has escaped? The answer is to be found in Mr. Stallo's method of attack. In desperate assaults, the bodies of the slain have been used, ere now, as steps to reach an enemy above. Mr. Stallo adopts a similar course. He slays his foes, and uses their bodies as a ladder when he makes further attacks. His method is equally simple and effective. He takes any important theory taught more or less dogmatically, and shows that, if it be true, then some other equally important theory taught with the like dogmatism, must be false; and this he does by setting the two theories, as enunciated by the ablest authorities, side by side, and leaving the reader to draw his own deductions.

His great onslaught is on the atomic theory, which lies at the root of all physical teaching:—

"There is the assumption," writes Mr. Stallo, "generally prevalent among physicists and chemists of the molecular or atomic constitution of bodies, according to which mass is not continuous but discrete, being an aggregate of unchangeable, and in that sense at least, simple units. This assumption leads to four other propositions, which, in conjunction with the principle of the conservation of both mass and motion, may be said to constitute the foundations of the atomo-mechanical theory. They are these:—(1) *The elementary units of mass, being simple, are in all respects equal.* This is manifestly nothing more than an assertion of the homogeneity of mass, in conformity with the hypothesis of its molecular or atomic constitution. (2) *The elementary units of mass are absolutely hard and inelastic*—a necessary consequence of their simplicity, which precludes all motion of parts, and therefore all change of figure. (3) *The elementary units of mass are absolutely inert, and therefore purely passive;* hence there can be no mutual action between them, other than mutual displacement caused by impulses from without. (4) *All potential energy, so-called, is in reality kinetic.* The term "energy," in the language of modern physics, denotes the cause of motion, and motion cannot originate in, nor can it be converted into, anything but motion. The invariable units of mass are inert, whatever be their position. Energy due to mere position is impossible."

We would have our readers carefully peruse the preceding quotation until they have fully mastered it. No doubt it accurately represents the teaching of very eminent authorities in physical science. Mr. Stallo goes on to quote a whole host of authorities who take the view thus laid down. Among these may be named Descartes; and Prof. Wundt, who says:—"Chemistry still refers the divergent quality of matter to an original qualitative difference between the atoms, but the whole tendency of physical atomism is to derive all the qualitative properties of bodies from forms of atomic motion. Thus the atoms themselves remain as elements utterly devoid of quality." Herbert Spencer is quoted to the same effect; so is Thos. Graham. Our readers will see that what is thus laid down as the atomic theory, is that matter in every form is composed of ultimate atoms, particles, molecules, grains—call them what we will—so small that they cannot be divided, and each one absolutely hard, and without qualities of any kind save weight. All these molecules or grains are exactly of the same size and form and weight, and differences between one form of matter and another are due to differences in the motions, arrangements, and numbers of these molecules. This is the doctrine which is laid down in many text books, and with which the student is early made familiar.

Mr. Stallo compares this hypothesis with that of Dalton, on which all chemical science is founded, and he shows that, according to this last, instead of there being only one kind of atom, there are as many kinds as there are elements. Instead of the atoms all being of the same weight, some of them are very much heavier than others. Thus, for example, the molecular weight of chlorine is 35·5 times as great as that of hydrogen, and if these weights are in proportion to the number of atoms contained in each molecule of chlorine, then such molecule must contain seventy-one atoms; but in this case, for reasons well understood, its specific heat would be far greater than has been ascertained by experiment. Again, hydrogen and chlorine are both held to be diatomic, that is, their molecule consists each of two atoms, yet the molecule of chlorine is said to weigh 35 5 times as much as the molecule of hydrogen. It is obvious that if the physical atomic theory is right the chemical theory is wrong. But the student first learns the physical theory in, let us say, the engineering classes of his college on two days in the week, and he learns the chemical theory on two other days in the chemical classes of the same college, and no one explains to him that they are totally inconsistent and irreconcileable. We cannot quote Mr. Stallo's arguments at length, but we reproduce the concluding paragraphs of his third chapter—

"In view of all this there seems to be no escape from the conclusion that the claim, according to which modern physical science is throughout a partial and progressive solution of the problem of reducing all physical phenomena to a system of atomic mechanics, is very imperfectly, if at all, countenanced by the actual constitution of theoretical chemistry—that this science, which is peculiarly conversant about atoms and their motions, is founded upon propositions destructive of the very basis upon which alone a consistent superstructure of atomic mechanics can be reared. And there appears to be little ground for the hope that these propositions may be speedily abandoned; for, in the opinion of the most distinguished chemists of the day, such an abandonment would throw the mass of chemical facts, laboriously ascertained by experiment and observation—induced, partly at least, by the propositions in question—into a state of hopeless prescientific confusion. In reference to the speculations of those who seek to deduce the specific differences between the ultimate units of mass from differences between their supposed inalienable velocities of motion or amounts of latent energy, it is to be said, not only that they fail to afford a solution of the difficulties of theoretical chemistry in the presence of the inexorable demands of the mechanical theory, but also that the attribution of inalienable energy or motion to a given mass is repugnant to the fundamental postulate of the absolute indifference of mass to motion. Helmholtz and others have investigated the conditions of vortex motion in a perfectly homogeneous, incompressible and frictionless fluid, which—as Maxwell has shown—is of necessity continuous and cannot be molecular or atomic. If these conditions could be realised, we should have constant but undistinguishable volumes of a permanently homogeneous fluid, so-called, endowed with constant quantities of inalienable motion. But no energy or motion can inhere essentially in distinct and separate masses—molecules or atoms—if, as the mechanical theory assumes, mass and motion are disparate—if mass is indifferent to motion so as to remain the same whether in motion or at rest, and if motion is transferable from one mass to another. This is one of the points distinctly insisted upon by Sir Isaac Newton, the greatest among the founders of the mechanical theory. Newton distinguishes between two kinds of force—the force of inertia (*vis inertiae*), and impressed force (*vis impressa*). The former alone according to him is *vis insita, i.e.*, inheres in matter; while of the latter he expressly says that "this force consists in action alone and does not abide in the body after action."*

We have now said enough to indicate the line Mr. Stallo takes, and to make our readers in some degree acquainted with his method. We shall next proceed to consider the way in which he has dealt with other questions nearly as important as the atomic theory.

BOOKS RECEIVED.

Elementary Text-book of Physics. By J. D. Everett, M.A., F.R.S. London: Blackie and Son. 1883.

Strains on Braced Iron Arches and Arched Iron Bridges. By A. S. Heaford. London: E. and F. N. Spon. 1883.

Journal of the Society of Telegraph Engineers. Vol. xii. Nos. 46 and 48.

Conversion Tables of Metric and British or United States Weights and Measures; with an Introduction. By Robert H. Thurston, A.M.C.E. New York: John Wiley and Sons; London: Trübner and Co. 1883.

Physical Treatise on Electricity and Magnetism. By J. E. H. Gordon, B.A. Second edition; revised, rearranged, and enlarged. Two vols. London: Sampson Low and Co. 1883.

Transactions of the Institution of Naval Architects. Vol. xxiv. Edited by G. Holmes. London: H. Sotheran and Co. 1883.

BEECHWOOD SLEEPERS.

A PAPER on the above subject was read at a recent meeting of the German Railway Association by Herr Claus, who alluded to the relatively small proportion of railways in Germany—only 8 per cent.—on which the system of an iron permanent way had been adopted, either in the form of longitudinal or transverse sections, notwithstanding the undeniable advantages of that mode of construction. Thus the question of wooden sleepers is an important one, more particularly on account of the special preference entertained for them in several countries. The subject has of late assumed the form of a discussion as to the supply of wood available for this purpose, in the course of which several reliable authorities have been commenting upon the relatively limited demand for beechwood, and have been suggesting its more extensive use for the purpose indicated. While in Germany and Austria 17 per cent. of the entire wooded surface is planted with beech, the sleepers made of that wood only represent 1 and 3 per cent. of the total quantities on the railways of these two countries.

Experience has shown that rough beechwood sleepers not impregnated, do not possess sufficient properties of endurance; their period of service averaging only 2½ to 3 years, as compared with 7 to 8 years for those of rough pine, and 14 to 16 years for those of rough oak. Of impregnated beechwood sleepers, those impregnated with creosote have proved the most durable, their period of service being reckoned on the Cologne-Minden line at nearly 18 years. Those impregnated with chloride of zinc have proved less durable, while the least favourable results have been obtained with those impregnated with sulphate of copper and sulphuret of barium. In those parts of Germany where beech trees are abundant, such as Hanover, the cost of a well impregnated beechwood sleeper is said to be only about half that of an impregnated oak sleeper. The principal obstacle to their use would seem, however, to have been the fact that the interior might often be quite decayed, while the exterior would appear in a good state of preservation.

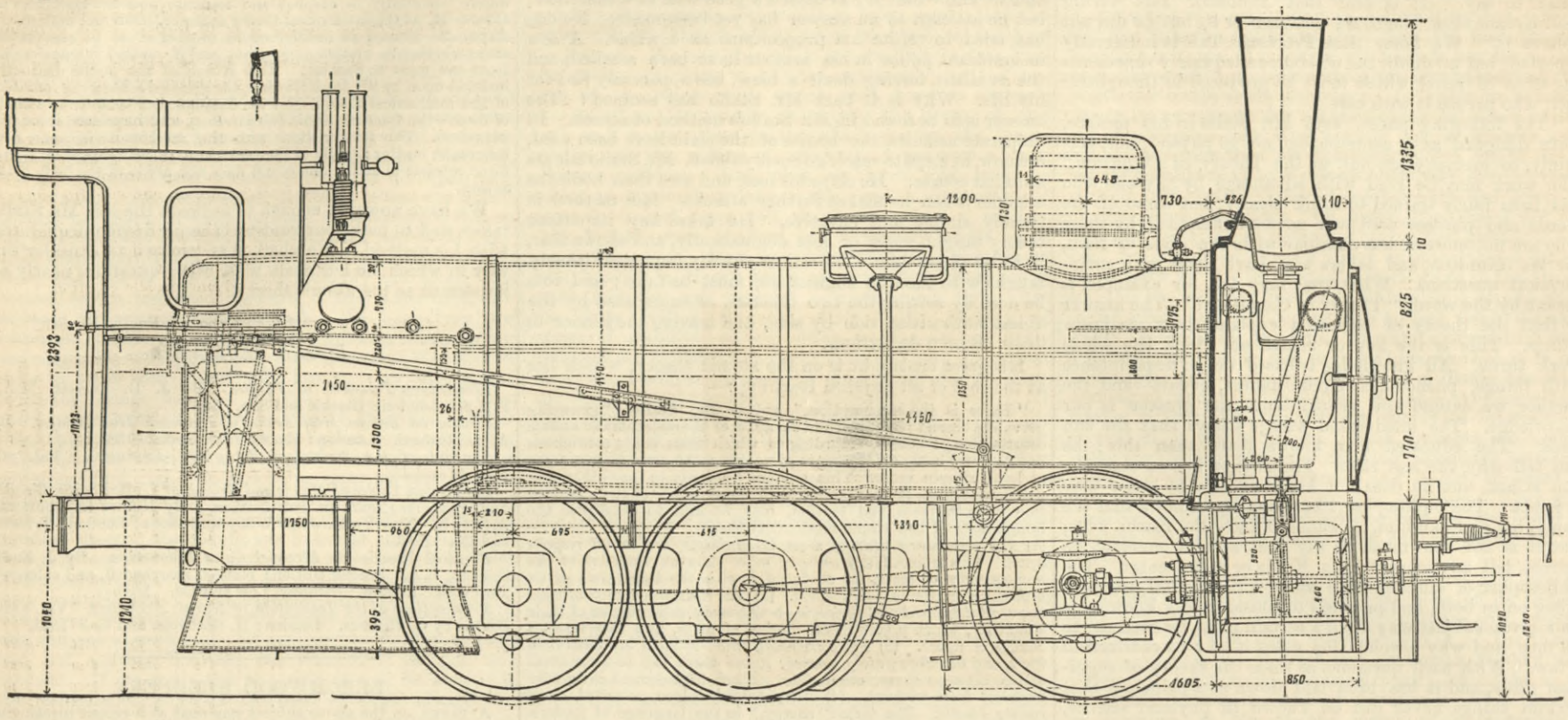
In France the employment of beech-wood sleepers is upon a more extensive scale. Detailed reference was made by Herr Claus to the process of thermo-carbolisation, invented by John Blythe, of Bordeaux. According to this process the sleepers are first dried to a given point of weight per cubic metre, being then placed in metal cylinders, in which they are exposed during five or ten minutes to a current of steam, which is mixed with the vapours of creosote oil. Creosote oil is then poured into the cylinders, and by the pressure of steam, the absorption of 24 lb. of the oil by each sleeper is effected. On account of the impregnation of the central portion of the sleepers by this process being incomplete, Herr Claus expressed his opinion that the process of Herr Rütgers—in general use in Germany—was more suitable for the purpose indicated. By this process the sleepers are placed in a drying stove, which is gradually heated up to 266 deg. Fah., and are allowed to remain there until no more aqueous vapours are thrown off, the minimum time being four hours. They are then placed in the iron cylinders, which are closed in an air-tight manner. During the continuous action of the air pump the cylinder is filled with tar oil containing creosote, previously warmed by steam pipes. A pressure is then created by a force pump, and is maintained until the normal quantity of oil—39½ lb.—has been absorbed, the greater amount of which, as compared with that used in Blythe's process, is supposed to effect a more thorough impregnation.

Herr Rütgers, who was present, remarked that, according to his experience of many years, beechwood sleepers were well adapted for use on both main and branch lines; but special knowledge of their properties was required in their employment. In this wood dry rot is very liable to develope itself, and then impregnation is useless. In order to render it safe for railway purposes it is necessary to subject the prepared sleepers, when as fresh as possible, to the siccative action of a high temperature, or to lixiviate them by the action of steam. The first manipulation is difficult, because beechwood is liable to split, and therefore it is usually considered preferable to heat the wood into the centre by steam above 212 deg. Fah., and to lixiviate it as much as possible. Should an aqueous impregnating fluid be afterwards employed the sleepers must first be let dry, for which purpose two or three months suffice in spring and summer. He considered that beechwood sleepers thus impregnated could compete with those of any other wood, and were decidedly to be recommended, although the price was somewhat higher than that of pine sleepers. He suggested the more extensive use of iron bed-plates or chairs in order to counteract the mechanical destruction of wood sleepers in railway traffic.

* "*Consistit hæc vis in actione solâ, neque post actionem permanet in corpore.*" Phil. Nat. Princ. Math., def. iv. (ed. Le Seur et Jacquier vol. i., p. 4.)

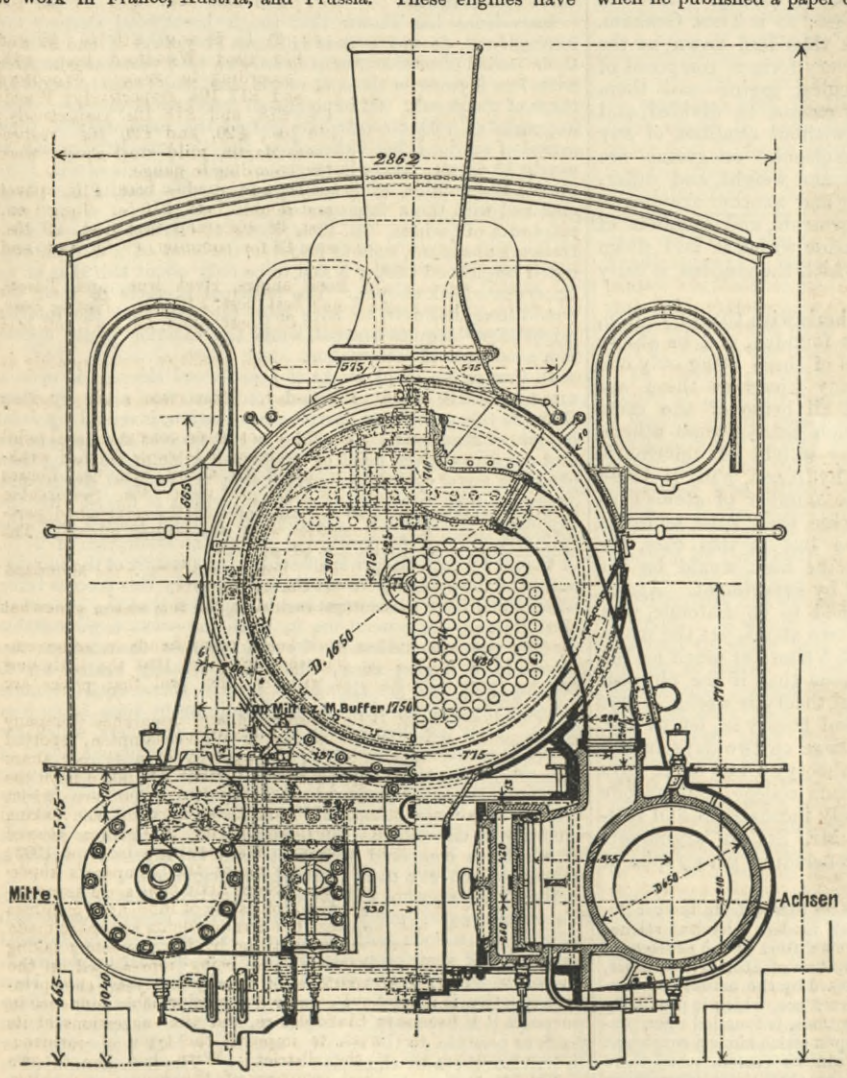
COMPOUND GOODS ENGINE.

MESSRS. HENSCHEL AND SON, CASSEL, ENGINEERS.



THE COMPOUND LOCOMOTIVE IN GERMANY.

Herr Borries, who has made a special study of the compound locomotive in Germany, has lately read, before the Union of German Engineers, an interesting paper on the present condition of the problem. He observes that the application of the compound system, which has been of such advantage in stationary and marine engines, is beset with difficulties in the case of locomotives. This is due to the necessity for great simplicity in construction and working, the great variations in the power required, and the large amount of that power as compared with the narrow dimensions within which it must be developed. The author of the compound locomotive is M. A. Mallet, of Paris. His first engine was started in 1876 on the branch from Bayonne to Biarritz, and some forty locomotives on this system are now at work in France, Austria, and Prussia. These engines have only two cylinders, of different sizes. A special feature is a valve near the smoke box, which enables the engines to be worked either simple or compound at pleasure. There is also in the valve chest a reducing valve, which enables the steam passing to the large cylinder, when working simple, to be of a lower pressure than that passing to the small cylinder. The reversing gear is worked by a divided shaft, and there are separate handles for working each cylinder, which can, however, be connected if required. The main advantage of this system is the great variation which can be made in the power developed. The disadvantages are: (1) The construction, handling, and working are complicated; (2) the full pressure comes sometimes upon the large piston and its mechanism; (3) the distribution of the steam, especially as regards compression, cannot be equally perfect with both methods of working.



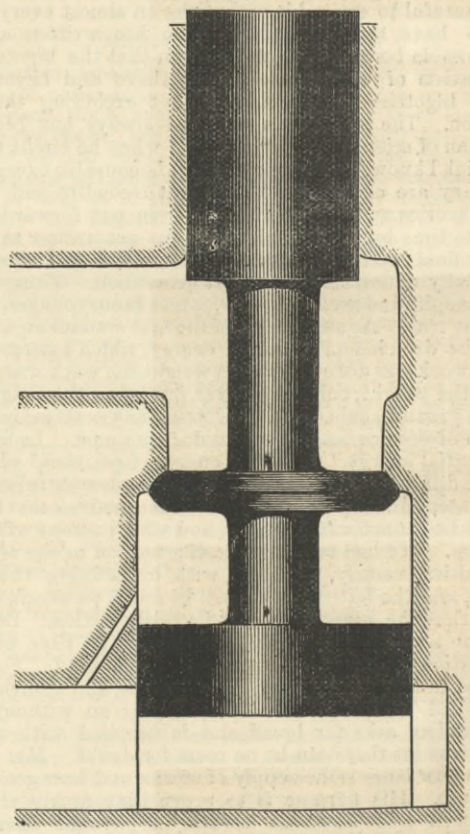
In 1881 Herr Schichau, of Elbing, made two small compound engines for the Eastern Railway of Prussia, and later compounded a goods engine for the Marienburg Railway. Mr. Webb, of the London and North-Western Railway, built in 1881 a compound engine for express trains. This engine has two small cylinders, coupled to the central axle, and one large cylinder coupled to the leading axle. The author considers that this arrangement is very complicated, and that the large cylinder will have a very unequal action on the leading axle, so that practically all the tractive force will be derived from the action of a single pair of wheels. He also speaks of minor disadvantages, and predicts that as two cylinders are really sufficient and have the great advantage of simplicity, there is no future for the Webb engine, especially in England.*

The author began his study of the compound system in 1880, when he published a paper on the subject in the *Railway Organ*, p. 220. He there laid down the following principles:—(1) To reap the full benefit of the system the engines should always work compound, not simple; (2) the mechanism should be as simple as possible, both in construction and working; (3) the correct cut-off for both cylinders should be given automatically by the valve gear, to prevent any loss of steam from faulty handling. Two small engines for omnibus trains were built on these principles in 1880, and started on the Hanover Railway. These were a combination of a tank engine and a luggage van, weighing 18 tons loaded, and having 22 square metres of heating surface. The valve gear was such that when the regulator was quite open the full boiler pressure came on the small cylinder, whilst at the same time steam passed through a throttled port into the receiver, and thus put pressure enough into the large cylinder to ensure starting the engine. As soon as the train was fairly started the regulator was partly closed, thereby shutting the direct communication to the large cylinder.

At the same time two other engines of exactly similar construction, but not compounded, were built; and hence it was possible to take two successive months, during which the same train was hauled alternately by a simple and a compound engine. The saving in fuel thus observed was 18 per cent. on the side of the compound engine, and this would have been greater had not the steam ports on the side of the large cylinder been too narrow. The distribution of the steam was equally good with the compound engine, the running was easier, and the successive emissions of steam were scarcely perceptible. Hence the fire burnt steadily, and there were scarcely any cinders or sparks. In consequence of these favourable results the Hanover Railway Company resolved to give the system a further trial, and with the approval of the Minister of Public Works ordered two six-coupled goods engines to be built on the compound system. These engines, together with ten normal goods engines, were ordered from Messrs. Henschel and Son, of Cassel, and were set to work in December, 1882. These engines are shown above, and only differed from the other engines so far as was necessary for the compounding to be carried out. Their principal dimensions are as follows:—

Diameter of right cylinder	460 mm.		18·1in.
Diameter of left cylinder	650 mm.		25·6in.
Proportion of area	1:2		1:2
Length of stroke	630 mm.		24·8in.
Diameter of wheel	1330 mm.		4·36ft.
Total wheel base	3400 mm.		11·15ft.
Total length of frames	8000 mm.		26·24ft.
Total length of engine	8891 mm.		29·16ft.
Steam pressure	12 atm.		12 atm.
Size of grate	1·53 sq. m.		16·47 sq. ft.
Total heating surface	121·6 sq. m.		1300 sq. ft.
Weight empty	35·6 tonnes		35 tons.
Weight loaded	39·7 tonnes		39 tons.

The cylinder is inclined at a slope of 1 in 40. The steam passes from the steam dome to the right-hand or small cylinder, partially expands there, and exhausts into the receiver pipe within the smoke-box. From thence it enters the large cylinder, and after completing its expansion there, passes to the chimney. To start the engine a reduction valve, 43 mm. diameter, was placed on the valve chest of the small cylinder. By this valve steam of one-third the boiler pressure could be admitted into the receiver, and so to the large cylinder. After starting, this valve was closed by a hand lever, placed close to the reversing screw. One of the engines was subsequently fitted with a Henschel reducing valve, shown below, having a piston behind the valve proper. On starting, this valve opens automatically, and



closes again as soon as the proper pressure is attained in the receiver, the pressure on the smaller area of the valve not being able to open it against the pressure on the piston.

In certain positions of the crank the receiver pressure would act at starting as a back pressure against the smaller piston. To prevent this a small valve, 1in. diameter, is provided, by which in such a case steam may be admitted to the other side of the smaller piston and thus put it in balance. The arranging of the points of cut-off was managed, not by dividing the reversing shaft, but by placing the levers which work the valves at an angle of 50 deg. from each other, instead of parallel as usual, the rods being, of course, of different lengths. Thus, in full forward gear, the lever of the right-hand valve is parallel to the centre line of the valve, whilst that of the left-hand valve is inclined to it. If the position is now changed from forward gear to mid gear, the right-hand slide moves more quickly than the left on account of the more favourable position of the lever, and the cut-off diminishes more quickly in the right cylinder than in the left. For forward gear the variations of cut-off are as follows: Small cylinder (right hand), 0·2, 0·4, 0·6, 0·8; large cylinder (left hand),

* See however Mr. Webb's paper recently read before the Institution of Mechanical Engineers at Liège, and the discussion thereupon.

0·32, 0·5, 0·66, 0·8. In backward gear the reverse is the case, but as tender engines never run backwards in regular working this is not of much importance.

The action of the steam is sufficiently shown by the indicator diagrams below. These give the diagrams taken from each end of each cylinder, with cut-off varying from eight to two-tenths of the stroke. It will be seen that with each cut-off the mean pressure on the small piston is about double that on the large piston, so that they do nearly the same work. Again, with the ordinary cut-offs, 0 3 to 0·5 in the small cylinder, the diagrams are very sharp and good, showing that there is no serious loss of pressure in the receiver. The mechanism attached to both pistons is alike, and precisely the same as on the normal engines. It was not thought necessary even to increase the counterweight on the side of the large cylinder, as its piston is only 100 lb. heavier than the other. The boiler was made of 2in. less diameter than the normal engines, on account of the higher pressure, and had five tubes fewer. The smoke-box was made somewhat longer to accommodate the receiver pipe. In all other points the two classes of engines were alike, the compound being distinguished merely by the different diameter of cylinders, different height of valves, different arrangement of steam pipes, and the presence of the reducing valve and back-pressure valve. The distribution of weight on the running wheels is as follows, in kilogrammes :—

	Empty.			Working order.		
	Left.	Right.	Total.	Left.	Right.	Total.
Leading axle ..	6300	6350	12,650	6850	6850	13,700
Driving axle ..	6400	6200	12,600	6450	6450	12,900
Trailing axle ..	5050	5300	10,350	6550	6550	13,100
Grand total..	—	—	35,600	—	—	39,700

This distribution is very good. The equality of the load on the right and left wheels is due to the fact that the large cylinder has thinner walls, and that the reversing lever, &c., is on the opposite side. On the whole the compound engine weighs only 1100 kilogs. (1·1 tons) more than the normal engine, and this difference might be easily decreased. The working of the compound engines is thoroughly satisfactory. Their power is somewhat in excess of the normal engines, *i.e.*, they can haul about 10 pairs of wheels more under equal conditions. Fully loaded trains, say of 120 to 130 pairs of wheels, can be hauled on gradients of 1 in 300 with a cut-off of 0·5 to 0·6, and on the level with 0·3 to 0·4. With such cut-offs the action of the steam is very regular and perfect. With a cut-off of 0·4 or less there is no audible beat of the exhaust steam, and the fire burns quite uniformly. There is never any escape of sparks from the funnel, so that a spark-arrester, which was originally fitted, has been removed; and only a very small quantity of fine ash collects in the smoke-box. The easy going of the engine is much praised by the drivers, and is no doubt due to the fact that the pressures on the two pistons are better arranged in relation to each other than with normal engines. The reversing gear and reduction valve work perfectly, and in shunting, &c., the engine is just as handy as any other.

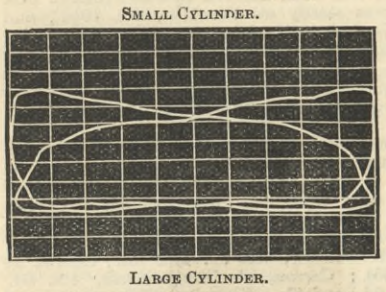
The comparative economy of fuel was tried by running the two compound engines alternately with two normal engines of the same set, on two quick and heavy trains, and upon a trip which told severely upon the power of the engines. In eight weeks an economy of 9½ per cent. was realised, whilst the weight of the trains was on the average 6 per cent. greater with the compound than with the normal engines. Thus it appears that the saving in fuel was only one-half what it had been with the omnibus engines. The reason of this difference lies in the fact that the goods engines when on steep gradients, and therefore using most steam, had to go very slowly, and therefore the action of the blast pipe at each semi-revolution was very irregular. This irregularity causes defects in the combustion, and cooling in the gases of the tubes. On the other hand in the omnibus trains the speed was much higher, and the cut-off was seldom more than 0·4 ; the combustion was then very uniform and the working perfect. It follows that the compound system will give best results with passenger or express trains. Now such engines consume a large part of the power—in express trains often one-half—in moving themselves ; and since the better utilisation of the steam comes in aid of the compound system, it may be expected that the power of a locomotive for the same consumption of steam will be much greater, in some cases as much as 20 to 30 per cent. The smaller consumption of steam will also improve the working of the boiler, and it may be expected that a saving of at least 15 to 20 per cent. of fuel will be effected. The cost of the compound engines here described was about £75, or 4 per cent., above that of the normal engines, whilst their power was greater by at least 6 per cent. Therefore, for goods engines the cost compared to the power may be considered equal, whilst with passenger engines it is in favour of the compound system.

In conclusion, this experience has established the fact that compound engines are thoroughly satisfactory as far as power is concerned, whilst their safety in working is superior to that of ordinary engines, inasmuch as the mechanism has a smaller strain upon it, and friction, with the accompanying danger of heating, is diminished. In special cases there is the advantage that the full steam pressure can be at once turned on the small cylinder, whilst if there is a breakdown on one side, the other can still be used as usual.

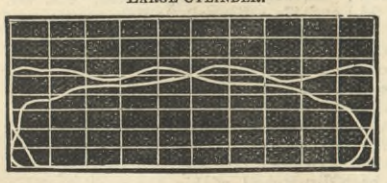
In the discussion Herr Stambke, the president, observed that the applicability of the compound system to locomotives was no longer in doubt, and that the simplicity of construction in the engines described was a distinct advance in the question.

No. 1.

Small Cylinder.



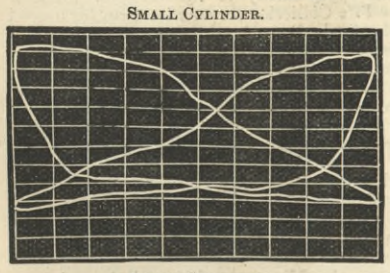
Large Cylinder.



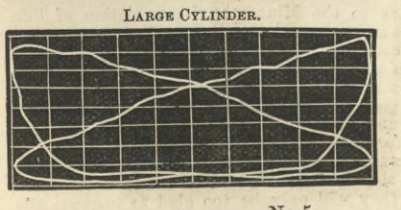
Cut-off at 0·8 (small cylinder after starting); boiler pressure = 12 atm.; mean effective pressure in small cylinder, 4·59 kg. per sq. cm.; mean effective pressure in large cylinder, 2 23 kg. per sq cm.; pressure in large cylinder reduced to dimensions of small cylinder, 4·46 kg. per sq. cm.

No. 4.

Small Cylinder.



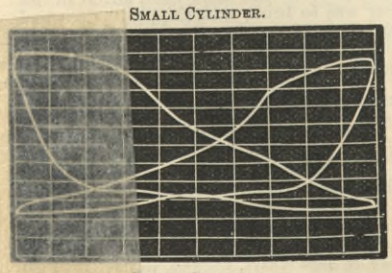
Large Cylinder.



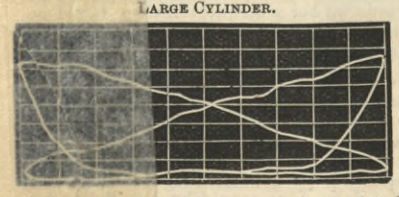
Cut-off at 0·4; boiler pressure = 12 atm.; mean effective pressure in small cylinder, 3·68 kg per sq. cm.; mean effective pressure in large cylinder, 2 07 kg. per sq. cm.; pressure in large cylinder reduced to dimensions of small cylinder, 4·14 kg. per sq. cm.

No 5.

Small Cylinder.



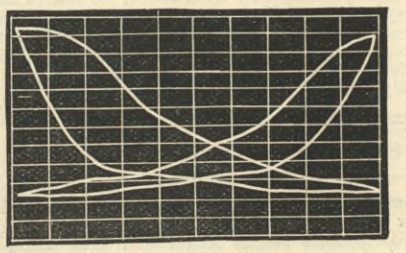
Large Cylinder.



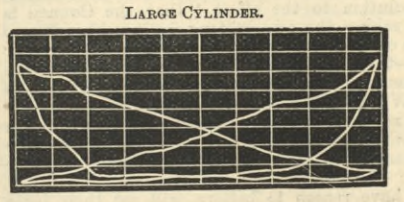
Cut-off = 0·3; boiler pressure = 11·4atm.; mean effective pressure in small cylinder, 3·08 kg.; mean effective pressure in large cylinder, 1·55 kg.; pressure in large cylinder reduced to dimensions of small cylinder, 3·10 kg.

No. 6.

Small Cylinder.



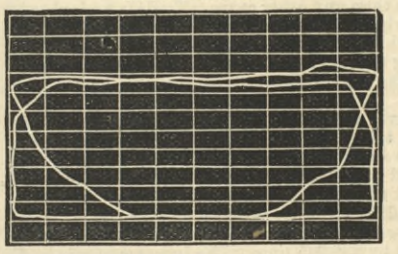
Large Cylinder.



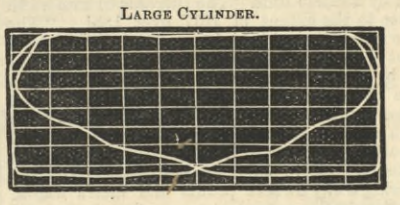
Cut-off, 0·2 ; boiler pressure, 12 atm.; mean effective pressure in small cylinder, 1·83 kg.; mean effective pressure in large cylinder, 1·01 kg.; pressure in large cylinder reduced to dimensions of small cylinder, 2·02 kg.

No. 7.

Small Cylinder.



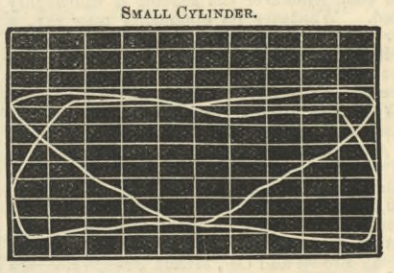
Large Cylinder.



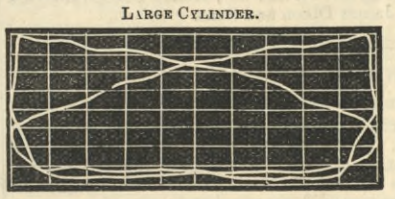
Cut-off, 0·7 ; boiler pressure, 11 atm.; mean effective pressure in small cylinder, 6·48 kg.; mean effective pressure in large cylinder, 3·16 kg.; pressure in large cylinder reduced to dimensions of small cylinder, 6·32 kg.

No. 8.

Small Cylinder.



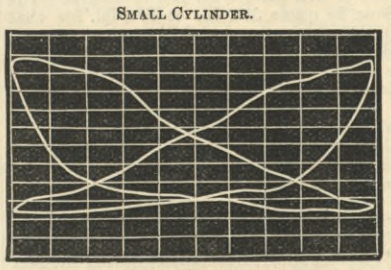
Large Cylinder.



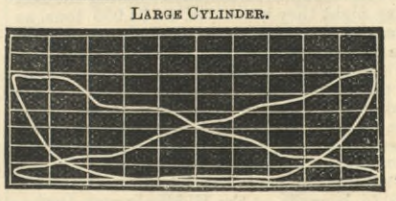
Cut-off, 0 6 ; boiler pressure, 11·8 atm ; mean effective pressure in small cylinder, 5·32 kg.; mean effective pressure in large cylinder, 2·61 kg.; pressure in large cylinder reduced to pressure in small cylinder, 5·22 kg.

No. 10.

Small Cylinder.



Large Cylinder.



Cut-off, 0·3.; boiler pressure, 11·5 atm.; mean effective pressure in small cylinder, 2·88 kg.; mean effective pressure in large cylinder, 1·29 kg.; pressure in large cylinder reduced to dimensions in large cylinder, 2·58 kg.

Indicator Diagrams from Compound Engine No. 545.

Date.	No. of diagram.	Cut-off, small cylinder.	Boiler pressure.	Revs. per second.	Mean effective pressure.		Pressure in large cylinder reduced to small cylinder.
					Small cylinder.	Large cylinder.	
			atm.		kg. per sq. in.	kg. per sq. in.	kg. per sq in.
January 23 ..	*1	·8	12	—	4·59	2·23	4·46
,, ..	2	·6	11	1·5	4·20	2·61	5·24
,, ..	3	·5	11·4	2	4·49	2·34	4·68
,, ..	*4	·4	12	2	3·68	2·07	4·14
,, ..	*5	·3	11·4	2	3·03	1·55	3·10
,, ..	*6	·2	12	2	1·83	1·01	2·02
February 13 ..	*7	·9	11	—	6·48	3·16	6·32
,, ..	*8	·6	11·8	1·5	5·32	2·61	5·22
,, ..	9	·4	11·8	1·6	3·29	1·70	3·40
,, ..	*10	·3	11·5	2·6	2·88	1·29	2·58

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

(*From our own Correspondent.*)

On 'Change to-day—Thursday—in Birmingham, and yesterday in Wolverhampton, business was more active; but the extent of new business done was not very considerable.

Bloomfield sheets were named as: 20 w.g., £9 ; 21 w.g. to 24 w.g., £10 10s.; 25 w.g. to 27 w.g., £12; best sheets, 30s. per ton extra ; best best ditto, 50s. per ton extra ; and best charcoal ditto, £10 5s. per ton extra. Summer-hill sheets not larger than 10ft. by 3ft. by ⅛in., £9 10s.; best sheets of the same price, £10 10s. Monmoor sheets, £8 10s.; best, £9 10s.; best best, £10 10s.; and charcoal sheets, £17. Gold's-hill sheets, singles, 96in. by 36in., £9 ; doubles, 84in. by 36in., £10 10s.; lattens, 72in. by 30in., £12; best sheets, £1 per ton extra ; and best best ditto, £2 per ton extra.

Woodford brand, 20 w.g., £9 ; 21 to 24 w.g., £10 10s.; 25 and 26 w.g., £12 ; and 28 w.g., £12 10s.; Woodford best, £13, £14 10s., £16, and £16 10s., according to gauge ; Woodford double best, £14, £15 10s., £17, and £17 10s. respectively; Woodford treble best, £15, £16 10s., £18, and £18 10s. respectively ; Woodford charcoal, £17, £18 10s., £20, and £20 10s. respectively. Close annealed Siemens-Martin mild steel sheets were £15, £16 10s., £18, and £18 10s. according to gauge.

Angles, £8 10s.; best ditto, £9 ; and double best, £10. Rivet iron, £8 10s.; best, £8 15s.; and double best, £10 5s. Tang iron, ⅜in. and $\frac{7}{16}$in., was £7 10s.; best, £8 10s.; and best best, £9 10s. Plating bars and cable iron were £8 for common, £9 for best, and £10 for double best sorts.

William Barrows and Sons' angles, rivet iron, and T-iron, £9 10s. for ordinary sorts ; and best best, £10 10s. Plating bars, marked "B.B.H. Crown" were £8 ; best ditto, £9 10s.; and best best charcoal ditto, £16.

Bars, £7 10s. to £8 2s. 6d. Common qualities move steadily at £6 5s. and £6 2s. 6d.

Strip iron was firm in price to-day. Most makers were quoting £6 5s.

In new business the pig market is not brisk, consumers still holding aloof in the belief that the tendency is towards further weakness. Average all-mines are quoted 60s. a ton, with best houses 5s. extra; medium sorts 50s.; and part-mines 45s. Serviceable descriptions at 42s. 6d. and 40s. run some of the established part-mine qualities hard. Hematites were not largely offered. The prices mostly quoted were 62s. 6d. and 60s.

The coal market was quiet. Forge qualities were abundant from Cannock Chase at 6s. per ton at the pits.

The demand for agricultural requisites has this season somewhat improved.

Galvanised light roofing work keeps many hands in active employment, but the roofing engineers complain that the little new business coming forward is without tone, and that prices are unremuneratively low.

The Midland Steam Boiler Inspection and Assurance Company at its annual meeting on Wednesday, in Wolverhampton, reported a profit on the year of £567. The payment of a 4s. per share dividend absorbed this, together with a further £47 taken from the reserve fund, leaving that fund at £6040. In the Southern district the boilers assured numbered 1257, and those inspected 809, making a total of 2166. In the Northern district the boilers assured numbered 673, and those inspected 329, making a total of 1002; making a grand total of 3068 boilers under the company's supervision, or 40 fewer than last year. Some little time ago a new company for insurance and inspection, consisting of influential members of the iron trade, was projected, but arrangements have been made for averting the threatened competition by the projectors taking shares in the Midland Company, and being represented on the directorate. During an existence of twenty-one years the operations of this company have exercised a very sensible influence in preventing explosions in Staffordshire, and the suggestions of its engineers have done much to improve the types of construction now in vogue in the district. With but one or two exceptions, it is the oldest company of the kind in the kingdom. The present chief engineer—Mr. E. B. Marten—who has been connected with the company since its formation, showed at the annual meeting in Wolverhampton on Wednesday, as examples of the various effects of explosions met with in practice, a number of models of fractured plates and the like, which have been highly spoken of by engineers in London, Middlesbrough, and other large engineering centres. In his report for the year ended June 30th last, Mr. Marten says there was no explosion during the year among the 1138 boilers under inspection, but a compressed air cylinder ruptured through the firing of gas within it. Of the 1930 assured there were seven slight cases of injury from shortness of water.

The South Staffordshire Institute of Iron and Steel Works managers on Friday had their annual excursion ; the place chosen being Messrs. Tangye's works at Soho. Amongst the many things inspected were the hydraulic lifting jacks and other hydraulic machinery, steam and gas engines in motion, the Wilson gas

* These diagrams are reproduced on this page.

producer gas furnaces, and the Siemens-Martin regenerative furnace.

In connection with the efforts now being made to organise the ironworkers in North Staffordshire, a large meeting of workmen was held on Monday at Hanley. Since 1878, their wages had, speakers stated, been regulated by the South Staffordshire Wages Board, and they were now dissatisfied with its operations. Resolutions were adopted giving notice of secession from the Board, and asking the employers to hold a meeting with a view to the formation of a Conciliation Board for the north of the county.

The market in North Staffordshire for light rolled iron is quieter than of late, and the demand is now more appreciable for heavy finished iron. Current demand for raw iron is contracted; nevertheless, the output and the sales of ironstone do not diminish.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—In a hand-to-mouth fashion there is a quiet, steady business doing in the iron trade of this district, and prices are well maintained, but the market continues without animation. Consumers generally show a strong disinclination to buy beyond their immediate requirements, and as users of pig iron have in most cases pretty large deliveries still to come in on account of old contracts, the weight of raw material actually required for present use is only very small. Finished iron makers generally have their books full of orders, but these are chiefly for early delivery, and they are more open to sell forward than for prompt specification.

The business doing at the Manchester iron market on Tuesday was again only small. For pig iron there was only a very meagre inquiry, and the continued absence of demand would seem to have had the effect of bringing sellers of some of the low-class district brands into the market at low prices, as iron was reported to have been bought at considerably under the current rates. There is, however, no perceptible weakening on the part of the better class makers, except that the slight attempt at an advance which was recently attempted in some cases has been scarcely maintained. Lancashire pig iron makers still hold firmly to 45s. and 45s. 6d., less 2½ for forge and foundry qualities delivered equal to Manchester, and for good brands of district iron 44s. 10d. to 45s. 10d., less 2½ for forge and foundry. Lincolnshire is the minimum basis of quotations.

In hematites there is still only a very small business doing, but occasional sales are made at about 59s., less 2½ for good foundry brands delivered into this district.

At the comparatively low prices now ruling for finished iron makers are kept fairly busy, and in most cases are indifferent about booking orders for quick delivery. The chief demand is for hoops and sheets, bars if anything being rather quiet. The minimum quoted rates for delivery into the Manchester district remain at about £6 2s. 6d. to £6 5s. for bars; £6 10s. to £6 12s. 6d. for hoops; and £8 5s. to £8 7s. 6d. for sheets.

Shipping inquiries are showing more animation as the season advances, and I hear of American buyers being over here keeping a watch on the market. At present there are several questions under the new tariff before the United States Treasury for consideration, and the decision with regard to these will no doubt influence the orders given out here.

The demand for locomotive and general railway plant, and for marine engine work, is keeping some of the leading branches of the engineering trade fully employed, but indications point rather in the direction of decreasing activity with a continued quietening down in the cotton machine trade.

Messrs. W. H. Bailey and Co., of Salford, have in hand for the Russian Government the construction of one of Professor Thurston's testing machines, for testing the torsion and ductility of metals which has been ordered for the Russian School of Engineering.

The action of the House of Lords Committee in throwing out the Manchester Ship Canal Bill has not deterred the promoters from renewed efforts to carry out the project. At a special meeting of the subscribers to the Parliamentary Fund held on Wednesday, resolutions were unanimously passed empowering the committee to proceed with the scheme, and it was strongly urged that the requisite steps should be at once taken to secure the consent of the Mersey Conservators to the plans for the improvement of the estuary. We may add that the rejection of the Bill has been a great disappointment to the commercial classes in the district, but whilst there is no doubt a very strong conviction that the construction of the canal, if not absolutely necessary to preserve the commercial position of Manchester, is at least essential for the interests of the district, the financial support which the scheme is likely to receive from the investing public is a very doubtful question. The financial aspect of the project is in fact its least satisfactory feature, and the statement presented to the subscribers with regard to the Parliamentary fund can scarcely be regarded as one likely to encourage the most sanguine expectations of success.

Messrs. Mather and Platt, of Salford, have put down special plant for lighting the whole of the Manchester Theatre Royal, where nearly 500 lights are employed each evening. The installation is placed in the basement of an adjoining warehouse, and consists of boilers, with engines and dynamos in duplicate, one section supplying the light each evening, whilst the other is kept revolving slowly in readiness for any mishap, or in the event of it being found necessary to change from one set to the other, which can be readily effected with scarcely any perceptible pulsation being caused in the lights. The boilers are of the locomotive multitubular type, with a working pressure of 120 lb. The engines are of the compound tandem class, and have the fly-wheel ends raised higher than the cylinder ends, the bed-plate being carried on a strong oblique stand for the purpose of keeping the driving belts for the dynamos above the floor line. The high-pressure cylinders are 12in., and the low-pressure 19in. diameter, with a stroke of 16in., and fitted with Mather and Platt's patent elastic metallic piston and steel rods cottered together inside the low-pressure cylinder. The valves are of the ordinary slide and expansion class, the expansion plates of each being adjusted separately by hand-wheels, and the cut-off for each cylinder is entirely independent. The valves are worked by two excentrics with wrought iron slides moving in cast iron brackets. The piston crosshead is turned to fit the slide, which is bored. The fly shaft is of wrought iron, and has the crank disc shrunk on the front end and the coupling on the back end, this coupling being added for the purpose of connecting the engines, if necessary, and running them together. The fly-wheel is very massive, and has two cast iron rings bolted on the rim, for driving the dynamos direct. The engines run at 190 revolutions, or 506ft. of piston per minute, and are governed with a quick-speed "Porter" and equilibrium valve. The dynamos are of the Edison K, or 250-light class, and are four in number, being used alternately in pairs, and are driven, as already stated, direct from the fly-wheel by 8in. patent link belts running at 3280ft. per minute. The electric current is transmitted from the dynamos to the theatre through four cables placed under the floor of the warehouse, and carried under the street in cast iron pipes 4in. in diameter.

During the past week the anticipation of an advance in the price of coal has tended to bring forward an influx of orders. There is, however, no great pressure for supplies generally, and there is no very great anxiety on the part of buyers to place out orders. As I intimated last week most of the coalowners in West Lancashire have, with the close of the month, decided to advance their pit prices for round coal 6d. to 1s. per ton, and the leading Manchester firms have advanced their delivered rates for house coal 10d. per ton. This upward movement is, however, based more on the anticipation of a rush of orders during the ensuing month, rather than upon any present greatly increased demand, as trade generally cannot be said to be more than fairly active for the time of the year. In burgy and slack, which still meet with only a slow sale at late rates, no alteration is being made. At the pit mouth prices now average 10s. for best coals, 8s. for seconds, 6s. to 6s. 6d. for common, 4s. 6d. to 5s. for burgy, and 3s. 6d. to 4s. for good slack.

Barrow.—The hematite pig iron trade still maintains its inactivity of the previous week, and the position at present is less satisfactory than it has been during the dull time of the past few months. From all quarters there is a falling off in the demand, especially on American account. It was from this quarter that the largest amount of business was effected; but it would seem that the wants of some consumers in the country can be fully satisfied at home. There is a downward tendency in prices, but they are not quotably altered. No. 1, 50s.; No. 2, 49s.; and No. 3 forge, 48s. per ton at makers' works. The output at the furnaces is fully maintained to the same extent as the past few months, and this is found to be quite sufficient to meet deliveries and fresh contracts; consequently, stocks which are largely held do not diminish, notwithstanding the exportation of metal. Steel makers fairly well employed, but orders of any moment are not being booked to the extent desirable. Prices are fairly well maintained, £4 15s. to £5 being quoted for heavy sections of steel rails. Iron ore quiet, with an increasing stock at the mines. Present rates are from 9s. to 11s., according to sample. Iron shipbuilders not very well placed for orders, but negotiations likely to lead to business are going on. Other industries steady. Shipping rather quieter.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

As I anticipated some time ago, a movement has been commenced among the miners for securing an advance in wages. The South Yorkshire and North Derbyshire Miners' Association have unanimously passed a resolution to the effect "that the Council is strongly in favour of asking the owners for a 5 per cent. advance upon the present rate of wages, and hereby instructs the secretary—Mr. W. Chappell—to communicate with the officials of the Yorkshire Miners' Association, with a view of asking the owners to convene a meeting at which the proposal may be amicably discussed." It was also resolved to render vigorous assistance to the men in North Staffordshire, who are out on strike against the demands of the owners for a reduction of 10 per cent. in their wages.

The coalowners, I have reason to believe, will set their faces against any disturbance of the wages question at present. A strong feeling prevails that a period of quiet will do more to put the coal trade on a sound basis than any other cause. Trade is undoubtedly "picking up," if slowly, and any unsettling of the wages arrangements, it is held by the coalowners, could only have one effect, and that the retarding of the gradual revival. Demand is steadily overtaking supply, and no artificial measures can hasten that process.

The Yorkshire Miners' Association has just issued a report with regard to the trade, the wages, the output, the accidents, and deaths in the Yorkshire coalfield. In 1882—the report states—the trade of Yorkshire and the United Kingdom has again shown a vast increase over that of 1881. In the year 1881 there was a large increase over that of 1880—an increase many people thought which could not be over-topped in 1882, but in the latter year the figures of 1881 were increased by 288,265 tons. The increase of miners in the pits had taken place to the extent of 1017 over 1881. "The class of men—adds the report—must have been of an inferior order, seeing that the output per man does not come up to the general average for Yorkshire by about 66 tons per man." In the United Kingdom they had an output of 156,499,977 tons of coal, or an average of about 301 tons per man, or 9½ tons per man less than the average in 1881. The increased output, say the officials of the Yorkshire Miners' Association, still continues to call sternly to the miners to decrease the output, in order to remedy the present wrong system of bartering away owners' profits and men's wages. "Restriction or regulation of the output means a great deal to the producers and sellers of coal, whenever the scheme is thoroughly and universally adopted. Whatever its opponents may say, a change will come over the various markets connected with the trade. Non-paying—if there are any—collieries will realise dividends, and collieries now paying dividends will realise immense profits. In consequence of such a state of things wages are bound to improve," and the Yorkshire Miners' Association are urged to never allow the agitation to drop, "but more than ever and with increased zeal stir up the whole country to take action, and so hasten good times," all which means that as the winter approaches we shall have the old struggle renewed.

Prince Swasti Sobhou, brother of the King of Siam, accompanied by his *attachés* and tutor, has visited Sheffield this week, and inspected the processes of manufacture at the works of Messrs. Thos. Firth and Son, John Brown and Co., Messrs. Joseph Rodgers and Sons, and Messrs. James Dixon and Sons.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

The Cleveland pig iron trade has been quiet and steady during the past week. No. 3, G.M.B., is still very scarce, but makers have not advanced their prices as it was thought they would do. Not much business was done at the market held at Middlesbrough on Tuesday. Whatever iron did change hands, was for prompt delivery, and on the basis of 39s. per ton for No. 3, G.M.B. The principal makers continue to quote 39s. 3d. to 39s. 6d. for that grade. No. 4 forge was not so scarce, and could be had at 37s. 9d. to £38 per ton net cash; very few sales were, however, made. Buyers generally were offering 38s. 9d. for No. 3 for forward delivery, but sellers held back in the expectation of doing better by waiting.

Warrants are in slightly improved demand now that No. 3 is so difficult to get from makers, and 39s. per ton f.o.b. is freely given by merchants who require iron to make up shipments.

The stock of Cleveland iron in Messrs. Connal's store at Middlesbrough on Monday last was 71,991 tons, or 500 tons less than on the previous Monday. In their Glasgow store they hold 584,896 tons.

The pig iron shipments have improved somewhat during the last few days, and on Monday night they amounted to 71,955 tons, as compared with 76,245 tons in the corresponding twenty-seven days of July, and 78,905 tons during the same period in August, 1882.

There is no change in the manufactured iron trade. The pressure for delivery is still maintained, as the shipyards are all working full time and making the most of the fine weather. Ship plates are £6 5s. per ton; angles, £5 10s. to £5 12s. 6d.; and bars, £5 17s. 6d., less 2½ per cent. discount, and delivered free on trucks at makers' works.

The North-Eastern Railway Company has let the contract for the extensive alterations to be made at the Middlesbrough Docks, and operations have already been commenced. About £10,000 will be expended on the new work.

The half-yearly meeting of the shareholders of the Scarborough and Whitby Railway Company was held at Scarborough on Saturday last. The report stated that about one-half of the permanent way was now laid, and the engineers and contractors see no reason why the line should not be opened for traffic by June next. The Esk Viaduct, one of the most important works on the line, is in course of construction and in a fair way towards satisfactory completion.

A Council meeting of the Cleveland Miners' Association was held on the 27th inst. at Saltburn, to discuss the desirability of having a new sliding scale to take the place of the present one which terminates at the end of the year. It was unanimously resolved that no future sliding scale be agreed upon unless it can be made to regulate the wages of members of the Association only. It appears that a great number of the men cease to pay their contributions to the Association so soon as the wages are fixed for a definite period, and this has given rise to great dissatisfaction.

Mr. F. W. Stoker, formerly general manager to Messrs. Johnson and Reay, iron manufacturers, Stockton, and more recently manager of the rolling mills department of Messrs. Palmer's Shipbuilding Works, Jarrow-on-Tyne, has just been promoted to the position of assistant general manager at the last-mentioned works.

The devastation at Boosbeck, in Cleveland, owing to subsidence of the surface through mining operations, still continues. It appears that the land and minerals both belonged to Mr. Christopher Jackson, of Saltburn. He sold the surface to various persons for building purposes, and the minerals to Messrs. Stevenson, Jacques, and Co., of Middlesbrough. He did not insist upon the latter firm leaving pillars in order to support the surface. Consequently, after mining to the end of their limit, they came back, taking out the pillars. Presently, as might be expected, the surface fell in. The damage is estimated at £10,000, and the value of the pillars removed at £200. It will be for the law courts to decide who must bear the loss.

The North of England iron manufacturers will have to consider next month whether or not they will give notice to terminate the present restrictive arrangement, whereby only ten shifts per week are worked, at the end of the present year. It has now lasted for nearly six months. It was entered into by the wish of a majority of the employers, and of the whole of the operative representatives, in the hope it would lead to higher prices of finished iron and higher wages. That hope has been entirely disappointed, although it is impossible to say how much worse things might have been but for its existence. At any rate, the employers have found the arrangement irksome, and of doubtful benefit, and in all probability they will not consent to its renewal next year. In the month of October ironworkers' wages will be again regulated by Dale's sliding scale, the first effect of which will probably be to make a reduction of from 5 to 7½ per cent.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

There is no improvement in the condition of the Glasgow warrant market, which has been lifeless during the entire week, with prices showing hardly any change. But while the speculative department is thus inactive, a large business is being done both for home consumption and shipment, and the stocks have consequently not increased so much as in the past few weeks. The exports of pigs for last week are particularly gratifying, amounting to upwards of 17,000 tons, as against 13,000 in the corresponding week of last year. An additional furnace has been put in operation at the Calder Ironworks, there being now 115 blowing, compared with 109 in the last week of August, 1882. The demand from the United States is still rather unsatisfactory, but large shipments are taking place to Canada, Italy, and Germany. This week the values of iron show little change.

Business was done in the warrant market on Friday morning at 46s. 11½d. cash, and 47s. 1½d. one month; the afternoon quotations being 46s. 11½d. and 46s. 11d. cash, and 47s. 1½d. one month. On Monday the market was steady at 46s. 11d., 46s. 10½d., and 46s. 11½d. cash, and 47s. 1½d. to 47s. 1d. one month; these being the figures both forenoon and afternoon, and there was scarcely any change on Tuesday. Business was done on Wednesday at 46s. 10½d. to 47s. 0½d. To-day—Thursday—transactions were effected at 47s. 1d. to 46s. 11d. cash and 47s. 3d. to 47s. 2d. one month.

The quotations of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 56s. 6d.; No. 3, 52s. 6d.; Coltness, 60s. and 52s. 9d.; Langloan, 59s. 6d. and 52s. 9d.; Summerlee, 57s. 6d. and 51s. 6d.; Chapelhall, 57s. and 54s.; Calder, 57s. 6d. and 50s. 3d.; Carnbroe, 55s. and 49s.; Clyde, 50s. 6d. and 48s. 6d.; Monkland, 48s. 3d. and 46s.; Quarter, 47s. 6d. and 45s. 6d.; Govan, at Broomielaw, 48s. 3d. and 46s.; Shotts, at Leith, 59s. 6d. and 55s.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s. 6d.) and 47s.; Kinneil, at Bo'ness, 49s. and 47s. 6d.; Glengarnock, at Ardrossan, 55s. and 47s. 6d.; Eglinton, 48s. 6d. and 45s. 6d.; Dalmellington, 49s. 3d. and 48s. 3d.

The manufactured iron trade maintains its former activity, there being a considerable pressure put upon some makers for the delivery of goods, but prices exhibit little or no alteration.

In the coal trade an active demand is experienced, although the shipping orders at some of the ports are not quite so heavy for future delivery as was anticipated. To the Continent and Canada, however, good cargoes have been dispatched within the past week or two. These observations apply chiefly to the Glasgow district. The stocks of coal at the Fife Collieries are smaller than for a good many years back, and the trade is good, while the inquiries seem to indicate that it will become better in the course of September.

The miners do not show so much enthusiasm in their participation in their movement for advanced wages as might be expected. In some places the men act at the open-air meetings as if their stoppage of work for the day—they now try to observe each Thursday as an idle day—were merely for holiday purposes. The fact is the colliers have been earning good steady wages for a considerable time past, and they are besides destitute of leaders in whom they can place confidence. The advance sought for in both the east and west is 6d. a day, and the employers will not hesitate to pay it, so soon as the price of coal rises so far as to warrant the concession being made without loss to the trade.

Mr. Connel, secretary to the Mineowners' Association of Fife and Clackmannan, has addressed a letter to Mr. Weir, the miners' secretary for the two counties, in which he says:—"I have had a meeting of coalowners at which I submitted your letter, in which you state that the men are of opinion that the greatly improved prices and continued good trade sufficiently warrant their asking an increase of wages, and I am instructed to reply that the men must have been misinformed, as the prices realised will not afford a further advance of wages at present, but the coalowners are in hopes that prices will shortly improve, and on the earliest opportunity that they can they will only be too glad to increase the wages." At a public meeting of the men since held, Mr. Weir has asserted that trade never was so brisk, and shipping prices had increased 1s. 6d. per ton. Notwithstanding the refusal contained in the above letter, he advised the men to send deputations to the employers on the question, and this was agreed to.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

I commented last week on the decline in steamship speculations. Singularly enough this week has been a disastrous one to Cardiff steamers, three or four having been wrecked, and amongst these the City of Durham, a vessel that has been the subject of more discussion than any other of late years, though, having got into new hands, it was expected that her subsequent history would be a gratifying one to shareholders. Mr. Angel, Cardiff, received notice on Monday of the total loss of this vessel on Saint's Head, Ushant. The same day Mr. John Cory heard of the loss of the Rydal, Mr. Fowley of the loss of the Edith, and on Tuesday Messrs. Cory were advised of the loss of the Rapid off Brest. These disasters may now improve steam shipping investment.

New coal finds have been a feature of late. The four-feet and six-feet have been struck near Cefn Pennar by Messrs. Beith. On the Plymouth estate a large area of four-feet has been found, and will be worked from Abercannaid by Mr. Bailey for the Plymouth Company; and Cyfarthfa has struck upon a missing seam near Pleasant View, which will prove a valuable addition. The Plymouth original four-feet—that which originated the name of the Merthyr four-feet—contains about 95 per cent. of carbon, and is one of the most valuable of the varieties.

It is the intention at Cyfarthfa to have a lengthy series of coke ovens erected, and the site is to be immediately in the rear of Ynysfach furnaces, but the kind of oven has not been decided upon.

Dowlais has entered upon a contract with the Coppée Company for the construction of the largest coal-washing machine in the kingdom. It will take seven tons of coal every five minutes, and manage easily a thousand tons per diem. The abandonment of tin-plate at Dowlais, now virtually decided upon, will give room for extension of mills, &c., and aid in the development of the steel works.

Cyfarthfa is pushing on well, and the spring may be said to give the date of practical operations.

The iron and steel trades are slow; little is doing, and prices are not remunerative. The only branch of the iron trade that shows any movement of note is that connected with the tin-plate trade, which shows distinct improvement and an upward scale of prices. The lowest quotation for ordinary coke tin-plate is now 16s.

Swansea is doing a large American business in plates at present, and its other business is active. In coal it despatched 34,000 tons last week, and nearly 9000 tons patent fuel. Cardiff and Newport are similarly busy in coal, and the highest averages of exports are kept up with vigour. Prices too are firm even for seconds, which realise freely 11s. f.o.b.

The action of the Marquis of Bute in continuing worked concessions, irrespective of the receiver being or not a Barry man, speaks well for the judgment and capacity by which he is advised. Lately two of the largest firms have had special tips allowed to them. Some of my contemporaries point to Ogmore as the next base of operations for the Barry promoters, but this is doubtful, as also an idea just floated that a branch of rail will be attempted from Peterstown on the Great Western Railway to Barry. There is a strong impression amongst the profession that if a Barry Bill came in again next session the preamble would be "not proven." Every month henceforth will see less reason for its promotion.

The estimated cost of the Barry Bill promotion was 5 guineas per minute for the whole period, forty-three days, the Bill was in committee.

Amongst the new companies started are the Cambrian Copper Company, Talybont, Cardiganshire, a company likely to promote railway enterprise in one of the backwoods of Wales, and Pontnewydd Tin-plate Company, which is to acquire the business so well carried on by Conway and Co.

The Bristol Channel Express Steamship Company is going to take up a trade that has been long neglected, and will put a fleet of steamers on service between Bristol, Cardiff, Weston-super-Mare, and other towns, on the shores of the channel. The first of the fleet, the Lady Margaret so-called after the daughter of the Marquis of Bute, was launched this week at Glasgow.

Several of the "Gales" of the Forest of Dean fell in this week to the Crown, royalties not having been paid up.

M. E. Peyrusson recently read a paper before the Academie des Sciéncés upon the danger of contagion from the use of cracked stone ware. He says the germs of cholera, typhoid fever, and similar diseases may be preserved even in the slight fissures on the glazed surface of crockery and faïence ware.

The Shipping Trade.—Messrs. H. E. Moss and Co., of Liverpool and London, in their half-yearly circular just issued, take a somewhat unfavourable view of the future of shipbuilding. They say that since February a large business in steamers has been done, and many of those building on speculation have changed hands at a fair margin of profit to the contractors, but that in June a reaction took place so rapidly that for a time shipowners and builders feared a panic might set in, with results that would prove fatal in many cases. Matters have, however, now smoothed down somewhat, and though the anxiety to realise is rather too eagerly shown by some holders, there is a decidedly better feeling, and there are better hopes of getting through the crisis with less calamity than was at first expected. Several causes have contributed towards this unquiet feeling, notably the low freights which have now been ruling for several months; and, secondly, the very general feeling that the market was overbuilt. The low freights unfortunately still exist, but as regards the new tonnage, it is silently absorbed—it is almost difficult to say by whom, but the fact exists—and it seems that very few steamers have been forced on the market and sold below contract price. Fortunately the foreigner is still as of heretofore a large buyer, and in addition to numerous purchases of ready boats, has placed orders with Clyde and other builders for many others. Though with few exceptions, yards are full for several months to come, there is an increasing anxiety among builders to book orders with the usual result, viz., that prices are easier for the buyer and worse for the producer. Mr. Moss holds, however, that there is no chance of any serious reduction in the cost of building for a long time to come. Materials are, as a rule, as low as they can be produced or imported, and labour is so unsatisfactory, and the men are so unreasonable, that it will prove a very unstable factor when any calculations of future cost have to be made. Iron sailing vessels are much sought after, and several orders for vessels of 1500 to 2000 tons register have been placed at £13 to £13 10s. The French Bounty seriously handicaps the British builder; for example, on a vessel, if built in France, of about 4200 tons, the premium paid by the Government to the shipowner would exceed by upwards of £5000 per annum the premium he would receive for a similar vessel if built in England; but, however, in spite of all this, orders are still given for long Cours vessels; and for coasting steamers —Cabotage—which do not participate in the premium, we have a practical monopoly. Messrs. Moss repeat what they have already said, that steel is not making the progress they expected it would make, and this will continue until improvements in the manufacture reduce the cost to a nearer approximate of iron.

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.

21st August, 1883.

4034. Preventing Glass-ware from Slipping, H. Walley, Manchester.
4035. Boats, H. F. Coombs, Canada.
4036. Fertilisers, H. J. Allison.—(*The Scribner Process Co. (Incorporated), New York, U.S.*)
4037. Electric Batteries, R. H. Courtenay, London.
4038. Cells of Voltaic Batteries, R. H. Courtenay, London.
4039. Hand-grip for Breech-loading Rifles, S. Bexfield, London.
4040. Solidifying Liquid Acids, &c., E. A. Brydges.—(*A. Marix, Paris.*)
4041. Grooming Brushes, A. Harvey.—(*R. W. Thompson, East Rockport, U.S.*)
4042. Furnaces, J. West, Manchester.
4043. Explosive Compounds. J. C. de Castro, London.
4044. Fibrous Packing, S. Pitt.—(*W. H. Perrine, New York, U.S.*)
4045. Joining Lead, &c., Pipes, H. J. Hampson, Manchester.
4046. Gas Motors, D. Clerk, Glasgow.
4047. Threshing Machines, E. Foden, Sandbach.
4048. Tramways, J. Hayes.—(*T. Sanders, Spuistraat, Amsterdam.*)
4049. Safety Appliances for Elevators, A. W. L. Reddie.—(*R. A. Chesebrough, New York, U.S.*)
4050. Augers, &c., H. J. Haddan.—(*H. E. Fuller and E. C. Bramhall, Washington, U.S.*)
4051. Tesserae. J. P. Rickman and A. Wood, London.
4052. Marine Night Signals, H. J. Allison.—(*R. J. Baker and J. P. Roberts, Providence, U.S.*)
4053. Regulating Fermentation in Liquids, W. P. Thompson.—(*H. G. Pommer and P. Ebell, Hanover.*)
4054. Universal Joints, W. G. Edmonds.—(*R. Edmonds, Norfolk, U.S.*)
4055. Propulsion of Vessels, H. Imray.—(*E. Oppikofer, Blumenegg, Switzerland.*)
4056. Instrument for Measuring Distances, J. T. Whish, Southsea.
4057. Compound Metal, H. H. Lake.—(*J. B. Jones, Brooklyn, U.S.*)
4058. Stoppers for Bottles, H. H. Lake.—(*F. B. Thatcher and J. W. Johnson, Connecticut, U.S.*)
4059. Galvanic Batteries, G. C. V. Holmes and S. H. Emmens, London.
4060. Traction Engine Brakes, W. Wilkinson, Wigan.
4061. Commercial Products resulting from the Operation of Galvanic Batteries, G. C. V. Holmes and S. H. Emmens, London.
4062. Rotary Pumps, S. George, London.

22nd August, 1883.

4063. Lacing Hook, H. H. Lake.—(*E. H. Train, Connecticut, U.S.*)
4064. Spring Punches, G. Sykes, Ashton-under-Lyne.
4065. Bevelling Metal Bars, N. Arthur, Leith.
4066. Shirt Studs, C. Cooper, Birmingham.
4067. Splitting Grain, H. Simon.—(*H. Seck, Dresden.*)
4068. Conveying Granular Materials, W. B. Dell, London.
4069. Bicycles, A. C. Henderson.—(*W. Bänerle, Augsburg, Germany.*)
4070. Lawn Tennis, &c., Bats, W. Chalmers, London.
4071. Galvanic Batteries, O. C. D. Ross, London.
4072. Securing Fur on to Hardened or Partially-felted Bodies of Wool, C. Vero and J. Everitt, Atherstone.
4073. Paper Boxes, T. Bishop, Birmingham.
4074. Pumps, A. J. Boult.—(*P. E G. Jacomy, Tarbes.*)
4075. Looms, A. M. Clark.—(*F. Charcot, New Jersey.*)
4076. Applying Colours to Surfaces, A. M. Clark.—(*H. Abbott and W. C. Garrison, Newark, U.S.*)
4077. Paper-making Apparatus, A. M. Clark.—(*M. Sembritzki, Zurich.*)
4078. Miners' Safety Lamps, S. Pitt.—(*H. Pieper, Liège.*)

23rd August, 1883.

4079. Chlorine, W. Weldon, Burstow.
4080. Gas Motor Engines, S. Griffin, Bath.
4081. Felt Carpets, W. Mitchell, Waterfoot.
4082. Valves for Taps of Casks, &c., H. Forman, Derby.
4083. Making Extracts of Orchal, B. J. B. Mills.—(*J. Peter, St. Etienne.*)
4084. Sugar, &c., G. Fry.—(*W. B. Espeut, Jamaica.*)
4085. Cutting Wheel Rack Teeth, &c., J. H. Stone, Birmingham.
4086. Low-water Safety Apparatus, J. W. Kenyon, Manchester.
4087. Slide Valves, J. Thom, Barrow-in-Furness.
4088. Steam Generators, &c, H. C. Bull, Liverpool.
4089. Horseshoes, E. Hewett.—(*C. Zincke, Hamburg.*)
4090. Velocipedes, H. H. Lake.—(*J. Larroque, Paris.*)
4091. Horseshoes, J. J. O. Wilms and J. H. G. Schaper, Hamburg.
4092. Velocipedes, J. Orme, London.

24th August, 1883.

4093. Surface Condensers, S. G. Browne, London.
4094. Walls for Fences, &c., W. Thompson, Wexford.
4095. Raising Sunken Vessels, R. W. Doherty, Liverpool.
4096. Varnish, E. T. Hughes.—(*J. Wojacrek, Vienna.*)
4097. Billiard Registers, T. W. Harding, Leeds.
4098. Bands, &c., W. White, Bingley.
4099. Railway Chairs, J. Revell, Dukinfield.
4100. Steam Traction Locomotive Cranes, T. Aveling, Rochester, and W. D. and S. Priestman, Kingston-upon-Hull.
4101. Thrashing Machines, J. Thomas, jun., Wrenbury.
4102. Apparatus for Measuring, &c., Cloth, J. Farmer, Salford.
4103. "Catches" for Skips, &c., J. Prisk, Redruth.
4104. Hanging Electric Lamps, T. T. Smith, London.
4105. Harvesting Machinery, J. Hornsby and J. Innocent, Grantham.
4106. Packing Case, J. Pearson and W. F. Orriss, London.
4107. Substitute for Sponges, S. Gamgee, Birmingham.
4108. Furnaces for the Combustion of Liquid Fuel, J. H. Selwyn, London.
4109. Supplying Disinfectants to Urinals, J. C. Kent, Bedfont.
4110. Electro-telegraphic System, A. Guattari, Paddington.

25th August, 1883.

4111. Straining Strings of Lawn Tennis Bats, W. Cole, London.
4112. Carts, &c., T. Briggs, Darwen.
4113. Forming a Ground in the Meshes of Net Fabrics, C. J. Cox, Nottingham.
4114. Casting Boxes, A. Sauvée, London.
4115. Sewing Machines, A. J. Hertu, Paris.
4116. Bullets, W. Bayliss & C. Brown, Birmingham.
4117. Washing Plates, H. Fletcher and F. J. Clarke, London.
4118. Brake, H. Pilkington, Bury.
4119. Files, J. Heap, Ashton-under-Lyne.
4120. Automatic Signals, L. Piskorski, London.
4121. Brushes, J. Thompson, London.
4122. Dyeing, &c., Fibrous Materials, L. Glover, Wakefield.
4123. Crushing Coal, &c., C. Sheppard, Bridgend.

27th August, 1883.

4124. Tricycles, C. Pollak, London.
4125. Making Trunks, O. Jacobi, Dresden.
4126. Beating Eggs, H. J. Newport.
4127. Metal Laths, G. M. Edwards, London.
4128. Atificial Palates, J. J. Wedgwood, London.
4129. Wardrobe Safety Locks, A. F. Martens, Hamburg.
4130. Steam Generators, W. A. G. Schonheyder, Shepherd's Bush.
4131. Ironing Machines, C. A. Allison.—(*G. W. Cottingham, Louisville, U.S.*)
4132. Stop Watches, A. Huguenin, Chaux-de-Fonds, Switzerland.
4133. Box for Holding Stamps, S. Edwards, London.
4134. Sorting Grain, &c., T. Stevens, Kingston-on-Thames.

Inventions Protected for Six Months on Deposit of Complete Specifications.

4008. Gas, &c., Engines, E. K. Dutton, Manchester.—A communication from J. Spiel, Berlin —*18th August*, 1883.
4020. Printing Machines, W. Brooks, London.—A communication from D. F. Simpson, New York, U.S.—*20th August*, 1883.
4036. Fertilisers, H J. Allison, London.—A communication from the Scribner Process Company (Incorporated), New York, U.S.—*21st August*, 1883.
4044. Fibrous Packing, S. Pitt, Sutton.—A communication from W. H. Perrine, New York, U.S.—*21st August*, 1883.
4058. Stoppers for Bottles, H. H. Lake, London.—A communication from F. B. Thatcher and J. W. Johnson, New Britain, Connecticut, U.S.—*21st August*, 1883.

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

3480. Hydraulic Hoisting Apparatus, A. B. Brown, Edinburgh.—*27th August*, 1880.
3409. Breech-loading Cannon, P. Jensen, London.—*23rd August*, 1880.
3410. Mixing Dough, J. Liddell, Glasgow.—*23rd August*, 1880.
3479. Raising, &c., Liquids, G. McCallum and R. T. Harris, Glasgow.—*27th August*, 1880.
3450. Gymnastic Apparatus, W. R. Lake, London.—*26th August*, 1880.
3494. Electric Lamps, St. G. L. Fox, London.—*28th August*, 1880.
3550. Preparing, &c., Liquids, F. A. Bonnefin, London.—*1st September*, 1880.
3578. Vehicles Propelled by Manual Power, W. J. Fraser, London.—*3rd September*, 1880.
3341. Couplings for Railway Carriages, E. C. Bowen, London —*17th August*, 1880.
3513. Oil Cups, E. Ludlow, Birmingham.—*30th August*, 1880.
3531. Windows, &c., H. Brittain, Birmingham.—*31st August*, 1880.
3449. Vessels for Liquids, E. Edwards, London.—*25th August*, 1880.
3457. Spikes for Railway Purposes, W. Clark, London. —*26th August*, 1880.
3476. Spike-screw, R. C. Perry, Manchester.—*27th August*, 1880.

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

3307. Purifying Foul Waters, H. Staples, London. —*23rd August*, 1876.
3312. Ventilating Cowl, T. Lloyd, Winchester.—*23rd August*, 1876.
3290. Artificial Leather, J. Harrington, Ryde.—*22nd August*, 1876.
3322. Sliding Stud, C. F. Elliott and J. Bayley, Liverpool.—*24th August*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, *14th September*, 1883.)

1973. Cartridges for Gallery, &c., Practice, J. H. Dunn, London.—*18th April*, 1883.
1997. Doors, &c., for Furnaces, J. Shepherd, Manchester.—*19th April*, 1883.
2002. Fire-extinguishing Apparatus, W. Miller, Glasgow.—*20th April*, 1883.
2003. Preventing the Corrosion, &c., of the Metal Sheathing of Wooden Ships, J. B. Hannay, Glasgow.—*20th April*, 1883.
2008. Registering the Number of Games of Lawn Tennis, E J. C. Baird, Ripple House, near Deal.—*20th April*, 1883.
2011. Cataloguing, &c., Catalogue Slips, E. Magnusson, Cambridge.—*20th April*, 1883.
2017. Velocipedes, G. G. Tandy, Clapham.—*20th April*, 1883.
2027. Displaying Goods, W. P. Thompson, Liverpool. —Com. from V. Rogiers.—*21st April*, 1883.
2037. Propeller for Vessels, A. Figge, London.—*21st April*, 1883.
2041. Indicating the Velocities of Air Currents, J. Thompson, Bolton-le-Moors.—*21st April*, 1883.
2043. Rifled Tubes, H. Pieper, Belgium.—*21st April*, 1883.
2045. Gun Carriages, W. R. Lake, London.—A communication from H. Gruson.—*23rd April*, 1883.
2054. Cleaning Boots, J. Hargrave, Burley, Leeds.—*23rd April*, 1883.
2055. Metallic Oxides or Bases, H. A. Bonneville, Paris.—A communication from L. C. E. Faucheux.—*23rd April*, 1883.
2057. Electric Lamps, &c., W. Hochhausen, New York.—*23rd April*, 1883.
2058. Magneto, &c, Machines, W. Hochhausen, New York.—*23rd April*, 1883.
2066. Printing Machines, H. M. Nicholls, London.—*24th April*, 1883.
2071. Railway Ties, A. J. Boult, London.—A communication from E. B. Hungerford.—*24th April*, 1883.
2072. Ash Buckets, R. D. Jones, Liverpool.—*24th April*, 1883.
2100. Heaters for Boilers, C. D. Yates, London.—*25th April*, 1883.
2103. Bottles and Stoppers, A. J. T. Wild, London.—*25th April*, 1883.
2104. Colouring Matters, F. Wirth, Germany.—Com. from Messrs. Dittler and Co.—*25th April*, 1883.
2116. Block Calendars, G. F. Redfern, London.—A communication from J. Patrick.—*26th April*, 1883.
2127. Steam Boiler Flues, E. G. Colton, London.—A communication from L. Hussey and G. W. Donaldson.—*26th April*, 1883.
2162. Lifting or Hoisting, T. Thomas, Cardiff.—*28th April*, 1883.
2185. Incandescent Lamps, W. Crookes, London. —*30th April*, 1883.
2237. Red Dye-stuffs, S. Pitt, Sutton.—A communication from V. C. Fabricken.—*2nd May*, 1883.
2380. Producing Murial Ceiling, &c., Hangings, S. C. Overton, London.—*7th May*, 1883.
2320. Submarine Torpedo Boat, J. Davies, near Farnborough.—A communication from P. B. Walker and H. Riggs.—*8th May*, 1883.
2321. Artificial Stone, B. Hess, Bayreuth, Germany. —*8th May*, 1883.
2372. Ship Windlasses, F. S. Manton, Providence, U.S.—*9th May*, 1883.
3636. Life Boat, A. M. Clark, London.—A communication from T. Hamilton.—*26th May*, 1883.
2989. Compounds for Making Effervescent Liquids, W. R. Lake, London.—A communication from G. Stollwerck.—*15th June*, 1883.
3255. Exhausting, &c., Fluids, W. B. Wright, Bromley-by-Bow.—*30th June*, 1883.
3289. Perspective Drawing Apparatus, H. J. Haddan, London.—A communication from W. Sweetworden.—*3rd July*, 1883.
3440. Coating Metal Plates with Tin, &c., T. James, Swansea.—*12th July*, 1883.
3543. Rocking Furnace Bars, J. Hampton, Loughborough, Leicester.—*18th July*, 1883.
3549. Washing Machines, J. Heselwood, Leeds —*19th July*, 1883.
3729. Drilling, &c., Rocks, A. Shedlock, New York. —*31st July*, 1883.
3755. Tricycles, J. and T. Webb, Coventry.—*31st July*, 1883.
3858. Fasteners for Gloves, &c., E. K. Dutton, Manchester.—A communication from C. A. Pfenning.—*8th August*, 1883.
3877. Treating Alcoholic Liquors, W. E. Gedge, London.—A communication from A. C. Tichenor.—*9th August*, 1883.
4008. Gas, &c, Engines, E. K. Dutton, Manchester.—Com. from J. Spiel.—*18th August*, 1883.
4036. Fertilisers, H. J. Allison, London.—A communication from the Scribner Process Company, Incorporated.—*21st August*, 1883.

(*Last day for filing opposition*, *18th September*, 1883.)

1849. Projectiles, L. A Groth, London.—A communication from Dr. H. Bischoff and M. Z. d. A. Mieg. —*12th April*, 1883.
1943. Albums, R. Moser, Berlin.—*17th April*, 1883.
1980. Gearing for Regulating the Speed of Machinery, W. O. Aves and G. Moss, London.—*19th April*, 1883.
1981. Tires, W. O. Aves and G. Moss, London.—*19th April*, 1883.
2059. Ring Spinning and Doubling Frames, J. Young and E. Furniss, Mellor.—*24th April*, 1883.
2064. Preventing Excessive Heat in Dynamo-electric Machines, H. Roberts, Pittsburgh.—*24th April*, 1883.
2076. Assisting Persons Learning to Sing, G. N. Corozzi, London.—*24th April*, 1883.
2086. Combustion of Fuel, T. Whitehead, Birmingham, and F. B. Chadwick, Cardiff.—*24th April*, 1883.
2097. Self-acting Couplings, T. Wood, Manchester.—*25th April*, 1883.
2098. "Tieing-in" Warps, J. P. Binns, Halifax.—*25th April*, 1883.
2099. Flushing Water-closets, &c., J. and I. Haigh, West Bromwich.—*25th April*, 1883.
2115. Insulators, J. S. Lewis, Birkenhead.—*26th April*, 1883.
2117. Switch Apparatus, J. Imray, London.—A communication from T. A. Connelly.—*26th April*, 1883.
2123. Lubricating Oil, N. C. de Kroeber, Russia.—*26th April*, 1883.
2124. Mowing and Reaping Machines, W. M. Cranston, London.—Partly a communicatlon from the Walter A. Wood Reaping and Mowing Machine Company.—*26th April*, 1883.
2140. Velocipedes, G. J. Stevens and J. S. Smith, London.—*27th April*, 1883.
2151. Looms for Weaving, J. Langton and J. Gregson, Preston.—*28th April*, 1883.
2160. Surgical Injections, O. Imray, London.—A communication from A. R. Larger.—*28th April*, 1883.
2163. Hauling, H. Johnson, jun., West Bromwich.—*28th April*, 1883.
2216. Horn and Bone Strips, H. A. Lyman, London. —Com. from W. A. Nettleton.—*1st May*, 1883.
2230. Cleaning Tobacco Pipes, H. Emery, Burslem.—*2nd May*, 1883.
2232. Spinning, B. A. Dobson and W. H. Singleton, Bolton.—*2nd May*, 1883.
2336. Locks for Doors, H. Parkin and C. J. Reynolds, London.—*8th May*, 1883.
2352. Artificial Stone and Cement, E. S. Shepherd, London, and J. S. Aspinwall, Nantlle Vale.—*9th May*, 1883.
2376. Preventing the Corrosion of Water Pipes, J. B. Hannay, Glasgow.—*10th May*, 1883.
2406. Tunnels, T. R. Crampton, London.—*11th May*, 1883.
2421. Fountain Pens, J. Morton, London.—*12th May*, 1883.
2442. Plates for Secondary Batteries, W. Hochhausen, New York.—*15th May*, 1883.
2670. Dynamo-electric Machines, W. Hochhausen, New York.—*29th May*, 1883.
2737. Adapting Railway Vehicles to Lines of Different Gauges, W. R. Lake, London.—A communication from J. W. H. Hullett.—*1st June*, 1883.
2968. Spanners, J. C. Bauer, London.—*14th June*, 1883.
3121. Saddle-bar, J. Passmore and E. C. Cole, Exeter. —*23rd June*, 1883.
3123. Electrical Apparatus, W. Hochhausen, New York.—*23rd June*, 1883.
3125. Spades and Shovels, J. Sidaway, Halesowen.—*23rd June*, 1883.
3199. Preparing Compounds for Sanitary Purposes, H. E. Overbeck, Liverpool.—*27th June*, 1883.
3213. Table Trucks for Weighing, T. McEntegart, Liverpool.—*28th June*, 1883.
3288. Busk and other Fastenings, H. A. Lyman, London.—A communication from W. A. Nettleton.—*3rd July*, 1883.
3292. Marine Danger Signals, Major D. Porter, Boston.—*3rd July*, 1883.
3428. Steam Boilers, J. Burlinson, Sunderland.—*12th July*, 1883.
3430. Detaching Gear for Ships' Boats, R. Hudson, Blyth.—*12th June*, 1883.
3565. Plates or Electrodes, R. Cunningham, Kingston Hill.—*20th July*, 1883.
3616. Magazine or Repeating Fire-arms, H. H. Lake, London.—A communication from the Spencer Arms Company, Incorporated.—*23rd July*, 1883.
3653. Cream, W. Horner, Cuddington.—*25th July*, 1883.
3704. Feed for Rollers and Purifierr, R. S. Piercy, Blackburn.—*28th July*, 1883.
3706. Steam Steering Apparatus, J. Downton and E. Wimshurst, London.—*28th July*, 1883.
3794. Applying Printed Designs to Pottery, J. Miller, Glasgow.—*3rd August*, 1883.
3931. Fluid Meters, H. H, Lake, London.—Com. from F. G. Hesse.—*14th August*, 1883.
3958. Facilitating the Transport of Cash, &c., in Shops, W. R. Lake, London.—A communication from G. R. Elliott.—*15th August*, 1883.
3966. Button Fastener, W. R Lake, London.—Com. from E. Kempshall.—*15th August*, 1883.
4044. Fibrous Packing, S. Pitt, Sutton.—A communication from W. H. Perrine —*21st August*, 1883.
4058. Stoppers for Bottles, H. H. Lake, London.—A communication from F. B. Thatcher and J. W. Johnson.—*21st August*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 22nd and 24th August*, 1883.)

3809. Chemicals, J. W. Kynaston, Liverpool.—*12th August*, 1883.
1032. Scraping, &c., Ships' Bottoms, G. W. Mallet, West Greenwich.—*26th February*, 1883.
1033. Rolling Metallic Tubes, P. M. Parsons, Blackheath.—*26th February*, 1883.
1014. Tin and Terne Plates, W. A. Johns, London.—*27th February*, 1883.
1070. Emery, Glass, &c, R. J. and A. Edwards, London.—*27th February*, 1883.
1082. Steam and other Boilers, T. Robottom, Nuneaton.—*28th February*, 1883.
1083. Separating Seed, &c, P. van Gelder, Sowerby Bridge.—*28th February*, 1883.
1086. Envelopes, E. Sturge, London.—*28th February*, 1883.
1092. Preparing Decoctions from Tea, &c., E. G. Brewer, London.—*28th February*, 1883.
1096. Hydrates of Alkalies and Alkaline Earth, C. F. Claus, London.—*28th February*, 1883.

1097. Pipes for Smoking Tobacco, O. Ber, Russian Poland.—28*th February*, 1883.
1117. Alcohol, W. R. Lake, London.—1*st March*, 1883.
1126. Brackets, J. Beech, Wolverhampton. — 2*nd March*, 1883.
1158. Date Indicator, G. H. T. Hawley, Bromley.—5*th March*, 1883.
1160. Disintegrating Apparatus for Flour Mills, C. Pieper, Berlin.—5*th March*, 1883.
1224. Truss for Rupture, &c., E. M. Bourjeaurd, London.—7*th March*, 1883.
1388. Treating Flax, &c., J. R. Dry, London.—15*th March*, 1883.
1414. Apparatus for Bolling, Seed-separating, &c, J. R. Dry, London—16*th March*, 1883.
1612. Cleaning, &c., the Journals of Car-axles, W. G. Mitchell, New York.—30*th March*, 1883
1625. Minimising the Effects of Collisions at Sea, W. N. Smith and R. R. Swann, London.—31*st March*, 1883.
1697. Alcohol, J. H. Loder, Leiden, Holland.—4*th April*, 1883.
2612. Checking the Number of Games, &c, Played at Cards, G. F. Howard, London.—25*th May*, 1883.
2963. Constructing Metal Fencing, A. Whitgrove, Worcester.—14*th June*, 1883.
3191. Brick-making Machines, P. Effertz, London.—27*th June*, 1883.

(*List of Letters Patent which passed the Great Seal on the 28th August*, 1883.)

1101. Applying Motive-power to Railways, T. W. Rammell, London.—1*st March*, 1883.
1113. Electric Generators, R. D. Bowman, Leytonstone, and J. E. L. and W. J. K. Clark, London.—1*st March*, 1883.
1116. Gas Engines, R. Steel and H. W. Whitehead, London.—1*st March*, 1883.
1133. Giving Alarms or Signals, A. M. Gibson, Ravenstonedale.—2*nd March*, 1883.
1139. Indicating, &c., the Flow of Electric Currents, P. R. Allen, London.—2*nd March*, 1883.
1140. Shaping, &c., Metals, P. R. Allen, London.—2*nd March*, 1883.
1153. Attaching Door Knobs to their Spindles, A. Varah, Sheffield.—3*rd March*, 1883.
1182. Electric Arc Lamps, J. E. L. Clark and W. J. K. Clark, London, and R. D. Bowman, Leytonstone.—5*th March*, 1883.
1183. Joints of Perambulator and Carriage Hoods, J. Collett, Olton.—5*th March*, 1883.
1205. Brewing, W. Lawrence, London.—6*th March*, 1883.
1211. Targets for Rifle Practice, F. Clarke, Canterbury.—6*th March*, 1883.
1222. Imparting Heat to Water and other Fluids, J. Jameson, Newcastle-on-Tyne.—7*th March*, 1883.
1325. Hydraulic Lifts, W. H. Johnson, London.—13*th March*, 1883.
1393. Looped Fabrics, H. H. Lake, London.—15*th March*, 1883.
1417. Ventilating Apparatus for Railway Cars, R. H. Brandon, Paris —17*th March*, 1883.
1504. Generating Gases, J. McEwen, Manchester.—22*nd March*, 1883.
1524. Attaching Shanks to Buttons, J. H. Johnson.—22*nd March*, 1883.
1860. Steel, &c., A. J. Boult, London.—12*th April*, 1883.
1933. Centrifugal Machines, A. G. Brookes, London.—17*th April*, 1883.
1937. Centrifugal Machines, A. G. Brookes, London.—17*th April*, 1883.
2491 Expansion Valve Gear, W. E Rich, London.—18*th May*, 1883.
2514. Making Steel by the Bessemer Process, A. Davy, Sheffield.—19*th May*, 1883.
2573. Porous or Spongy Plates, F. T. Williams and J. C. Howell, Llanelly.—23*rd May*, 1883.
2630. Construction of Silos, J. W. Butler, Blackheath.—26*th May*, 1883.
2841. Safety Saddle bars, Sir T. Dancer, Malmesbury.—7*th June*, 1883.
2925. Obtaining Motive-power, A. W. L. Reddie, London —12*th June*, 1883.
3101. Separating Ortho-toluidine from Paratoluidine, Dr. J. Weiler, Ehrenfeld, near Cologne.—22*nd June*, 1883.

List of Specifications published during the week ending August 25th, 1883.

5624, 8d.; 5863, 6d.; 5898, 2d.; 5921, 2d.; 6008, 6d.; 6026, 2d ; 6040, 6d ; 6044, 2d.; 6054, 6d.; 6059, 2d.; 6062, 2d.; 6066, 4d.; 6076, 2d.; 6078, 6d.; 6093, 6d.; 6094, 2d.; 6097, 2d.; 6111, 2d.; 6132, 2d ; 6133, 2d.; 6137, 2s. 8d.; 6138, 2d ; 6139, 2d.; 6144, 6d ; 6148, 2d.; 6150, 2d.; 6151, 2d ; 6152. 2d.; 6155, 4d ; 6162, 2d.; 6163, 6d.; 6170, 1s. 4d ; 6172, 6d ; 6177. 2d ; 6178, 2d.; 6179, 2d.; 6183, 6d.; 6184, 2d.; 6187, 2d.; 6188, 1s. 2d.; 6190, 2d.; 6191, 2d.; 6192, 6d ; 6193, 6d.; 6194, 6d.; 6198, 6d.; 6199, 6d.; 6201, 2d.; 6202, 2d ; 6203, 6d.; 6204, 6d.; 6205, 6d ; 6206, 6d.; 6208, 4d.; 6209, 2d.; 6210, 6d.; 6212, 6d.; 6213, 6d ; 6214, 6d.; 6218, 4d.; 6219, 4d.; 6220, 2d.; 6221, 2d ; 6222, 6d ; 6223, 6d.; 6224, 6d.; 6225, 4d.; 6227, 2d.; 6230, 2d.; 6231, 8d.; 6232, 6d.; 6233, 4d.; 6236, 6d.; 6235, 2d.; 6236, 4d : 6237, 6d.; 6238, 2d.; 1, 6d.; 2, 6d.; 3, 10d.; 4, 6d.; 6, 6d.; 7, 10d.; 8, 6d.; 9, 2d ; 10, 2d.; 11, 6d.; 14, 2d.; 15, 2d ; 16, 1s.; 18, 8d.; 21, 6d.; 22, 6d.; 25, 4d ; 26, 6d.; 27, 2d ; 30, 2d.; 32, 2d.; 33, 4d.; 34, 6d.; 35, 4d.; 36, 2d ; 37, 6d.; 38, 6d.; 39, 4d.; 41, 2d.; 42, 2d ; 43, 4d.; 46, 6d.; 47, 2d ; 48, 6d.; 49, 4d.; 50, 6d.; 51, 6d.; 52, 2d.; 53, 4d ; 54, 4d.; 55, 6d ; 57, 6d.; 58, 2d.; 59, 6d.; 61, 6d ; 62, 6d.; 63, 4d.; 64, 6d ; 65, 10d.; 67, 6d.; 68, 6d.; 75, 6d.; 78, 6d.; 80, 4d.; 81, 4d.; 84, 6d ; 85, 4d.; 92, 6d.; 97, 2d.; 101, 4d.; 103, 2d.; 105, 6d ; 106, 6d.; 109, 6d ; 116, 6d.; 149, 6d.; 205, 4d.; 223, 6d.; 232, 4d ; 340, 6d.; 635, 4d.; 766, 4d.; 836, 4d.; 1580, 4d.; 1910, 6d.; 1983, 6d.; 2050, 4d.; 2143, 6d.; 2205, 6d.; 2241, 4d.; 2297, 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.*

5552. Voltaic Batteries, *L. Hartmann, Middleton-square.*—22*nd November*, 1882.—(*Not proceeded with.* 2*d.*

This relates to a zinc and silver battery, with a solution of caustic potash or soda as the exciting liquid.

5580. Manufacture of Carbons, Candles, Electrodes, &c., *W. Cunliffe, Hornsey.*—23*rd November*, 1882. 6*d.*

This relates to improvements in machinery or apparatus for the manufacture of carbons for electric lighting and other purposes.

5586. Underground Conductors for Electric Currents for Lighting, *R. J. Gülcher, Notting-hill.*—23*rd November*, 1882.—(*Not proceeded with*) 2*d.*

According to this invention the conductors are made entirely of iron, and the protecting tube for the conductor does duty as the return.

5584. Electric Bell, *W. R. Lake, London.*—23*rd November*, 1882.—(*A communication from C. F. de Redon, Paris*) 6*d.*

The object of this invention is to simplify the arrangement of the parts of electric bells. According to the inventor's design the movable armature, the opposing spring, and the rod which carries the hammer e united and constitute one piece, having the form of a very flexible spring, which surrounds the electro-magnet. This spring carries at one part the armature, and at another the hammer; it also serves as the interruptor of the current.

5594. Dynamo-electric Machines, *C. D. Abel, Southampton-buildings.*—24*th November*, 1882.—(*A communication from B. Abdank-Abakanowicz and C. Roosevelt, Paris*) 6*d.*

This relates to the employment of particular forms of magnets in dynamos. The inventors find that the most economic magnetic field is obtained by interrupting a circular electro-magnet core at one point for a small distance, so that the two poles remain opposite each other. For winding purposes they use wire of flat section, made of laminated copper bands.

5624. Obtaining and Applying Elastic Force for Motive Power, &c., *J. Haddon, Forest Hill.*—27*th November*, 1882. 8*d.*

The compressing cylinder of the improved engine contains two pistons, one having a long and the other a short travel, the rod of one passing through that of the other, and being operated by a cam on the crank shaft. The space between the pistons receives the charge through the slide valve, situated above and between the compression and working cylinders, placed side by side on a bedplate. The motion of the two pistons in relation to each other compresses the charge, which passes through a valve in the rear piston, the further motion of which completes the compression, and the charge then passes by the slide valve to the space between the two pistons in the working cylinder. The latter pistons move in opposite directions, and are at the time in close proximity. The charge is exploded, and the pistons travelling in opposite directions actuate their respective cranks on the crank shaft. The space between the pistons is then open to the exhaust, while a fresh charge has entered the space on the outer face of one or both pistons, and is there exploded, thus giving an explosion for each half revolution. A pump driven by the crank shaft supplies air to coils of pipe placed in a vessel containing gasoline, and perforated so as to diffuse the air over the surface thereof, whereby it is impregnated with the gasoline, and is then conveyed to the compression cylinder. A separate pump effects the exhaust.

5631. Dynamo-electric Machines, *C. A. McEvoy and J. Mathieson, Adelphi.*—27*th November*, 1882. 6*d.*

The inventors construct their revolving armature ring of a central boss of gun-metal with radiating spokes which are U-shaped at their outer ends. A ribbon of soft iron is wound into a ring around the outer ends of the spokes, being laid between the two prongs of their forked ends. On to the ring so formed are then wound coils of insulated wire, one by the side of the other round the ring. The magnet poles are formed so as not only to come opposite the outer circumference of the ring, but also to come opposite to the two sides of the ring.

5669. Apparatus for Measuring or Indicating Electric Currents, *J. Blyth, Glasgow.*—29*th November*, 1882. 6*d.*

This measuring instrument consists of a solenoid, the coils of which form part of the circuit and an iron core, the core being attached to one end of a helical metal spring which has its other end adjustably fixed. When a current passes through the solenoid coil it tends to pull the core into the solenoid, and when the spring is adjusted so that its tension balances the pulling force the amount of extension required for that purpose is a measure or indication of the current. The instrument is fitted with appliances for adjusting the spring, and with a scale on which to read the indications obtained, such scale being marked with ampères to directly show the current.

5693. Telegraphing into and from Railway Trains in Motion, *W. L. Hunt, Westminster.*—30*th November*, 1882.—(*A communication from R. M. Hunter, Philadelphia, U.S.*) 6*d.*

This relates to various modes of and apparatus for telegraphing into and from a railway train running at any speed. According to one method the inventor utilises the rails as a conductor, by providing them at intervals with automatic mechanism, which is adapted to break the circuit through the rails, and cause it to traverse a wire up into the car, the latter being provided with suitable transmitting and receiving telegraphic apparatus.

5711. Conductors for Electric Currents, *W. R. Lake, London.*—30*th November*, 1882.—(*A communication from F. K. Fitch, New York.*) 4*d.*

The inventor makes a compound wire of phosphor bronze and copper, the latter forming the principal conductor.

5863. Watch or Clock, *J. Pallweber, Austria.*—8*th December*, 1882 6*d.*

The ordinary dial and hands are abolished, and in their place a plain dial is used, with openings through which the figures indicating the hours and minutes are exhibited in their proper order, such figures being painted on discs actuated by suitable mechanism to cause them to revolve at the required speeds.

5898. Musical Instruments, *F. W. Wolff, London.*—9*th December*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in accordians, so as to increase the number and character of the tones, and to enable the performer to vary the same at will.

5921. Compound Engines, and Slide Valves therefor, *H. Dansey and O. Robinson, London.*—12*th December*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to construct slide valves of compound engines so that the exhaust steam from the high-pressure cylinder may pass directly to the low-pressure cylinder, and it consists in making the slide valve triangular, one face working on the valve face of the high-pressure cylinder and the other on that of the low-pressure cylinder.

6008. Process and Apparatus for Obtaining Ammonia, *F. Lorenz, Germany.*—16*th December*, 1882. 6*d.*

The object is to obtain ammonia from the hot gases of bone and other furnaces, and it consists in mixing the gases with aqueous gases or steam generated by the heat of the gases themselves. The hot gases are still further reduced in temperature in a regenerator of suitable construction, where they meet and heat cold gases coming from the water tower and passing to the acid water. The hot gases pass from the regenerator to a condenser, which may be a surface condenser, from which the ammonia fluid is drawn off, whilst the remaining gases are carried to the lower part of the water tower, and passing upwards are further deprived of ammonia. To recover any remaining ammonia the gases are reheated in the regenerator, and then treated in the acid tower.

6026. Projectiles for Rifles, *H. Simon, Manchester.*—18*th December*, 1882.—(*A communication from The Schweizerische Industrie Gesellschaft, Switzerland.*)—(*Not proceeded with.*) 2*d.*

This relates to the use, in combination with rifles of very small bore and quick pitch, of projectiles of considerable length relatively to their diameter, and consisting of a lead core enclosed in an outer casing of copper.

6040. Wagons, *H. C. Bull, Brooklyn, U.S.*—18*th December*, 1882. 6*d.*

This relates to wagons for goods traffic on railways, and which by a slight change can be run on ordinary roads, thus avoiding unloading. Each wheel is mounted on a separate axle and can turn independently, each pair being mounted on a turntable pivotted and provided with anti-friction bearings, whereby the wagon can turn in a small space. The axles are hollow and contain a lubricant which passes through openings to the bearings by centrifugal action. The inside end of the two axles of each pair of wheels works in a lay sleeve so as to keep the axles rigid. On the railway the turntables are kept from turning by a pin passed through the head of the draw-hook. A ring of metal is placed over the tire of each wheel so as to increase the diameter to that of the flange, and is secured by a key and collar on the end of the axle, whereby the wagon is rendered suitable for travelling on ordinary roads.

6044. Spinning Fibres, *E. Tweedale, Accrington.*—18*th December*, 1882 —(*Void.*) 2*d.*

This relates to ring spinning machinery in which centrifugal action causes the yarn to "balloon" or rotate in the outline of a cone or ellipse, and in which ballooning wires are used to prevent it encountering the yarn on the two adjoining spindles. These wires are connected on the opposite sides of the frame, the wires being attached to bell-crank levers carried on studs, and one arm connected by a link with a central shaft, there being a like bell-crank and connection with the shaft and each side, and a hand lever enables both wires to be moved in and out of working position simultaneously. The attachment and wires are also connected with the lifting or traverse motion, so as to be automatically lowered when the winding on has attained the desired extent.

6054. Saddle-bar, *J. Pearse, Cheltenham.*—19*th December*, 1882. 6*d.*

The object is to release the stirrup strap when a rider is thrown, and it consists in providing the saddle bar with an upper arm acting as a spring and a lower horizontal bar carrying the stirrup strap, the two arms being united at their forward ends by a vertical cross piece cast solidly with the arms. The other extremity of the spring arm carries a link with an eye to receive the lower bar, over a projection on which it passes and locks it in position until subjected to lateral strain. The bar is suspended at its forward end to a plate secured to the saddle by means of a curved link joint rivetted to the plate and passing through an eye in the bar near the forward end of the spring arm.

6059. Distillation of Coal. *E. Drew, Bayswater.*—19*th December*, 1882 —(*Not proceeded with*) 2*d.*

The object is to obtain the various products of coal at a single distillation, and it consists in passing the mixed vapours from coal through a series of condensers, each maintained at a temperature lower than its predecessor, and in each case adapted to the condensation of the required product, and at the same time considerably reducing the pressure within the series of condensers by the application of a suitable exhauster.

6062. Fountain Pens, *W. H. Davis, Bloomsbury.*—19*th December*, 1882.—(*Not proceeded with.*) 2*d.*

This relates, First, to means for admitting air to fountain pens and for preventing escape of ink from the air holes; and Secondly, to a more simple arrangement of the needle and point of the "stylus" pen.

6066. Waterproof and Vermin-proof Textile and other Fabrics or Materials, &c., *W. R. Lake, London.*—19*th December*, 1882.—(*A communication from D. M. Lamb, New York.*)—(*Not proceeded with.*) 2*d.*

This consists in combining the material to be rendered waterproof and vermin-proof with a solution consisting of india-rubber or other hydrocarbon gum dissolved in a suitable light hydrocarbon solvent, and treated with the gas generated from common salts and sulphuric acid, after which it is purified, and then applied to the fabric or material.

6076. Treatment of Gold and Silver Ores, *L. A. Groth, London.*—20*th December*, 1882.—(*A communication from the Campbell Mining and Reducing Company, New York.*)—(*Not proceeded with.*) 2*d.*

This consists in subjecting ores containing gold and silver in a pulverised state first to the roasting process of a desulphurising furnace, and afterwards to the action of a bath of molten lead, not for the purpose of amalgamating the metals, but for the purpose of mixing the pulverised ores with the lead, in order to prepare them for more rapid and successful smelting in a smelting furnace.

6078 Window Blind, *L. A. Groth, London.*—20*th December*, 1882.—(*A communication from H. Olausen, Norway*) 6*d.*

This relates to window blinds of paper or linen, and consists in forming them to fold in plaits when drawn up by cords threaded through eyes, so as to pass alternatively on opposite sides of the plaits.

6093. Looms for Weaving, *J. Laird, jun., Forfar, N.B.*—21*st December*, 1882. 6*d.*

This relates to looms for weaving bags, sacks, or other articles in which the cloth at intervals has to be woven into single cloth to form the bottoms, and it consists in rendering such looms automatic. A spur pinion on the end of the shaft carrying the "pace beam" gears with a pinion on an adjustable stud in a lever attached to the gable of the loom, the second pinion having an adjustable finger shaped so as to come in contact with a stud acted upon by a spring, and projecting from a ratchet disc carried loosely upon the 'pace beam" shaft. At the back of the disc is a cam formed in segments capable of being changed to vary the extent of surface. Upon the second motion shaft, or wiper shaft, or other suitable shaft of the loom, an excentric is fitted which drives a pawl engaging with the ratchet teeth at the instant that the pinion on the finger comes in contact with the stud, whereby the ratchet disc is slightly moved round, so that the pawl continues for a time to catch into the ratchet teeth and rotate the disc. The adjustable cam at the back of the disc during this time is in contact with a roller carried by a lever, and which, being raised, presses its other end upon a drag lever and increases the tension of the warp, while the lever also through a draw rod pulls down the horizontal board of the dobbie machine into position for forming the bottom of the bag. Other improvements are described.

6094. Double-driving Tricycles, &c., *S. Lee and M. Stodart, London.*—21*st December*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to enable the width of "double-driving front-steering" tricycles driven by balance gear to be reduced, and it consists in the method of dividing the driving shaft and removing one wheel.

6097. Soles for Foot Coverings, *G. H. Jones and H. C. Hemsley, Kettering.*—21*st December*, 1882.—(*Not proceeded with.*) 2*d.*

The waist of the sole is formed with a number of holes in the centre so as to allow air to enter and ventilate the boot.

6109. Ovens Heated by Gas, *W. A. Crommelin, J. Lees, H. Spain, and W. H. Thompson, London.*—21*st December*, 1882. 6*d.*

The object is to construct bakers' and other ovens in such a manner that no smoke shall be given out. Bunsen burners are arranged, so that the fumes from the gas enter flues surrounding the internal walls of the oven. These flues pass under the bottom, at the sides, over the roof, and finally descend to the foot of the chimney.

6110. Cushions and Cushioning Materials for Permanent Way, more especially for Use between the Chairs and Sleepers, or Rail Flange and Sleepers, *W. P. Thompson, Liverpool.*—21*st December*, 1882.—(*A communication from J. L. B. du Pont, Paris*) 4*d.*

This consists essentially in the use of a number of sheets of tarred felt and cork superposed and placed between the seating surface of the sleeper and the rail or chair of the permanent way.

6111. Evaporating or Concentrating Saccharine, Saline, or other Solutions, *W. P. Thompson, Liverpool.*—21*st December*, 1882.—(*A communication from A. Gilain, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists in employing for the evaporation and concentration of saccharine or other solutions, of vacuum apparatus in single, double, or multiple effect, in which instead of steam being admitted to the pan (or into the first pan, if there be a series), the pan is subjected to the action of furnace gases, the pan being placed in that part of the course of gases comprised between the last flue of one or more generators and chimney, so as to recover the waste heat escaping from the boilers. The gases traverse the tubular system of the apparatus, and the vapours are fed to a condenser or to the vapour space of the next in a series.

6112. Safety Boat, *E. Edwards, London.*—21*st December*, 1882.—(*A communication from A. Le B. Dulier, France.*)—(*Not proceeded with.*) 2*d.*

The boat is spherical and made preferably of sheet metal, and it is divided by a horizontal partition, the lower part containing a steam engine and boiler to actuate paddle-wheels, while the upper part receives the passengers.

6113. Armour Plates, *J. H. Johnson, London.*—21*st December*, 1882.—(*A communication from Marrel Brothers, France*) 6*d.*

This consists in armour plates with steel surfaces of different degrees of hardness and tenacity on opposite sides, obtained by casting different qualities of steel on opposite sides of a division plate arranged inside a mould.

6114. Photometric Apparatus, *S. H. Emmens, Soho-square, and J. Munro, West Croydon.*—22*nd December*, 1882. 6*d.*

This relates to photometrical apparatus depending for its action upon the employment of light absorbing media, and according to one modification it embraces a prismatic analyser of the light, which is also a photometer. A ray of light, admitted through a small orifice, is reflected through the prism by a sliding mirror, and when reflected by the prism displays its spectrum upon a reflecting screen, in front of which is a slip of glass graduated with fine lines to measure the parts of the spectrum, and also to gauge its intensity by noticing the vanishing points of the lines. The instrument is enclosed in a case with an eye-hole, suitable means being provided to regulate the position of the slidings in relation to the prism. A second modification in a small portable form is more applicable for use in regard to electric light; and consists of a prism or wedge of neutrally tinted glass, which by a screw can be made to interpose a greater or less thickness of glass in the path of the beam of light. In a third modification the measurement is effected by means of a shadow cast on the wedges of any convenient object, such as a wire stretched across the objective.

6115. Coupling and Uncoupling Railway Carriages, Trucks, &c., *J. Anderson and J. Darling, Glasgow.*—22*nd December*, 1882. 6*d.*

The object is to enable carriages to couple together automatically, and to be uncoupled without having to get between them; and it consists in forming the coupling of two hooks with inclined faces, which on coming in contact force the hooks back until their noses pass each other, and are caused to engage by a spring acting upon the hook. The hooks are disengaged by means of levers or other means actuated from the side of the vehicle.

6116. Steering Apparatus, *J. Imray, London.*—22*nd December*, 1882 —(*A communication from J. C. Lake, New Jersey.*) 6*d.*

The object is to automatically lock the steering tiller, so as to prevent the rudder from being moved by the water, and yet leave it free to be moved by the steersman, who, by the locking apparatus, is protected from the shocks resulting from the impact of waves against the rudder. The rudder head is enclosed in a case fixed to the deck, and has on it a circular toothed segment rack, with which gears a pinion on a horizontal shaft, turned by the hand steering wheel. The shaft turns in bearings in an arm, fixed with a little play on the casing, and under it is a block pivotted to the interior of the casing, and having a groove, through which passes a toothed segment, and on each side of it wedge pieces pressed by a spring, so as to hold the rack with strong friction. The wedge pieces are so arranged in combination with cheeks, which bear against the arm of the tiller shaft, that when the rack, owing to wave action on the rudder, tends to move in either direction, the wedges become tightened, but when the tiller wheel is turned the initial movement tends to slacken the wedges, leaving the tiller rack free.

6117. Cutting Pearls, &c., *J. Imray, London.*—22*nd December*, 1882 —(*A communication from E. R. Road, Paris.*) 4*d.*

Instead of using toothed saws a thin disc without teeth is caused to revolve rapidly, or a thin blade without teeth is caused to reciprocate rapidly and cut the pearl, which is pressed against its edge by a holder of special form.

6118. Receptacles or Vessels of Secondary Batteries, *G. Binswanger, London.*—22*nd December*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the formation of these receptacles of metal, rendered proof against the action of acid and electrolysis by the application of a coating of enamel, to which a protective bituminous or other solution is also applied.

6119. Dish Covers, *A. G. Hewitt, Sheffield.*—22*nd December*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in forming such covers with double walls, between which hot water is introduced, so as to enable the covers to retain heat better.

6121. Water-closets and Sewers and Traps for the same, *W. R. Lake, London.*—22*nd December*, 1882.—(*A communication from C. F. Pike, Philadelphia, and E. Z. Collings, New Jersey, U.S.*) 1s.

The object is to seal water-closet and other traps by means of a continuously running stream of water which is maintained in a fresh condition for absorbing sewer gas and preventing the generation of fungus growth; and also to provide a disinfectant running fluid seal for such fixtures, and to means for cleansing and disinfecting the traps of water-closets, sewers, and the like.

6122. Gas Fires and means for Ensuring the Proper Carrying off of the Products of Combustion, *W. T. Sugg, Westminster.*—22*nd December*, 1822. 8*d.*

In the back of an ordinary grate a slab of steatite dust and fire-clay is set at an angle of 45 deg., and the grate above the slab is filled to any desired height with steatite dust and asbestos formed into irregular lumps. In front of the grate is a piece of gas pipe fitted with a number of Bunsen burners, each provided with a cock and arranged at the same angle as the back slab, so that the gas flame plays upon the latter at an acute angle. The gas pipe can be swung round to clean the burners. The service pipe is connected with a gas box, on top of which is adjusted a regulator. To prevent down draughts in chimneys of gas fires they are closed by a plate in which a tube is inserted large enough to carry off the products of combustion, but smaller than the chimney down into which it projects, so that hot air collects in the space between it and the chimney and prevents cold air entering the top end of the tube.

6123. Folding Cot Carriages, *T. Trotman, Camden Town.*—22*nd December*, 1882. 6*d.*

The object is to construct a folding double perambulator, so that it may be converted into a cot at pleasure for outdoor or indoor use, for which purpose the whole of the body can be removed from the wheel frame and attached to suitable rockers.

6124. Colour Boxes, *T. Foxall, Euston-square.*—22*nd December*, 1882. 6*d.*

The boxes have a series of compartments to receive the colour tubes, preferably formed by a corrugated metal plate mounted on a platform a distance from the bottom, and forming a raised rack.

6127. Railway Fog Signal Apparatus, *J. Coleman and J. Henson, Derby.*—22*nd December*, 1882. 6*d.*

This relates to apparatus for placing fog signals on the rails, and can be either worked by the semaphore signal wire or by a separate wire. The signals are piled one on the other in a cylinder placed below the ground level, and are raised by a weighted cord. Above the reservoir is a stop plate, with a space between sufficient for one signal to be pushed away edgewise. A horizontal lever arm is actuated through suitable means by the wire, and when brought over

the cylinder receives a signal which it then carries forward until it rests upon the rail.

6126. WARMING ROOMS AND BUILDINGS, *E. Hopgood, Ryde, and E. Jenner, Grosvenor-gardens.*—22*nd December*, 1882. 6*d*.

This consists in the combination of an open stove with a system of hot-water circulation. On either side of the fire basket is an upright box, the two being connected by curved horizontal pipes passing behind the fire. Iron pipes lead from the stove to the place to be heated.

6128. FASTENERS FOR GLOVES, BOOTS, &c., *H. Vollmer, Manchester.*—22*nd December*, 1882.—(*A communication from F. Gütemann, Germany.*)—(*Not proceeded with.*) 2*d*.

A metallic plate has a hook at one end which passes through the glove, and over which an eyelet in the other side of the glove is passed. A spring cap hinged to the rear of the plate prevents the glove becoming unfastened.

6130. GAS ENGINES, *A. M. Clark, London.*—22*nd December*, 1882.—(*A communication from V. J. Laurent, Paris.*) 1*s*. 2*d*.

A mixture of gas and air is drawn by a piston into a cold cylinder, and there compressed by the piston whilst a spray of cold water prevents it heating. The compressed gases are then heated in a regenerator to about 200 deg. or 300 deg. Cent. by utilising the sensible heat of the gases which have done their work and are being expelled. The gases then enter a hot cylinder by a valve, which remains open during a portion of the stroke, and come in contact with a platinum wire rendered incandescent by an electric current, and are thus ignited, the wire being coiled in a series of concentric circles, so as to be distributed over the whole area of the cylinder. The used gases then pass during the back stroke to the regenerator and give up their heat. The cylinder in which the gas is compressed and cooled has a dead space of variable capacity, to enable the volume of gas delivered at each stroke to be regulated. The regenerator consists of an assemblage of tubes, up which the gas to be heated passes, while the heating gases pass downwards between the tubes. The distributing valves are operated by hydraulic pressure. A parallel motion is employed instead of providing the crosshead with guides, and the levers are extended and work a pump, which delivers water to a chamber, such water being partly used to cool the first cylinder, and partly to operate the distributing valves which are placed above the hot cylinder. The latter is placed in the same line above the cold cylinder.

6131. ENAMELLED AND METALLISED GLASS AND FICTILE WARE IN IMITATION OF ENAMELLED METAL WARE, *A. M. Clark, London.*—22*nd December*, 1882.—(*A communication from J. Feix, Austria.*) 4*d*.

The article of glass is covered with a layer of platinum, nitrate of silver, graphite, or other analogous substance which is a conductor of electricity, and enamels applied thereto to produce any required design, and fired in the ordinary way. The article is then placed in an acid or cyanide bath, and an electric current passed, whereby the parts not enamelled will receive a metallic deposit of copper, zinc, or silver without loosening the enamel.

6132. MECHANICAL RETORT FOR DESTRUCTIVE DISTILLATION OF ANIMAL AND VEGETABLE MATTERS, *J. Lyle, Highgate.*—22*nd December*, 1882.—(*Not proceeded with.*) 2*d*.

Within a circular casing rollers are arranged in annular grooves made to receive them, preferably in concentric order. A pan also with annular grooves rests upon the rollers, and is caused to revolve by suitable gearing. The central part of the pan has an eye with a depending lip to facilitate the discharge of the material treated through a central aperture in the bottom of the casing. A series of rakes are fixed at suitable angles in the casing, and stir or rake the contents of the pan, and blades gradually guide the material from the edge to the centre of the pan.

6133. PERFORATING OR PRINTING DESIGNS THROUGH OR UPON PAPER, &c., *F. Squire, Hackney.*—22*nd December*, 1882.—(*Not proceeded with.*) 2*d*.

This relates particularly to apparatus for punching designs upon the edges of wings, toecaps, and other parts of boots and shoes, and it consists of a circular table upon which two or more dies with perforations are secured, side openings being formed in them for the introduction of the leather. Punches slide over the dies, and when depressed by a lever or treadle stamp or perforate the design through the leather.

6134. PRESERVATION OF ANIMAL AND VEGETABLE MATTER, *J. Townsend, Glasgow.*—23*rd December*, 1882. 4*d*.

One of the preservative compounds consists of boracic acid and potash; a second of boracic acid, carbonate of soda, and chloride of potassium; and a third of boracic acid, borax, and chloride of potassium, different methods being described of employing any of the above compounds.

6135. KIERS OR APPARATUS FOR BOILING AND CLEANSING PULP MATERIAL AND FABRICS, *J. Dimmock, Over Darwen.*—23*rd December*, 1882. 4*d*.

The kier consists of a cylindrical vessel with a hole at each end fitted with an air-tight cover for charging and discharging, and at either end a cock for blowing out. In the middle a grid is fixed to keep the material in each part separate, while there is a free passage for liquid. The vessel is mounted on tubular trunnions, and caused to revolve. One trunnion serves to admit cleansing fluid, which is driven in by steam entering by an injector nozzle, while the spent liquor is discharged through the other trunnion.

6136. MOTIVE-POWER ENGINES, &c., *J. A. B. Bennett, King's Heath, Worcester, and B. P. Walker, Birmingham.*—23*rd December*, 1882. 6*d*.

This relates to engines worked by the explosion of a mixture of atmospheric air and the vapour of petroline or other liquid volatile hydrocarbon, parts of the improvements being also applicable to hot-air engines and gas engines. The explosion takes place in a cylinder similar to that of a gas engine, and is effected by a small dynamo or magneto-electrical machine driven by the engine. In communication with the cylinder is a pump worked by a lever actuated by the engine, and which is in connection with a reservoir containing the liquid hydrocarbon. An air pump worked by the same lever compresses and forces air into the cylinder, both the hydrocarbon and the air first passing through a chamber, the former in the form of a spray which the air takes up in the form of a vapour. The charge circulates round the cylinder and absorbs the heat before passing into the cylinder. The pumps and the electrical apparatus can be worked by hand to start the engine.

6137. MACHINERY FOR PRINTING ON BOTH SIDES OF A MOVING WEB, CUTTING THE WEB INTO LENGTHS OR SHEETS, AND COLLECTING, FOLDING, COUNTING, AND DELIVERING SUCH SHEETS AS A FOLDED PRODUCT, *W. Conquest, London.*—23*rd December*, 1882. —(*A communication from Messrs. R. Hoe and Co., New York.*) 2*s*. 8*d*.

This relates, First, to the printing mechanism, and consists of a single central type-carrying cylinder of sufficient diameter to enable the type formes to be secured thereon circumferentially, and also provide proper taking space for distribution between the formes. Two series of impression cylinders are arranged about the circumference of the type cylinder, and driven in unison with it. A web-turner between the impression cylinders turns the web as it passes between the two series; Secondly, transverse severing and folding mechanism, capable of severing the web into four-paged sheets, and imparting two parallel folds thereto, or of severing it into half or two-page sheets, imparting one transverse fold thereto, and it comprises two cylinders, each provided with members of the web-severing, controlling, and folding devices. The invention further relates to collecting mechanism placed between the cutting cylinders and the folding cylinders when desired to produce an eight-page product, in addition to a two-page and a four-page cylinder; also to mechanism for laying or flying the open sheet; and also for collecting sheets with one fold; to devices for dividing a web longitudinally and transferring one half upon the other; for dividing sheets delivered into quires or lots; for imparting final folds to a sheet of paper; and to devices by which the sheets as they issue from a printing or folding machine are folded and sealed in a wrapper.

6138. LUBRICATING CERTAIN PARTS OF MACHINERY, *E. B. Petrie and W. A. Entwistle, Rochdale.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

This consists, First, in applying "metalline" or "oilless carbonate" to sliding bearings; Secondly, in lubricating the collars and footsteps of spindles of spinning and doubling machines by forming grooves therein, and filling them with "metalline" or "oilless carbonate."

6139. SHUTTLES, *T. Brooks and T. Tweedale, near Rawtenstall, Lancashire.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to form the peg or tongue so that the cop or spool may be easily placed thereon when raised, and held more securely when pressed down into the shuttle.

6140. TRACTION ENGINES, *E. Foden, Sandbach.*—23*rd December*, 1882. 4*d*.

The object is to mount the engine on springs, so that the vibration in passing over rough roads shall not materially affect a variation in the depth of the gearing. The travelling wheel axle and the third motion shaft are arranged to work together in one axle-box at each side, and are fitted with ball points, each axle-box working in a separate horn plate bolted to the side plates of the boiler behind the fire-box, and at the top of the horn plates a spring box is attached on each side on which the boiler is suspended. The second and third motion shafts are fixed exactly in the same horizontal plane, so that the action of the springs does not affect the depth of the gearing. The spring-boxes are arranged with a central spindle which can be screwed down to take the weight off the springs, and put it direct on the spindle if desired.

6141. TIRES OF WHEELS FOR RAILWAY AND TRAMWAY PURPOSES, *T. E. Rigby, Manchester.*—23*rd December*, 1882.—(*A communication from J. Rigby, Cleveland, U.S.*)—(*Not proceeded with.*) 2*d*.

This relates to the formation of tires separate from the body of the wheel, so that they may be rolled or cast. The body is formed with a raised portion on the same side as the flange of the tire, such portion extending round the periphery, and being recessed at the base and bevelled off on the upper part to form a dovetail to receive a rim on the tire, which is shrunk on and secured by bolts.

6142. APPARATUS FOR BURNING GAS FOR COOKING, HEATING, ILLUMINATING, &c., *J. W. Plunkett Dunstall Priory, Kent.*—23*rd December*, 1882. 6*d*.

The object is to provide means whereby the act of opening the oven door or placing utensils on the gas stove shall cause the burners to be supplied with gas, and when the burners are ignited the expansion of a suitable rod prevents the gas being turned off. The invention also relates to the application of similar apparatus to lamps.

6143. DISINFECTING COMPOUNDS, *J. S. McDougall, Manchester.*—23*rd December*, 1882. 4*d*.

The object is to produce a solid disinfectant which may be used dry, and which is yet readily soluble in water for use in a fluid form when desired, and it consists in adding crude tar oils or crude tar acids, or carbolic or cresylic acids or their homologues, to soluble salts of the bases.

6144. WATER HEATERS AND FUEL ECONOMISERS, &c., *J. S. McDougall, near Manchester.*—23*rd December*, 1882. 6*d*.

An outer cylinder has perforated ends to receive tubes extending through the cylinder, and is placed in a flue and the heated gases caused to circulate through the tubes while water circulates round them.

6146. DYNAMO-ELECTRIC, MAGNETO-ELECTRIC, OR ELECTRO-DYNAMIC MACHINES, *R. Matthews, Hyde.*—23*rd December*, 1882. 8*d*.

The object is to form disc armatures or electro-magnets so that the lines of force from the field magnets are always enveloped by the coils on the armature, and not one-half only, as usual in some machines. The armature is preferably constructed of sheet copper discs placed side by side in a plane at right angles to the axis of rotation, and cut, stamped, or cast of suitable section, so as to form a number of single or multiple coils connected together, so that the current circulates in opposite directions in the continuous coils. When the multiple coil is used the inner end is attached to the upper end of the next similar disc, so as to have no projections in the way of the magnets. The discs for single coils form zig-zag spaces alternately inside and outside, and in the outside spaces, which are not enveloped by coils, another such disc is arranged, the inner parts being bent to clear the next coil when they pass each other. Another part consists in making the armature similar to the Gramme ring, but with the wire strips, bars, or disc made to describe an irregular coarse thread, the sides being radial, the number of internal enclosures equal to the number of like polar magnetic fields round a core of either magnetic or dia-magnetic material. For continuous current with the first-mentioned disc armature, the discs are placed in advance of each other, so that the pairs of coils or discs are not at their maximum induction at the same time.

6147. TRICYCLES OR VELOCIPEDES, *F. C. Glaser, Berlin.*—23*rd December*, 1882.—(*A communication from H. L. Blaes, Enshetm, Germany.*)—(*Not proceeded with.*) 4*d*.

This relates to means for driving the velocipede at different speeds, and consists in passing the driving chain over two or more pitch wheels, either of which can be caused to actuate the driving axle.

6148. KILN FURNACES, &c., *J. Sawyer, Hoxton.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

To admit a current of air to the fire of a pottery kiln, the front of the furnace is formed with apertures regulated by an adjustable screen. Under the ashpit is a flue which conducts air to the back of the fire, while behind the bars is a perforated bridge. In the upper part of the front of the furnace is a feed hole with a sliding door.

6149. EXTRACTION OF SACCHARINE MATTER FROM VEGETABLE SUBSTANCES, *C. D. Ekman, Sweden, and G. Fry, London.*—23*rd December*, 1882. 4*d*.

This consists in the manufacture of sugar from vegetable substances by boiling under pressure in a solution containing sulphurous acid and a base or alkali.

6150. AUTOMATIC ELECTRIC SIGNALLING APPARATUS FOR RAILWAYS, &c., *H. J. Haddan, Kensington.*—23*rd December*, 1882.—(*A communication from P. H. Fortin and J. J. Langlet, Paris.*—(*Not proceeded with.*) 2*d*.

This relates to automatic apparatus for communicating between different stations of a railway, and is also applicable to mines and industrial establishments. For railways it comprises a pedal placed parallel to the rail, and consisting of a contact lever adapted to be actuated by the wheels of passing trains; a multiplying lever actuated by the first lever and forming part of the signalling apparatus proper; a commutator lever connected to the second lever by a link and having at each end an extension situated over a mercury cup. The multiplying lever has a lug by which it can be held in the required position, the locking taking place when the armature of an electro-magnet is placed under the lug by the attraction of the magnet at the moment when the contact with the wheel and the passage of a current takes place, the closing of the circuit being effected by one or other of the extensions of the commutator lever dipping into the mercury cup.

6151. BILLIARD TABLES, &c., *J. M. Fletcher, London.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in the application of electric bells to billiard tables, so that when a ball enters a pocket the bell will be sounded.

6152. ORNAMENTING THE SURFACE OF LEATHER AND THE LEATHER SURFACE SO PRODUCED, *J. H. Epstein, London.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to give the surface of leather the appearance of oxidised copper or bronze, and it consists in coating the surface with a varnish composed of shellac copal, turpentine, and dyeing ingredients. A part of the varnish is removed by rubbing with oil of turpentine when only partially dry.

6154. BEDSTEADS, *G. Gentle, London.*—23*rd December*, 1882. 6*d*.

This consists in a bedstead of ordinary appearance, but which forms two or more distinct and separate bedsteads side by side.

6155. MACHINES FOR CALENDERING, *P. Jensen, London.*—23*rd December*, 1882.—(*A communication from Westphal Brothers, Berlin.*—(*Not proceeded with.*) 4*d*.

The machine consists mainly of revolving glass conveying rollers, over which the material is passed tightly stretched, while in a direction across that of the motion of the paper other glass rollers are moved and produce the required calendering or smoothing. The latter rollers are hollow for cooling purposes, and their position may be changed while in motion.

6156. SASH FASTENERS, *J. E. Cope, Birmingham.*—23*rd December*, 1882. 6*d*.

The object is to form a sash fastener so that it cannot be opened from the outside by inserting a knife between the meeting of rails and sashes, and it consists in adapting a guard or fly to pivot on the circle plate, and actuated by the lever arm so as to occupy a position behind the latter when closed. A fixed guard may be used instead of the pivotted guard if desired.

6157. FASTENINGS FOR GLOVES, &c., *G. Capewell, Birmingham.*—23*rd December*, 1882. 6*d*.

This relates to fastenings with hinged arms, which are passed through eyelets in the article to be fastened, and it consists, First, in arranging the spring actions so that they are not in contact with the base plate; and Secondly, in the use of a ring or slide to secure the arm, instead of the spring action.

6158. CARPETS, *F. B. Fawcett, Kidderminster.*—23*rd December*, 1882. 8*d*.

This consists, First, in saving weft material by the omission of picks; Secondly, in saving time and obtaining a safe tie with two picks to each wire, and with the stuffer passing below each alternate pick on the back; Thirdly, in the method of working the stuffer warp, detaching its heald from the comber board and operating it independently; Fourthly, in manufacturing carpets with alternate rows of piles and with certain colours in parts or blocks of the pattern confined to the large or small rows of pile; Fifthly, in weaving three shot fabrics, instead of raising the pile loops under and between two adjacent upper shoots, raising them over one of them, whereby the loops are made fuller and rounder; Sixthly, in weaving three-shot fabrics in which the third shoot is removed from the face to the back, thereby avoiding the pinching of the pile loops and producing a firmer fabric; Seventhly, the combination of thick and thin figure warps; Eighthly, the employment of two frames of similar warps from which threads are raised over wires sometimes together and sometimes separately, along with threads from other frames; Ninthly, the employment of the frames of similar threads rising over wires to the right and left; Tenthly, raising over wires sometimes a thread from one frame and sometimes from two or more frames.

6159. LOOMS FOR WEAVING, *J. Pemberton and R. Pearson, Preston.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the dobby or jacquard mechanism, and consists in dividing the lattice barrel into two sections placed side by side on the same axis, but operating independently in such manner that while one portion carrying one system of lattices is caused to produce the side borders in handkerchiefs or similar goods, the other portion is caused to produce the cross borders.

6160. SEWING MACHINES, *A. Guillaume and A. Lambert, Belgium.*—23*rd December*, 1882. 6*d*.

This relates to improvements in sewing machines with a shuttle of large diameter, as described in patent No. 1744, A.D. 1882, and it consists, First, in forming the stitch by means of the shuttle guide composed of slides fixed to the base plate, and placed at each side of and above the shuttle in combination with the shuttle or bobbin carrier of large diameter, and the shuttle driver composed of a plate of trapeze form, on which are supports placed against the shuttle, and which alternates in a guide of the same shape formed in the slides of the bobbin carrier guide at one side of the carrier; Secondly, in the combination of the guide with a ring fixed in the middle, and of a ring with the hook on one side and a gearing on the other, having a continuous rotation in the first ring and the shuttle carrier; Thirdly, in the gradual diminution of the spiral projection with the hook on its end for disengaging the thread from the hook; Fourthly, in mechanism for actuating the shuttle driver; and Fifthly, in the arrangement of the tension lever suspended to the needle lever.

6161. HYGROMETERS, &c., *F. H. F. Engel, Hamburg.*—23*rd December*, 1882.—(*A communication from W. Klinkerfues, Germany.*) 6*d*.

This consists in the combination of a straight hygroscopic hair-string, and a non-hygroscopic bent slack string connected by means of another non-hygroscopic string to the axis of an index pointer, in such a manner that the shortening of the hair-string deepens the bend of the slack string, whilst the lengthening of the hair-string reduces the bend.

6162. WATER-CLOSET APPARATUS, *J. Rider, Bristol.*—23*rd December*, 1882.—(*Not proceeded with.*) 2*d*.

This consists of a stoneware container glazed inside and out, of an urn shape, with a round, flat foot, with hole for screwing it to the floor. In the top is an opening to receive a china cone, and on one side is a brass axle passing through under the top, with an air-tight socket at each end. The axle has an elbow arm with a plug at one end, and a china cup with a hollow boss at bottom receives the plug. There is a cross balance arm on the side of the axle, and on one side of it is a balance weight.

6163. REMOVING OR CARRYING-OFF SMOKE, DELETERIOUS GASES, AND STEAM FROM RAILWAY TUNNELS AND COVERED STATIONS, *D. C. Green, Brooklyn, U.S.*—23*rd December*, 1882. 6*d*.

An inverted trough or hood is arranged immediately above the line of travel of the chimney of the locomotive engines, so that the smoke issuing therefrom enters such hood, and is conveyed along to a suitable outlet by a current of air maintained in the hood by suitable blowing apparatus or steam jet arranged at proper distance apart in the hood, and directed so as to produce an onward flow of air.

6164. APPARATUS FOR PRODUCTION OF ELECTRIC LIGHT, *A. M. Clark, London.*—23*rd December*, 1882.—(*A communication from L. Gerard and W. V. Bonsor, Brussels.*) 8*d*.

The objects are, First, to simplify the construction of dynamo-electric machines; Secondly, to increase the intensity of the magnetic field and its action upon the armature by the particular form of the pole pieces; Thirdly, to eventually maintain the field at a predetermined intensity, and be able to render the field or inducting current distinct from the exterior current without the assistance of an auxiliary dynamo; Fourthly, to allow in a modified form of dynamo, having several armature rings on same shaft, with their respective collectors, and under the influence of the same field magnets, of obtaining from the same machine so-constituted currents of high and low tension simultaneously, and distributed in different circuits; Fifthly, to simplify and improve commutators or collectors by making the contact surface plane; and Sixthly, to provide an apparatus which will permit of the extinction of a lamp or the stoppage of a motor in the series, without any alteration in the condition of the dynamo machine. The armature ring consists of as many cast iron sector-shaped segments as there are bobbins in the ring. The middle part of these segments is cut away, leaving a flat core to wind the induced wire upon, and the form of the ends is such as to leave radial slots between the segments to promote ventilation and check local currents in the ring, plates of non-magnetic material being interposed between the ends to magnetically insulate the segments. The segments are screwed to arms of a hub of non-magnetic material keyed to the shaft. The field magnets may be in two sets, with the same poles facing each other. The pole pieces are built up of several semicircular segments, of such sectional form as to embrace not only the external peripheries and sides of the ring, but also the greater part of its internal periphery. The armature shaft is mounted in adjustable bearings, so that it can be truly adjusted to the geometrical centre of the pole pieces. The armature bobbins are wound in the ordinary way, and connected to their respective commutator blades, part of the current generated being utilised in maintaining the intensity of the field, and the remainder for work in the exterior circuit, and so as to eventually make the field independent of variations in work in the exterior circuit, the induced wire may be wound in two distinct circuits, each provided with its own commutator, and respectively used for the field and for exterior work. Each commutator is a plain disc of non-conducting material with copper strips, so arranged that the diameter upon which the brushes rub intersects n-a of the strips, n being the total number of strips, and a, a number of the strips left out of circuit, and corresponding to the bobbins passing through the neutral region of the magnetic field. These strips are of logarithmic, spiral or epicycloidal shape. Apparatus is provided for inserting a resistance in the exterior circuit equivalent to that of any lamp or other apparatus which should fail to work.

6166. LITTER FOR USE IN STABLES, &c., *H. Symons, Totnes.*—26*th December*, 1882. 6*d*.

The litter consists of peat moss dried and disintegrated, and intimately mixed with one or more of the sulphates of magnesia, lime, potash, or soda.

6167. FIRE-ARMS AND BAYONET ATTACHMENTS THEREFOR, *A. W. L. Reddie, London.*—26*th December*, 1882. —(*A communication from E. T. Starr, New York.*) 6*d*.

This relates principally to breech-loading fire-arms in which the breech block containing the hammer and other cock mechanism is pivotted within the receiver, and it consists, First, in the combination with the receiver and a block pivotted to swing backward and downward therein, and a lever for operating the block pivotted on the same centre as the block and receiver, having between them a bore formed partly in the rear wall of each of a locking bolt or key connected with the lever, so as to be operated therein, and which fits the bore and holds the block against backward and lateral movement; Secondly, in forming the locking key with a notch in its rear side, and the lever with a projecting hook to engage the notch; Thirdly, in the combination with the receiver, block lever, and locking key of a hammer with a projection upon its tumbler, which comes against the lever in cocking and prevents it swinging down to withdraw the key while the hammer is at full cock; Fourthly, in the application of a spiral main spring to the swinging hammer; Fifthly, in the combination with an extractor working under the barrel, and with a bifurcated front, of an operating lever with a horn to enter the bifurcated part, and a spring bearing on the horn and controlling the action of the lever. The invention further relates to bayonet attachments, one of which consists in forming the bayonet with two sockets, one of which fits the barrel, and the other receives the end of the ramrod.

6168. DEVICES FOR JOINING THE ENDS OF LEATHER BELTS, &c., *H. H. Lake, London.*—26*th December*, 1882.—(*A communication from A. Johnston, New York.*) 8*d*.

A main plate is formed with two parallel rows of flattened tapering teeth at each side, the inner rows being arranged with their broad faces in planes transverse to the plate, and the outer rows with their broad faces parallel therewith, the two rows being adapted to be bent at right angles to each other when passed through the ends of the leather to be connected. Supplementary plates may be used and provided with teeth, which pass through the first plate and secure the two together, and other teeth to secure them to the leather.

6169. SILICA FIRE-BRICKS, SILICA FIRE CEMENT, &c., *H. Edwards and H. Harries, Glamorgan.*—27*th December*, 1882. 4*d*.

This consists in the manufacture of silica fire-bricks, &c, by the use of a small proportion of Portland cement in addition to or in lieu of the lime which is usually added to the ground silica.

6170. BAR ROLLING MILLS, *J. Imray, London.*—27*th December*, 1882.—(*A communication from U. Haskin, Pennsylvania.*) 1*s*. 4*d*.

The principal objects are to provide means for twisting the bar as it passes from one pair of rolls to the next, so that it may then be pressed at right angles to the previous pressure. To means for separating the rolls so as to give access to the metal under operation in case of accident; to means for correctly adjusting the driving gear of the successive rolls so as to make allowance for wear and for variation of speed, and in cases of rolling bars, such as rails, having parts of their sections of various thickness to provide against the undue straining and cracking of the thin parts, and against the bending of the bars as they are delivered from the rolls. To twist the bar the upper roll of the first pair is set with its axis slightly inclined to the lower roll, and the bar which is thus twisted is guided to the next rolls through a helical guide. To give ready access to the metal between the rolls the housings of horizontal rolls and the guides attached to them are divided in a horizontal plane passing through the line of travel of the bar, so that the upper part, the upper roll, and the upper hub of the guides can be raised. In the case of vertical rolls the framing is divided vertically. The raising or turning back can be effected by hydraulic power.

6171. VACUUM BRAKE APPARATUS, *J. Gresham, Salford.*—27*th December*, 1882. 10*d*.

This relates, First, to the combination of parts of the rolling ring system with the diaphragm or sack system of brake cylinders. The vacuum chamber is mounted on trunnions, and the cylinder has a flange at its upper end, to which the outer edge of the diaphragm is secured, the inner part being secured to the piston plate by a washer and screws, or instead of a diaphragm a bellows arrangement may be substituted; Secondly, to an improved arrangement of valve combined with the above described improvements; Thirdly, to improvements for signalling, and also to modifications of valve mechanism and apparatus described in patent No. 1494, A.D. 1881.

6172. KILNS FOR BURNING BRICKS, POTTERY WARE, LIME, &c., *H. Knowles, Leicester.*—27*th December*, 1882. 6*d*.

This consists in constructing continuous or semi-continuous action kilns with separate chambers divided from each other by partition walls with flues and passages therein, the flues being constructed of different capacities at different parts, and provided with dampers In the partitions are vertical flues with inlet passages at bottom of one side, such passages opening into one chamber, and outlet passages at the upper part of the other side of the partitions opening into the adjoining chamber, through which flues and passages the waste heat and products of combustion from one chamber are conveyed to the other chamber, and utilised in drying and burning the goods therein.

6175. CORKING BOTTLES, *H. J. Worssam, London.*—*27th December*, 1882.—(*Not proceeded with.*) 2*d.*

The bottles are placed in recesses in a table, over which is a second table, the two revolving together and the latter having holes through it for the passage of the corks which are forced into the bottles by a punch worked by a crank and connecting rod.

6176. MANUFACTURE OF GLUCOSE SYRUP AND GRAPE SUGAR, *H. J. Haddan, Kensington.*—*27th December*, 1882.—(*A communication from Dr. H. Endemann, New York.*) 4*d.*

This consists in producing grape sugar or glucose by exposing starch to the action of tribassic or ortho-phosphoric acid under a heat higher than the boiling point of water, and under pressure higher than the atmospheric pressure.

6177. TRAMWAYS OR LIGHT RAILWAYS, *J. C. Mewburn, London.*—*27th December*, 1882.—(*A communication from G. Michelet, Brussels.*—(*Not proceeded with.*) 2*d.*

The rail consists of a main rail of the Vignoles type and a counter rail shaped to fit between the head and foot of the main rail, the two being connected by rivets or bolts. A tie bar is used composed of a flat or chamfered iron bent at a right angle at the ends, and bolted to the two rails which it is to maintain separated.

6178. VELOCIPEDES, *W. Woods and B. R. Mills, London.*—*27th December*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in connecting the crank shaft to the driving axle by means of a jaw or forked head at each end of the crank shaft, and similar jaws fitted to the lower and upper ends of a vertical shaft, and to the inner end of the driving wheel axle. In each jaw is pivotted a ball with centre pins projecting at right angles to the pivot, those at one end of the crank shaft being coupled to those of the lower end of the vertical shaft, and those at the upper end of the latter to those of the inner end of the driving axle by double-forked connecting-rods.

6179. BOX FOR PARCELS POST AND LIKE PURPOSES, *F. C. Nutter, London.*—*27th December*, 1882.—(*Not proceeded with.*) 2*d.*

The box is of any required size and shape, and the lid is either hinged thereto or separate. Over the lid is secured a sheet of paper or cloth with flaps coated with adhesive material, so that they may be secured to the box, and prevent the removal of the lid.

6183. ELECTRICAL GENERATORS AND MOTORS, *T. J. Handford, London.*—*27th December*, 1882.—(*A communication from T. A. Edison, New Jersey, U.S.*) 6*d.*

The object is to provide means whereby the current collectors or commutator brushes of dynamo-electric machines or electro dynamic motors may be retained at the points of maximum electro-motive force or work of the generator or motor without undue or destructive sparking, the capacity of the machine being thereby largely increased. The invention consists in making the current collectors of a material of inferior electrical conductivity, and making inferior contact copper (which is usually employed), whereby the resistance of the circuits formed between the bars of the commutator as the brushes pass over them is greatly increased. In order to still further increase the resistance of the circuits, the commutator bars may be constructed of or surfaced with a material making inferior contact compared with copper. By this means the bridge formed by each collector across the commutator bars has a large resistance compared with the local coils, the circuit of which is completed within the machine by the bridging of the commutator bars; hence the local current generated is very weak, and the spark reduced to comparatively *nil*.

6184. MACHINE FOR OBTAINING MOTIVE POWER, *E. S. Eyland, Bristol.*—*27th December*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a disc to which levers carrying weights are pivotted.

6185. ELECTRIC ARC LAMPS, *A. M. Clark, London.*—*27th December*, 1882.—(*A communication from La Société Solignac et Cie., Paris*) 6*d.*

This relates to an arc lamp in which the upper carbon is made to act also as a reflector, for which purpose it consists of a block or stick of carbon of relatively large section enclosed by resting in an annular cup or block of refractory material which protects its side and allows only the lower end to be consumed. This end consumes evenly over its whole surface, which remains flat and forms a powerful reflection in close proximity to the arc.

6186. STEAM AND OTHER MOTIVE POWER ENGINES, *T. Hancock, Wolverhampton.*—*28th December*, 1882. 1*s.*

The following is a description of the application of the invention to a steam engine:—The steam chest is cylindrical, with its axis in a direction across the main cylinder, and is divided in the middle, forming two separate chests, one end of each of which is less than the other, and a piston valve being fitted to work one in each of such parts of different diameter in each chest. The two valves in each chest are rigidly connected and move together. One steam chest acts to supply steam to one side of the main piston only and to exhaust it from the other. Each main cylinder port is connected with the steam chest; one by a port into the small part to act as the steam port for one end, and the other by a port into the larger part to act as the exhaust port from the other end of the cylinder. The main piston uncovers a port communicating between the cylinder and the back of the larger valve, and causes both the valves to be driven forward and the ports closed, a ring working in the chest and connected with the larger valve closing the small port from the cylinder. As the valves in one chest close those in the other are opened by a small port communicating with the steam chest at the outer face of the smaller valve, thus driving both valves open. The steam pressure at the back of the larger valve, after the valves are closed in one chest, is relieved immediately those in the other are opened by a port communicating between the space containing such pressure and the space in the other steam chest which is open to the exhaust. When desired to work expansively each steam chest has added to the smaller part a smaller port in which are the steam port and inlet, and the steam valve is of two diameters, and slides on a stalk prolonged from the other valves, and steam is admitted by a port to close the inlet at the desired time. To control the degree of expansion a number of holes are formed at increasing distances from one end of the cylinder so as to communicate with a passage running parallel to the cylinder, and a small port communicates between the latter and the port which supplies steam to close the steam valve. Within the parallel passage is a hollow cylinder with a number of holes through one side, and capable of being moved endwise to bring any one of the holes opposite the holes in the cylinder, a long port through one side of the hollow cylinder being always in communication with the port to supply steam for closing the steam valve.

6187. COLLAPSIBLE PACKING CASE, *R. R. Blandy, Shepherd's Bush.*—*28th December*, 1882.—(*Not proceeded with.*) 2*d.*

The sides and ends of the case are hinged together, and the bottom is hinged to one side, while the lid is hinged to the other side of the case, so that the case when not in use can be folded flat. Angle irons secure the sides and ends in position for use.

6188. PRINTING MACHINES, &c., *J. H. Johnson, London.*—*28th December*, 1882.—(*A communication from B. Anthony, New York.*) 1*s.* 2*d.*

This relates, First, to mechanism for printing simultaneously on both sides of two webs, and causing them to issue so that the method of associating the webs together, described in patent No. 2879, A.D. 1882, may be used; Secondly, in printing from one set of stereotype plates continuously on both sides of one or more webs, and in such a way as to produce perfected papers at twice the rate which an ordinary web press does, while papers of various numbers of pages may be printed on the same machine; Thirdly, to a process of taking *papier maché* matrices from type arranged so that its surface is cylindrical; and Fourthly, to means for regulating the tension of the roll of paper so that the tension is automatic, that is to say, it is caused to fluctuate within narrow limits about any required mean amount and to be practically independent of the size of the roll, of the velocity of the machine, and of the variations in brake power. This consists, First, in the combination of two forme-bearing cylinders (whose axes are parallel) with mechanism for deflecting (after it has been printed on both sides) the path of one of the webs, whereby two webs are simultaneously printed on both sides, and are caused to issue with the opposite side up to that which entered the apparatus; Secondly, the combination of two triangular plates fixed parallel to each other, with a roller whose axis is at an angle to the planes of the plates, whereby the sides of a travelling web or sheets in tapes are reversed; Thirdly, in a web printing press, the combination of a plurality of forme-bearing cylinders (all the formes on each of which are placed abreast in a line parallel to the axis and the columns lying in the direction of its rotation), with impression and carrier cylinders; Fourthly, in the combination of mechanism described in claim 3, with mechanism for bringing together different portions of a travelling web without stopping its motion; Fifthly, in the combination with mechanism described in claim 3 with mechanism for bringing together different portions of a travelling web and mechanism for afterward longitudinally folding the web without stopping its motion; Sixthly, in first making up the type forme on a chase curved to fit the cylinder of the press, and adapted to the rapid drying of the matrix, in making from such curved forme a matrix and drying it in contact with the form, in casting a stereotype plate from the matrix, and finally using both the type, forme, and the stereotype in printing; Seventhly, in a chase curved cylindrically and adapted to receive type, column rules with inclined sides fastened thereto, so that the sides facing one another of any two consecutive rules are parallel, and the rules lie parallel to the axis of the type cylinder when the chase is placed thereon; Eighthly, in the combination with a shaft carrying a roll of paper and brake acting thereon, of a tension roller connected to the brake lever and freely movable in a guiding slot, whereby variations in the tension of the paper cause movements of the tension roller, and the latter in turn acts upon the brake.

6195. ILLUMINATION OF LIGHTHOUSES, *J. R. Wigham, Dublin.*—*28th December*, 1882. 6*d.*

This consists in arranging two or more lenses side by side in lighthouses, with lamps or burners situated in the focus of each such lense, so as to form a much broader beam of light than hitherto, the spaces between the lenses being either fitted or not with dioptric or other reflecting apparatus for throwing back the light and heat on the focal burners.

6196. INSULATING CONDUCTORS FOR ELECTRIC LIGHTING AND OTHER PURPOSES, *W. Smith, London.*—*28th December*, 1882. 4*d.*

This consists in the use of gutta-percha mixed with ground coal as an insulating material for electrical conductors.

6197. SHOOTS APPLICABLE MORE ESPECIALLY FOR LOADING COAL, ORE, GRAIN, &c., INTO THE HOLDS OF VESSELS, *S. W. Snowden, West Hartlepool.*—*28th December*, 1882. 6*d.*

The upper ends of preferably two shoots are hinged to a table supported by legs or suspended over the hatchway, and above which is the hopper to lead the coal to the troughs. Each trough is made telescopic, the sections being distended or drawn in by means of a chain and windlass. The lower part of the upper division of each trough is connected by a link to a nut, through which a screw works, so as to incline the troughs as desired.

6200. DRYING STARCH AND OTHER AMYLACEOUS SUBSTANCES, *W. R. Lake, London.*—*28th December*, 1882.—(*A communication from L. Maiche, Paris.*) 6*d.*

This relates to a process of rapidly drying starch "*in vacuo*," and consists in first drying the blocks of drained starch or raw starch in a stove a sufficient time to allow a thin yellow layer to form on the surface, which layer is removed and the blocks wrapped in paper and subjected to the double action of a vacuum and heat in a closed apparatus.

6207. ATTACHING FALSE AND REVERSIBLE CUFFS TO SHIRT SLEEVES, *F. S. Turner, Finchley-road.*—*29th December*, 1882. 6*d.*

A small wristband is attached to the shirt sleeve, so as to overlap the false cuff. One end of the cuff is secured to the wristband by a stud, and the other end, after passing round the wrist, is also secured by the stud, when the wristband passes round the outside, and is in turn secured by the same stud.

6211. APPARATUS FOR TURNING LEAVES OF MUSIC, *J. C. Mewburn, London.*—*29th December*, 1882.—(*A communication from O. Erganian and O. E. Torossian, Constantinople.*) 6*d.*

The apparatus consists of a turning lever actuated by a pedal, and which takes hold of and releases automatically the leaf to be turned by means of special mechanism, consisting essentially of a spring barrel, a releasing device, and a grooved metal plate fitted in an opening in the leaf to be turned.

6215. REGISTERING THE MILEAGE OF VEHICLES, *J. Imray, London.*—*29th December*, 1882.—(*A communication from F. Bisson, Paris.*) 6*d.*

Motion is communicated from one of the travelling wheels by a band to a pulley connected to suitable counting mechanism, when the band is tightened by means of a roller actuated by levers.

6216. TUBULAR BOILERS, *J. Armer, Dartford.*—*29th December*, 1882. 4*d.*

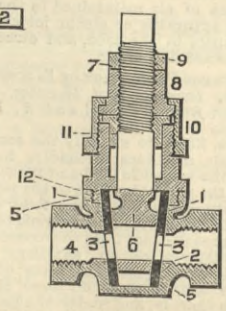
The object is to provide an increased amount of tube surface, and it consists in bending the tubes so as to give them a gentle helical twist throughout their length.

6217. VELOCIPEDES, &c., *J. Harrington, Coventry.*—*29th December*, 1882. 6*d.*

This relates, First, to provide velocipedes capable of being used either by one, two, or more persons, and consists in providing a tricycle or other front steering velocipede with an extra seat and driving wheel caused to trail after the vehicle; and Secondly, to improved differential driving gear for velocipedes.

6222. COCKS OR VALVES FOR STEAM, WATER, GAS, &c., *A. Bradshaw, Accrington.*—*29th December*, 1882. 6*d.*

In the drawing at 1 is a taper split tube of metal or vulcanite ground or turned to fit, and placed within the body or valve of the cock 2, and having passage ways 3 corresponding with the passage ways 4 4 of barrel or body of the cock: the lower end of the tube



3 rests slightly on the bottom, top, or part 5 of the barrel 2. Inside the split tube 1 is the taper plug 6, its spindle being chased or screwed at 7, so as by the adjusting nut 8 the said plug will if screwed down expand the split tube 1 and ensure the latter fitting accurately and truly to the interior of the barrel of the cock, and securing a perfectly steam, water, or fluid tight tap; 9 is a lock nut, 10 a screw cap, 11 the gland, 12 the stuffing-box piece chased and screwed in at 12.

6226. GALVANIC BATTERIES, *T. J. Howell, Lambeth.*—*30th December*, 1882. 4*d.*

This consists principally in the use in a galvanic battery of a porous pot of pure carbon charcoal, of manganese and carbon, plumbago and carbon, or of any other carbons found most expedient, and placed in an insulating earthenware or any suitable vessel. The carbon porous pot serves both as the carbon electrode and the ordinary earthenware porous pot or plate combined. The pot may be suspended by a flange some distance from the bottom of the outer vessel, and in the space left a plate of zinc is placed, from which an insulated wire passes. Within the pot nitric acid and water is placed in the proportion of about ¼ acid to ¾ water, and also a small quantity from ½ oz. to 1 oz. of fluoric acid to every 6 oz. nitric acid, and in the outer vessel 1 part sulphuric acid to 9 parts water, together with a small quantity of free mercury to keep up the amalgamation of the zinc electrode.

6228. TELEPHONIC AND MICROPHONIC TRANSMITTING INSTRUMENTS, *J. Imray, London.*—*30th December*, 1882.—(*A communication from Dr. J. Ochorowicz, Paris.*) 6*d.*

This consists in a telephonic or microphonic instrument forming part of the line circuit by magnetic powder in a magnetic field, so that as the field is varied by vibrations caused by sound pulses, the resulting changes in the condition of the powder particles cause electrical undulations in the circuit. One form of instrument consists of a strong iron or steel disc fixed a little above a pair of magnets presenting opposite poles towards each other, with magnetic filings, such as iron filings, between them; the circuit wires being attached to the magnets, the vibrations of the disc will cause the required electrical undulations in the circuit.

6239. UMBRELLAS AND PARASOLS, *L. Engel, London.*—*30th December*, 1882. 6*d.*

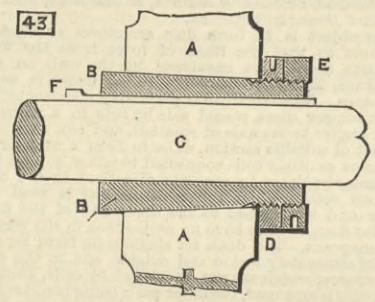
To form the joints connecting ribs of "Paragon" form with the top notch, a T piece is attached to the end of each rib, the stem being compressed in the trough. The head of the T is drilled to receive the wire. The top notch has two flanges, between which the head of the T pieces are received, the stems being bent inwards, and the wire holds them securely. The joints between the stretchers and runner are also formed with T pieces, the heads of which enter between flanges and are secured by a wire. The joints between the stretchers and ribs are formed by splitting the trough end of the stretchers and inserting a middle piece, so as to form a double fork, which embraces a bit on the rib, a pin being inserted through the whole. The eye for attaching the cover is formed on the outer side of the rib by wire bent to form the eye and secured in the trough.

19. GAS MOTOR ENGINES, *P. F. Forest, Paris.*—*1st January*, 1883. 6*d.*

The inventor claims, First, the improved gas motor engine, in which the engine shaft situated at the back end of the engine directly actuates the ignition and admission slide by means of a cam, and is itself driven by the piston rod through a rocking beam in front and a connecting rod passing from a lever on the shaft of the rocking beam to a crank on the engine shaft at the back; Secondly, constructing the cylinder with external helical ribs, either solid or hollow, in order to accelerate the cooling of the cylinder; and Thirdly, in the construction of a hollow slide valve with chambers for the mixture of the gas and air forming the combustible charges, and openings and channels for the admission of the gas and air to the chambers and thence to the cylinder.

43. FRICTION DEVICE FOR SECURING CARPET LOOMS AND OTHER MACHINES AGAINST BREAKAGE, *T. Hardcastle, Kidderminster.*—*3rd January*, 1883. 4*d.*

Upon the driving shaft C is the friction device B secured by the key F. The boss of the driving wheel A is bored so as to fit the taper bush B. By means of



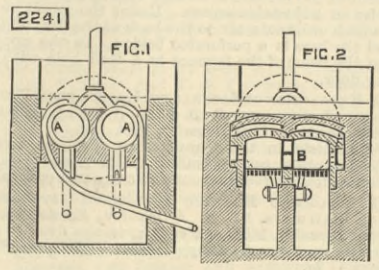
the nuts D and E the driving wheel is tightened on the bush to any desired extent, but upon any excessive strain being brought to bear upon the wheel it will slip round the bush B.

66. SHADES FOR LAMPS, &c., *J. H. Johnson, London.*—*4th January*, 1883.—(*A communication from E. Lefebure, Paris.*) 6*d.*

This consists in forming lamp shades with a jointed frame similar to that of an umbrella, so that the shade can be opened or closed when desired.

2241. FURNACES FOR STEAM BOILERS, &c., *F. C. Glaser, Berlin.*—*2nd May*, 1883.—(*A communication from C. A. Petzold, Berlin*)—(*Complete*) 4*d.*

This consists in effecting the consumption of smoke in furnaces by causing heated air to enter, Firstly, in divided streams above the fire-grate, and also in divided streams at the fire-bridge. In the middle of the fire-grate is a cast iron hollow partition B, serving to support the double-arched fire-brick top of the furnace, and which has openings in front provided with regulating valves. The upper part serves to



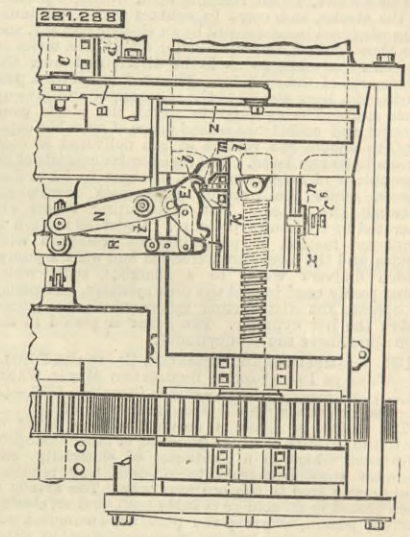
supply air through the inner sides of the furnace above the fireplace. Above the arched top and behind the outer sides are other air passages, with openings in front provided with regulating valves, while the arches and sides of the furnace are pierced with holes, through which heated air passes to the space above the grate. The lower part of the partition serves to lead air to the hollow cast steel rings A at the fire-bridge, which are formed with a chamber, through which cold water circulates, and can be afterwards used to supply the boiler.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

281,288. METHOD OF AND DEVICE FOR PREPARING AND PACKING BRAN, &c, *William A. Morrison, Cambridge, Mass.*—*Filed April 12th*, 1883.

Claim.—(1) A method of preparing bran and kindred substances for the market, consisting in feeding the material from bulk to a mould box, in which it is measured and compressed into a cake, the cakes being expelled in quick succession from such box as fast as completed. (2) In machinery for converting bran and analogous substances into compact cakes a mould box to receive and measure the material, a plunger adapted to traverse such box and compress the material, and an adjustable gate governing the discharge mouth of said box, such gate, when in one extreme position, constituting the bulkhead which closes the mouth of the box, and against which the cake is compressed, and in the other position opening the box and permitting the escape of such cake, substantially as and for the purposes set forth. (3) In combination, the mould box, the gate, the plunger, and the cut-off plate, with the feed opening governed by such gate, substantially as set forth. (4) A step in the process of forming bran and analogous substances into portable cakes, which consists in discharging steam into the material in its descent to the mould box. (5) In machines for forming bran and analogous substances into compact cakes, the combination, with mechanism for reducing the material to solid cakes, of means for introducing a current of steam to intercept and moisten such material in its passage to the moulding chamber. (6) The herein-described hopper, consisting of the chute C^2, with its partition E^2, the gate F^2, and inlet port G^2, and the bin D^2. (7) In combination, the lever B^1, cam D^1, bar C^1, wedge *q*, bar *t*, and shipper



bar R, substantially as stated. (8) The combination, with the mould box and its plunger, of the cut-off, its lever N, and the shipper bar R, substantially as and for purposes set forth. (9) In combination with the mould box and its plunger, the dogs *k l*, the sector E^1, with its teeth *i j*, and the bar *m*, the dog *x*, and counter-balance arm c^6, secured to the rock shaft which carries the said arm *m*, substantially as described. (10) In combination, the mould box and its plunger, the cut-off, the lever N, connecting such cut-off with the shipper bar R, the sector E^1, with its teeth *i j*, the dogs *k l*, secured to and moving with the plunger, the shipper bar R, and the clutch mechanism with which such bar operates, substantially as set forth. (11) The combination, with the mould box, its plunger, and the cut-off, of the lever N, shipper bar R, and sector E^1, with its teeth *i j*, the sector being linked to the shipper bar, and the lever pivotted at its tail to said bar, substantially as herein described. (12) The sector, with its teeth *i j*, in combination with the plunger and the dogs *k l*, carried by such plunger, the sector being connected with and operating to reverse the shipper bar, substantially as set forth. (13) In combination with the lever B^1 and gate Z, the wedge *q*, curved bar *t*, and shipper bar R, carrying such bar *t*, substantially as stated. (14) The combination, with the sector and its dogs *k l*, and the shipper bar R, of the arm *m*, carried by the rock shaft *n*, and adapted to interpose its upper end between the dog *k* and the forward tooth of the sector, substantially as hereinbefore described. (15) In combination with the lever B^1, its pendant arm C^1, and the cam D^1, the post d^3, and latch h^3, the latter being pivotted to the bracket f^3, substantially as set forth.

CONTENTS.

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HULL AND BARNSLEY RAILWAY AND DOCK COMPANY.—An ordinary half-yearly meeting of the shareholders and directors of this company was held on Saturday, at noon, Lieut.-Colonel Smith, M.P., presiding. The chairman said he did not see why the line should not be opened to Howlen by the 1st of April next year. If all went well with the Aire and Ouse bridges, he did not see why the whole line should not be opened by the 30th June next year.