A Seven-Day Journal

A Big Gasworks Amalgamation.

Two of London's gas undertakings, the Gas Light and Coke Company and the Brentford Gas Company have, it is officially announced, agreed to amalgamate. Subject to parliamentary sanction being secured the amalgamation, it is proposed, should become effective on January 1st, 1926. The amalgamation, it is held, will provide the Gas Light and Coke Company with fresh territory for expansion and development, and in the Brentford Company's area will secure economies principally in the matter of transport, which has always been a source of some difficulty in view of the situation of the company's works at a considerable distance up the river Thames. The Gas Light and Coke Company is already the largest supplier of gas in the world. Last year it sold over 167 million therms, to produce which it used 2,055,117 tons of coal and carburetted 10,689,431 gallons of oil. The Brentford Company, together with the Richmond and the Harrow Companies now incorporated in it, sold last year over 27 million therms, and used 318,380 tons of coal and 2,650,293 gallons of oil.

Profit-sharing in 1923.

ALTHOUGH still bearing witness to the prevailing trade depression, the returns for 1923, issued last week by the Ministry of Labour of the profit-sharing schemes in operation in this country, show a slight improvement over those for the preceding twelve months. A total of 234 schemes were known to be in operation, of which 33, covering 59,000 workpeople, were in the engineering, shipbuilding and other metal trades. Of the total, the Ministry is able only to give figures dealing with 172 schemes, embracing 121,022 employees. The average bonus paid amounted to £7 6s. per head, or a ratio of bonus to earnings of 5.1 per cent. This figure shows an increase of £1 0s. 9d. over that for 1922. In the engineering and shipbuilding group, details are given of 22 schemes, having 13,464 participating employees. An average bonus of £1 2s. 4d. was given, or 1 per cent. of the earnings. In the glass, chemical, coal, oil and paint group of industries there are ten profit-sharing schemes, with 23,127 enployees, who received an average of £8 17s. 2d.; while the 32 schemes associated with the supply of gas, water and electricity, declared an average bonus of £6 4s. 7d. to the 31,359 employees covered by them. During the year six schmes were discontinued—two following the liquidation of the firms concerned, three owing to trade depression, and one because the scheme did not secure the results expected—and eight new schemes were started. Included in the new schemes is one in the chemical manufacturing industry, employing 6800 workpeople. The firm in this case makes an issue of ordinary shares to its employees on favourable terms, but although included in the Ministry's statistics, this scheme can hardly be said to come within the accepted definition of "profit-sharing." The figures given above relate solely to competitive business concerns, and may be supplememted by the details for 1923 of co-partnership productive societies issued by the Labour Co-partnership Association. These latter figures, however, give no indication as to the number of employees participating, and in this respect are not so valuable as are the figures of the Ministry of Labour. The 66 British societies had a balance of profit of £214,535, and together paid a sum of £40,726 as dividend on wages. Three societies are associated with the metal trades, and with a turnover of £87,647, made a profit of £2568. Only one paid a bonus, a dividend of 6d. in the pound on wages which amounted to a total of not more than some seven hundred and twenty-five pounds.

French Naval Manœuvres.

THE operations of the French Fleet in the Mediterranean between Marseilles and Toulon during the past week were not so much in the nature of manœuvres as of a demonstration, intended to impress upon the public the insufficiency of a navy which is obviously unable to ensure the safe transport of troops from North Africa to France. Having at his disposal three battleships, a light cruiser surrendered by Germany, four submarines and nine torpedo boats with a number of aircraft, Admiral Daumesnil could do little more than demonstrate the defensive and attacking qualities of the battleships and submarines. It is certain that this fleet could have been greatly reinforced had not the Atlantic squadron been engaged in exercises off the coast of Brittany. On the assumption that the small Mediterranean fleet is the best that can be assembled at the present moment the French naval critics deplore that it should have fallen so far below the numerical strength of the Italian navy, but the position is by no means so desperate as is represented in view of the activity being displayed in carrying out the programme of naval construction. The intention is to convince the Socialist Government that no economy is permissible which may weaken a fleet intended ultimately to render inviolate the seaway across the Mediterranean. The demonstration was, indeed, decided upon after M. Herriot and his colleagues had witnessed the naval review at Spithead.

The Schneider Seaplane Cup.

IT would seem unlikely that this country will now be able to endeavour to recover the Schneider International Seaplane Cup wrested from it last year by the United States. The race is to take place at Baltimore on October 24th–25th. Considerable hope centred round a high-speed research aeroplane which the Gloucestershire Aircraft Company had built for the Air Ministry. This machine was fitted with a Napier "Lion" engine coupled directly to a Fairey all-metal airscrew running at 2400 revolutions per minute. Had it shown on trial a speed in excess of that of the winning American machine last year—177½ miles an hour—it was the intention to lend it to the constructors for the purposes of the race. Failing the attainment of such speed it was to have been kept by the Air Ministry for research purposes. On Friday evening of last week it was given a short trial at Felixstowe, and showed itself to be very fast. Unfortunately on alighting something went wrong with, apparently, a part of the undercarriage or floats which caused the machine to dive and sink in the harbour. The pilot escaped unhurt. No other British machine, it is understood, is available to take the place of the one thus lost.

The Late Mr. Donald Bremner.

FEW men have taken a more active share in recent Clyde shipbuilding undertakings than Mr. Donald Bremner, whose death in his sixty-ninth year was announced at the end of last week. A native of Wick, the late Mr. Bremner joined the firm of James and George Thomson, of Clydebank, when he was quite a young man. He devoted himself to the commercial side, remained with the firm as commercial manager until it was taken over by John Brown and Co., Limited, then of Sheffield, after which he left to become a partner in the Clyde Shipbuilding and Engineering Company, Limited, at Port-Glasgow. Sometime later he severed his connection with this firm and acquired the neighbouring yard of John Dunlop and Co., which firm he reconstituted as Dunlop, Bremner and Co., Limited, and continued to manage it for several years until it was eventually sold to Lithgow's Limited. Mr. Bremner then transferred his interests to the other side of the river, when, in conjunction with Mr. H. M. Macmillan, he helped to establish the Blythswood Shipbuilding Company, Limited, at Scotstoun. His last work was to lay out the Lloyd Royal Belge shipyard higher up the river, which is now the Jordanvale yard of Barclay, Curle and Co., Limited. Mr. Bremner continued to manage this yard until the Belgian firm was compelled by exchange difficulties and the shipbuilding depression to close down the Clyde yard. In his later years he was connected with the Steel Company of Scotland, Limited, of which he was a director. After he retired from business, Mr. Bremner continued to live at Crieff.

The World's Largest Lifeboat.

THE formal launching of the New Brighton motor lifeboat, which is stated to be the world's largest lifeboat, took place on the Mersey on Wednesday last, when the new boat was presented to the Royal National Lifeboat Institution and handed over to its New Brighton branch. The William and Kate Johnson, so named after the two generous Liverpool donors, who with local help presented the boat to the Institution, is a 60ft. twin-screw boat of the Barnett type. She has a beam of 15ft., with a depth of 4ft. 6in. and a displacement of 40 tons. Her propelling machinery comprises two of the Institution's new 90 horse-power petrol engines, and the deck auxiliary machinery is electrically driven. Altogether, there is accommodation for about 150 people and two passenger cabins are provided. New features include a life-saving net, a searchlight and a line-throwing gun. When completed last year the New Brighton boat made a tour round the British Isles before taking up her station on the Mersey, where she replaces the steam lifeboat Queen. The lifeboat Queen was stationed on the Mersey for twenty-six years, and was instrumental in saving 196 lives. The New Brighton motor lifeboat was prominent among other British and foreign lifeboats which assembled on the Thames in July to mark the occasion of the Institution's centenary, and there is probably no lifeboat in the Institution's fleet which is so widely known.

New Shipbuilding and Shipping Directors.

ON the lamented death of Viscount Pirrie, it was to be expected that some changes would take place in the directorates of the undertakings with which he was so closely connected. At the end of last week the announcement was made that two further directors had been elected by Harland and Wolff, Limited, in the persons of Mr. John Craig, of Motherwell, and Mr. John Sampson, of London. Mr. John Craig is the chairman of David Colville and Sons, Limited, and he is closely connected with the Clyde coal and iron industries. He joined the firm of Colvilles when quite a boy, and now he is not only the head of his firm, but one of the best-known men in the British steel trade. Mr. Craig's wide experience and marked business ability make him a notable addition to the Belfast directorate. Mr. John Sampson is well known in shipbuilding circles, and he is also a director of John Brown and Co., Limited. He is no stranger to Belfast, for he was a principal in Harland and Wolff for thirteen years. Other changes following the death of Viscount Pirrie have taken place on the board of the Oceanic Steam Navigation Company—the White Star Line. It is announced that Colonel H. Concanon and Mr. A. B. Cauty, hitherto Liverpool directors, have been elected as full directors in association with Mr. E. C. Grenfell and Mr. Harold A. Sanderson the chairman of the company. Both Colonel Concanon and Mr. Cauty are well known and highly esteemed in Liverpool shipping circles, and gratification has been expressed that, although they have been elected to the London directorate, they are not to sever their Liverpool connection, but will remain at the Liverpool office of the White Star Line.

A Large Refuse Power Plant.

A BEGINNING with what is claimed to be the largest refuse power plant in the world was made last week at Glasgow. The Helen-street plant, which will occupy about 15½ acres, is to be designed and constructed on entirely new principles by Heenan and Froude, Limited, of Worcester and Manchester. It will deal with the whole of the rubbish from the south side of the city, and the heat from the destructor will be used to raise steam for driving two 5000-kilowatt turbo-alternators, a third set being installed for stand-by purposes. The current generated will be sold to the Electricity Department. Heenan and Froude, we understand, have given particular attention to the mechanical feeding of the refuse to the destructor and the mechanical clinkering of the furnaces, both of which operations are carried out in such a way that a constant head of steam is maintained at the boilers. The plant is designed to run continuously throughout the twenty-four hours, and it is estimated that the yearly output of current will approximate to 58,000,000 units, of which 50,000,000 will be sold to the Electricity Department, and the remainder utilised in the works for the running and lighting of the plant and for charging a fleet of fast electric vehicles, which are to be employed in transporting the *débris* to the destructor plant. There is expected to be a large demand for the clinker for road-making and building purposes. Glasgow Corporation is to be congratulated on the lead it is giving towards obtaining an economical solution of the problem of disposal of city refuse. At this stage, it is not possible to give further details of the installation, but in view of the long and successful experience of the designers of the plant, there seems little doubt that the Helen-street refuse power plant will only be the first of several large plants of this type to be installed in this country.

Still Engine Locomotive Developments.

WE learn that the Still Engine Company, Limited, of Westminster, has granted a full licence to Schneider et Cie., of Creusot, for the construction of Still engine locomotives in France. It is understood that work will begin immediately upon a design for a main-line locomotive, and the firm is said to have in view the use of such internal combustion locomotives, not only in France, but also on the railways in Tunis. In the case of the Tunisian railways, the Still engine locomotive is particularly attractive, because the amount of water needed would only be about 10 per cent. of that which would be used by an ordinary steam locomotive of equal power. Moreover, no tender is required, and the amount of fuel carried would be sufficient for a run of from eight to ten hours at full power. The advantages of the Still system for locomotive work have not been overlooked by British locomotive builders, and a main-line Still locomotive, designed to develop 1000 to 1200 brake horse-power, is at present under construction in the shops of Kitson and Co., Limited, of Leeds. The engine is of the 2–6–2 coupled type, and is designed for mixed class traffic, and for a maximum speed of 40 to 50 miles per hour. A four-cycle eight-cylinder totally enclosed type of engine will be employed, with two sets of four horizontal cylinders, placed opposite to each other. The bore of the cylinders is 13in., with a stroke of 15½in. In the centre of the crank shaft a double pinion is provided, which is geared at a ratio of about 2 : 1, with a jackshaft below. The jackshaft is connected to the three coupled driving wheels on either side by coupling-rods of the ordinary type. The working pressure of the boiler is 180 lb. per square inch, and the locomotive is designed to start on steam. We are informed that the main engine bedplate is now completed, and that one line of cylinders will shortly be finished, and prepared for preliminary bench tests for flexibility.

The British Empire Exhibition.

ENGINEERING EXHIBITS, No. XXIII.*

TEXTILE MACHINERY IN THE PALACE OF ENGINEERING.

In a recent article we dealt with the sixty-odd textile machines which are exhibited in the Palace of Industries. It will come as a surprise to many to know that there are about fifty more textile machines in the Palace of Engineering. They are, however, so scattered and in some cases so intermingled with other plant that nothing but a careful search will reveal them all.

In this section all of these exhibits are run by individual firms, of whom two at least provide comprehensive displays. Of them the stand of Tweedales and Smalley (1920), Limited, of Castleton, Rochdale, is virtually a complete cotton plant up to the point where the looms take up the work, while that of Robert Hall and Sons, Limited, of Bury, contains a very varied selection of winding and weaving machines. Neither of these plants is arranged in factory form and all the processes are not seen going on simultaneously, as can be done in the big co-operative mill which we recently described, but each of the machines on either stand can be inspected in operation as and when required.

In all there are eleven firms exhibiting textile machines and many accessories thereto in the Palace of Engineering, and, speaking either collectively or individually, the exhibits are of a high order. Many of them are of a special nature so that there is comparatively little repetition of the machines in the Industrial Section, while nearly all have some new features which raise them out of the beaten track and warrant a description of them. It is with these special features that we propose to deal, confining ourselves in the case of the more ordinary of the machines merely to mentioning them in passing.

* No. XXII. appeared September 19th, 1924.

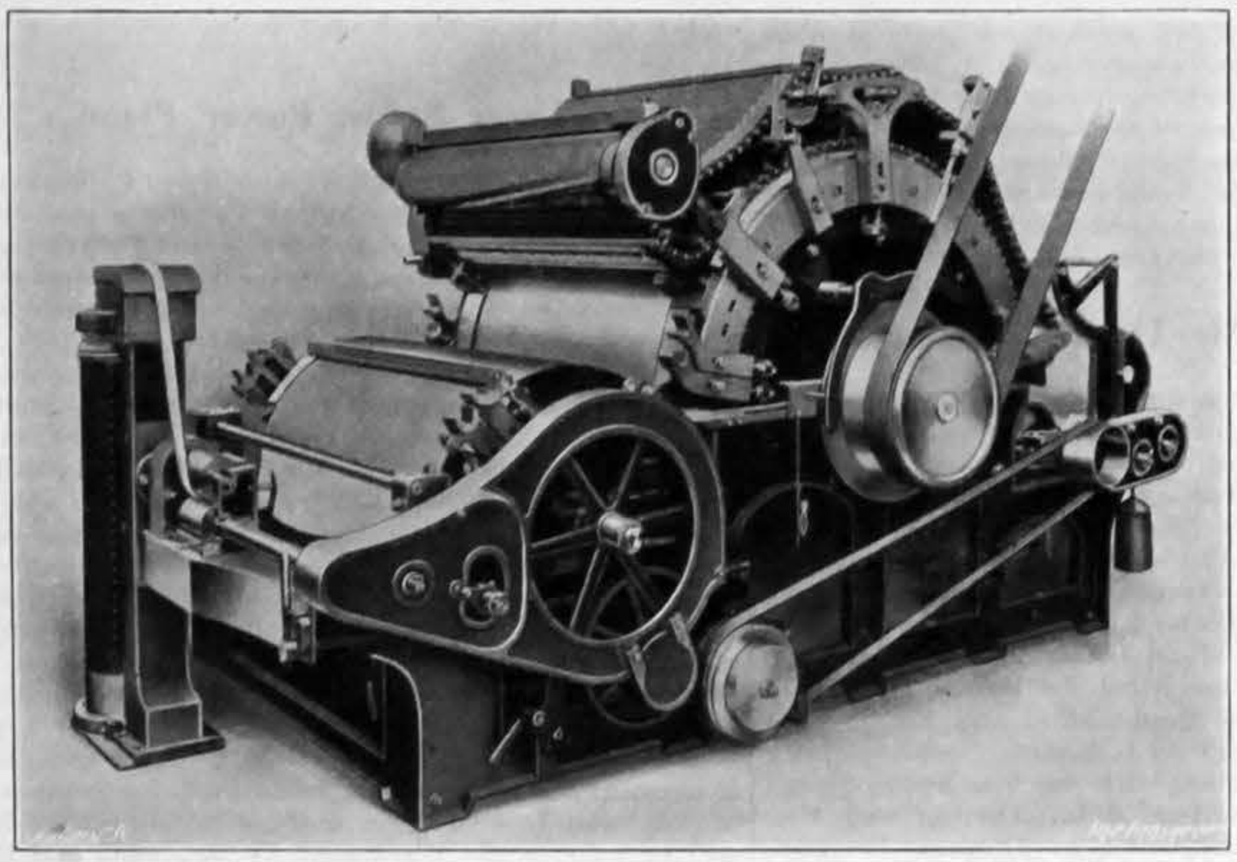
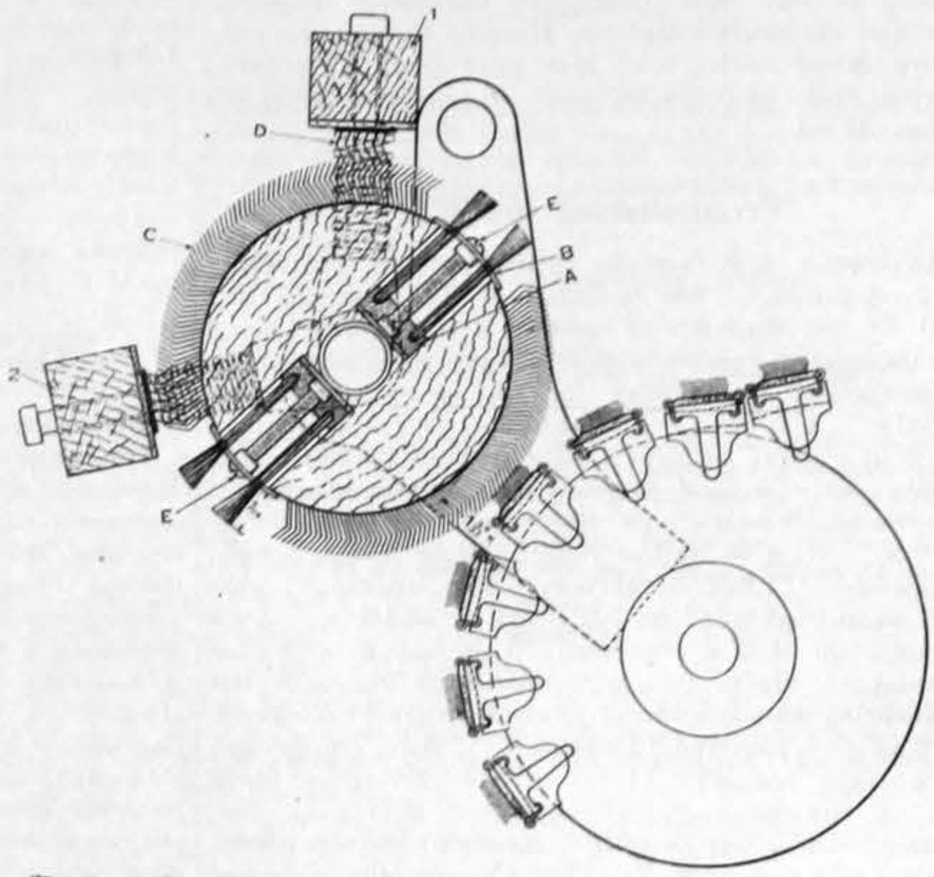


FIG. 438—REVOLVING FLAT CARDING ENGINE—TWEEDALES AND SMALLEY



"THE ENGINEER" SWAIN Sc.

FIG. 439—PHILIPSON'S COMBINATION BRUSH FOR CLEANING FLATS OF CARDING ENGINE—TWEEDALES AND SMALLEY

TWEEDALES AND SMALLEY.

A series of nine machines is shown by this firm. First we have a "Crighton" opener, which loosens and cleans the cotton and delivers it to a lattice feeder or "porcupine feed table," which by a different process continues the opening and cleaning. The third machine is a single-beater scutcher and lamp machine.

Next is a formidable revolving flat carding engine, which transforms the lap into a sliver and in the process discards the short fibres. This machine is illustrated by Fig. 438 and contains many recent improvements. The usual wooden roller for carrying the lap is replaced by a cast iron fluted roller giving a better grip, the grid has a movable lid which can be adjusted *after* the adjustment of the grid bars has been made, and there are facilities for regulating the mote knives and for resetting the back portions of the card after grinding, all parts for effecting this being adjusted by two setting screws, one on each side of the card.

Fig. 439 shows Philipson's patented combination brush for cleaning the flats, which is fitted to this machine. The importance of accurately adjusting the bristles and regulating their projection through the plate B as they wear is great. This is done by shifting the lag A by the screw E and singeing off the ends of the bristles to the required projection. C is the wire clothing on the brush roller, and D is the clearer for keeping the points of the wire brush clean by pressing down any loose cotton that may be there into the wire so that it cannot again come in contact with the flats. For cleaning the brush the clearer D should be pulled down from position 1 to 2, and then, while the brush is rotated in the reverse direction, the clearer is raised again to position 1. This diagram shows also the relative positions of the wires on the brush and the flats respectively.

There are also on this stand a drawing frame and a set of three fly frames, viz., a slubbing, an intermediate and a roving frame, the first of which is shown by Fig. 440. These are all fitted with an electric stop motion and with Tweedales patented differential motion, the feature of which is that by a special arrangement of the gear wheels friction is reduced to a minimum. This firm is also showing a ring spinning frame and a ring doubler—Fig. 441.

HOWARD AND BULLOUGH, LIMITED.

Howard and Bullough, Limited, of Accrington, are showing only a single machine, but it is a formidable one, occupying the whole of a large stand. It is their latest revolving swift air drying sizing machine, and it is shown in diagram form by Fig. 442. The most important improvement in this machine is the replacing of the old-fashioned cylinder singeing method by a series of revolving "swifts" in the upper chamber. The "sheet" of warp threads enters the machine first at the lower chamber, where it is conducted three times between and once over a series of four rows of gilled heating pipes, passing thence to a series of eleven revolving swifts, round each of which it passes, finally to emerge at the other end of the machine ready for the loom.

The "revolving swifts" are in effect skeleton cylinders built up of armed rings connected by cross-heads. They revolve free on ball races, rotated by the

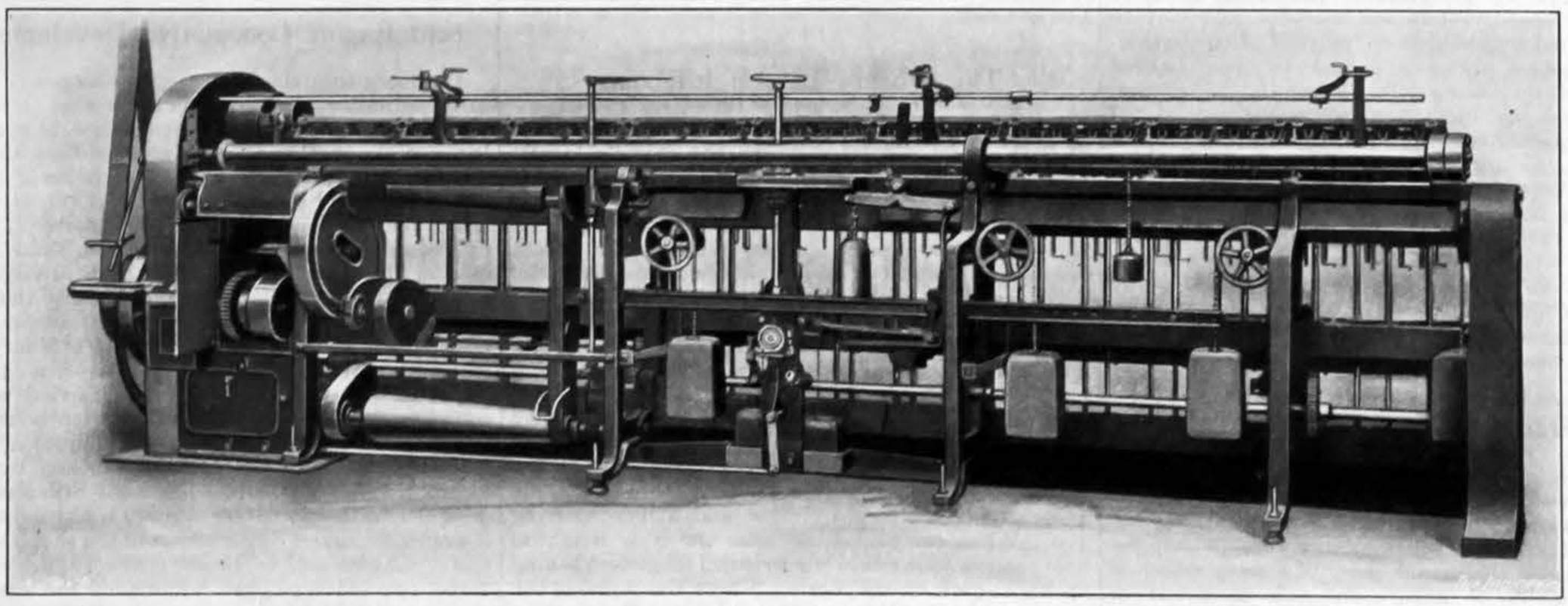


FIG. 440—SLUBBING FRAME—TWEEDALES AND SMALLEY

sheet of threads as it passes over them. Inside each of these swifts rotates a fan at a far higher speed. Both the swifts and the steam pipes are so arranged that any individual unit can be disconnected if required without affecting the operation of the machine. The advantage of this system is that, as the thread passes from one swift to the next, the whole of its surface is presented to the action of the hot air. Similarly, as the thread passes round each swift, the rim of which is made up of a series of rods, it is all equally subjected to the action of the fans and there is no tendency to flatten the thread by this process.

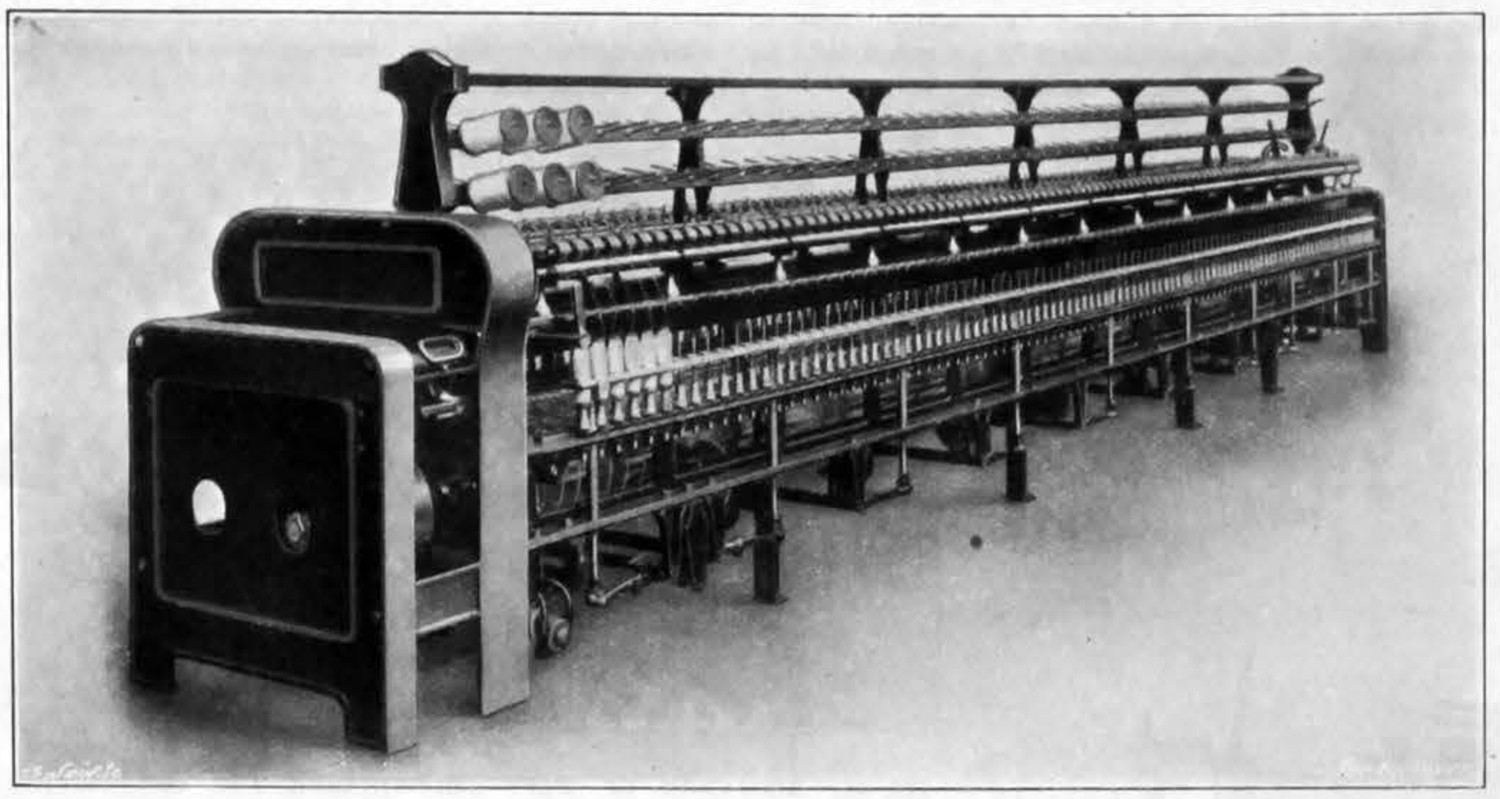


FIG. 441—RING DOUBLING FRAME—TWEEDALES AND SMALLEY

The whole of the actions in the two chambers can be plainly seen at all times by the operative, as both are surrounded by glass windows, which are never blurred by condensation owing to the action of the exhaust fan on the top of the chamber. These windows can be opened and shut as required, and this, combined with the arrangement for cutting off the individual steam units and fans, permits of a perfect control of the temperature and humidity in the chambers.

It is claimed that, as compared with the cylinder dryer, this system increases the output by 25 to 30 per cent. while reducing the steam consumption by about the same amount.

ROBERT HALL AND SONS (BURY), LIMITED.

Hall and Sons, Limited, of Bury, are showing no less than seventeen machines, viz., thirteen looms, three winding machines, and a "plaiting" or cloth folding and measuring machine. In the two last there are no particularly unusual features, but most of the looms may be described as for special purposes, and some of them have distinctly novel improvements.

Among the special looms are a tapestry and velvet carpet loom, a double plush and velvet loom, a hose pipe loom—Fig. 443—a heavy belting loom, an automatic "Steinen" loom—Fig. 444—a narrow fabric loom with twin shuttles, a short horsehair loom shown by Fig. 445, and an ingenious automatic hand loom for the use of wounded ex-Service men, which is controlled and worked by a single simple rocking movement easily actuated by one hand at the rate of from forty to sixty picks per minute. This last machine is illustrated by Fig. 448. The others are a drop box loom, a Turkish towel loom, a quick-speed overpick Lancashire cotton loom, a heavy linen loom, and an ordinary hand loom.

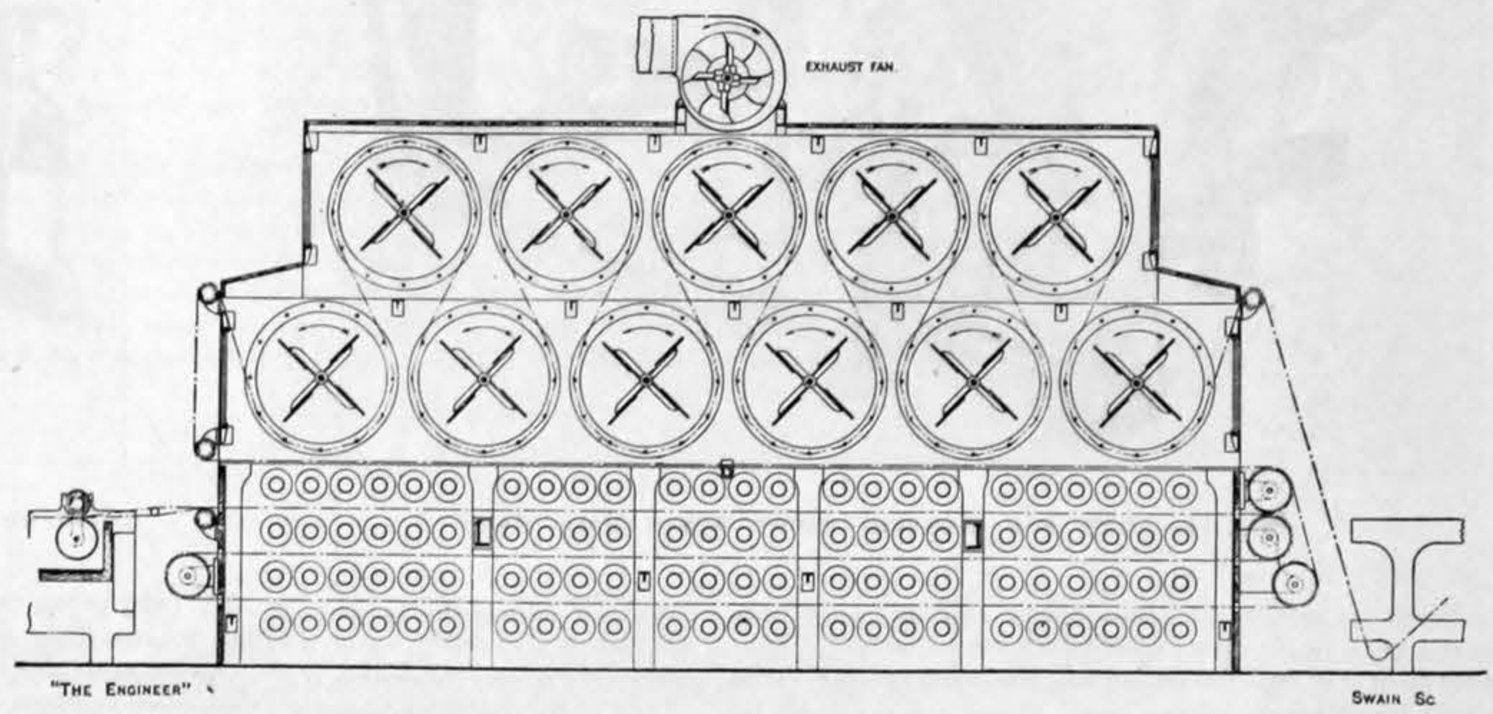


FIG. 442—REVOLVING SWIFT AIR DRYING SIZING MACHINE—HOWARD AND BULLOUGH

The hose pipe loom works on the positive shuttle principle by means of a machine-cut rack and pinions and a metal shuttle with a rack on its underside. The rack is moved by means of levers controlled by a tappet, thus turning the pinions which engage in turn in the rack on the shuttle and move it across the shed. The shedding is operated from whole-plate outside tappets by means of top and bottom jack levers connected by adjustable rods and rod couplings. These tappets are arranged to lift the healds so that the hose is woven circularly without seam or selvidge.

The "taking-up" motion is on the worm and wheel principle and is positive and continuous, different change wheels being used to vary the quality of the hose. The hose is here shown gripped by three fluted rollers geared together, but for certain qualities of hose a single spiked roller can be adopted.

After being "taken up" the hose pipe passes underneath the loom to a coiling mechanism at the back, thus enabling very long lengths to be woven. To ensure that the hose is strong enough to support the high pressure of water required in fire brigade work, &c., a double beat of the slay is provided. This is given by a special arrangement of levers and arms from the slay to the crank, so that for every pick two beats are given with only one revolution of the crank.

One of the most interesting machines on this stand is the automatic loom illustrated by Fig. 444. This machine, or any number of them, can be worked without attendance of any sort and in the pitch dark as well as under any other conditions. In this loom each of the warp threads passes through a separate light metal contact disc which drops if the thread breaks and makes an electrical contact which stops the loom. Simultaneously with the loom stopping an electrical bulb is lighted, locating the loom which demands attention while the dropped disc locates the thread which requires repair.

The great feature about this machine, however, is that which is covered by the Steinen patent, which permits of 144 bobbins being placed in a hopper or magazine. Each of these in turn falls automatically into the shuttle, and as it does so is threaded by compressed air without stopping the machine. Meanwhile the empty bobbin has been automatically thrown out of the shuttle by a mechanism actuated by an electrical contact set up merely by the fact that the thread has been wound off it, thereby exposing a copper collar which sets up the contact. The amount

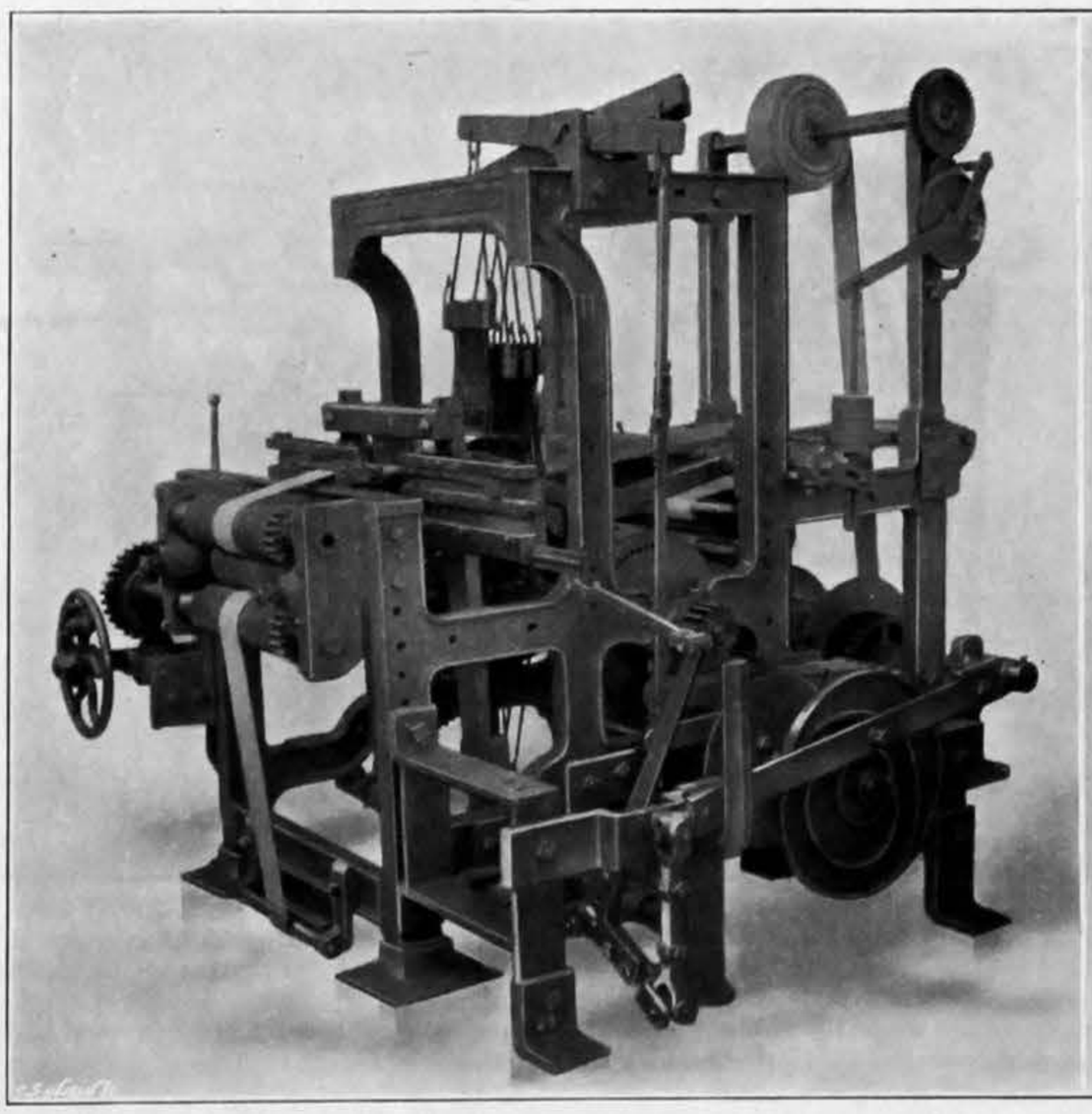


FIG. 443—HOSE PIPE LOOM—HALL

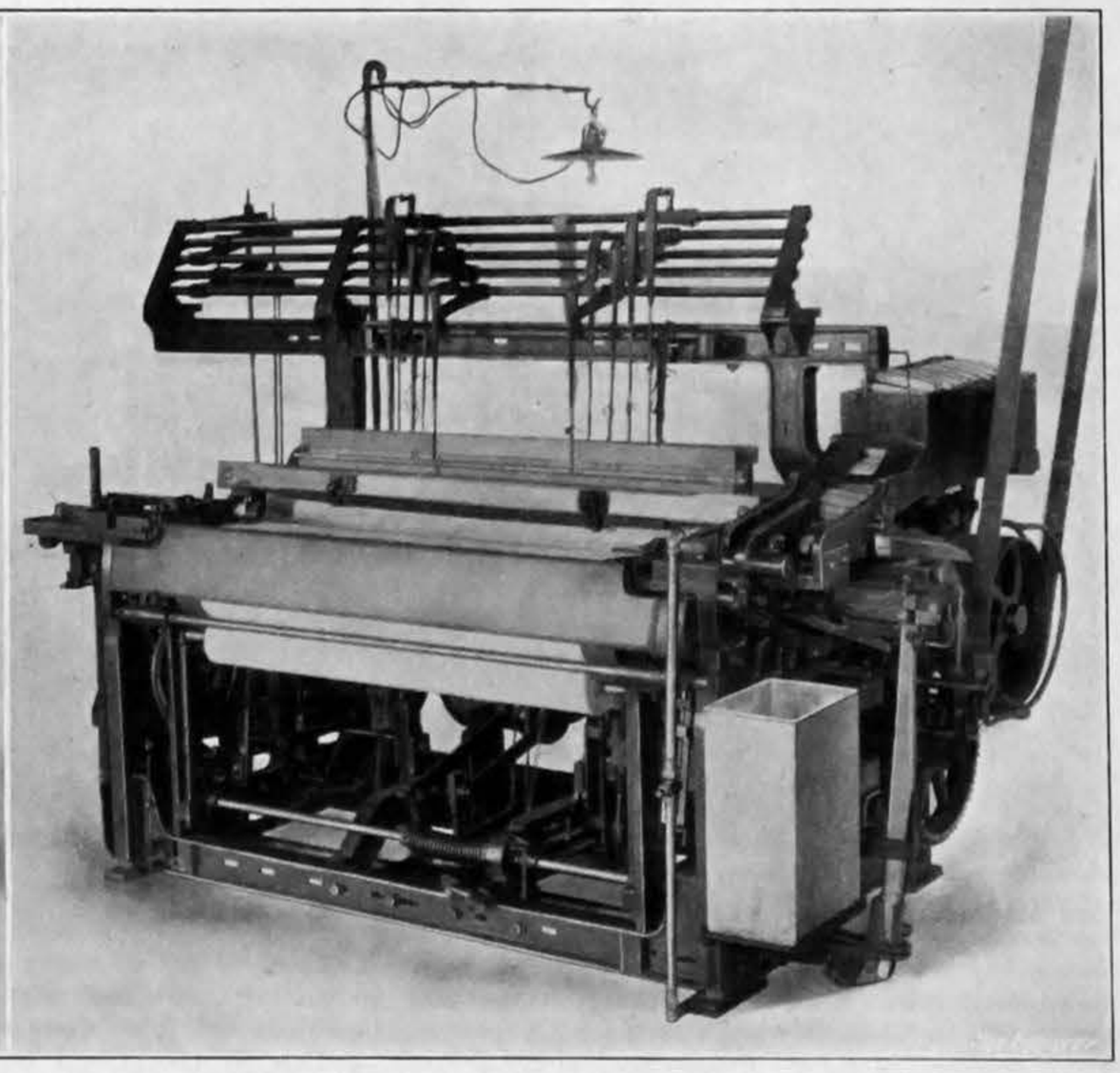


FIG. 444—AUTOMATIC LOOM WITH "STEINEN" MECHANISM—HALL

of thread which remains on the bobbin at the time of its rejection can be adjusted to a minimum by the method adopted in covering the copper contact when winding.

The patented loom for weaving horsehair cloth, such as is used for carriages and tailors' linings, is at once ingenious and unique. Instead of an endless weft thread, the handling of which forms the basis shed. There is an arrangement in the needle carrier to open the grip so that the hair may be released when it has been drawn across.

A special weft motion is furnished in the loom by which the dobby barrel does not turn if the needle fails to grip a hair and thus the shed is unchanged. Where the shedding is done by tappets instead of by a dobby a clutch arrangement is provided, by

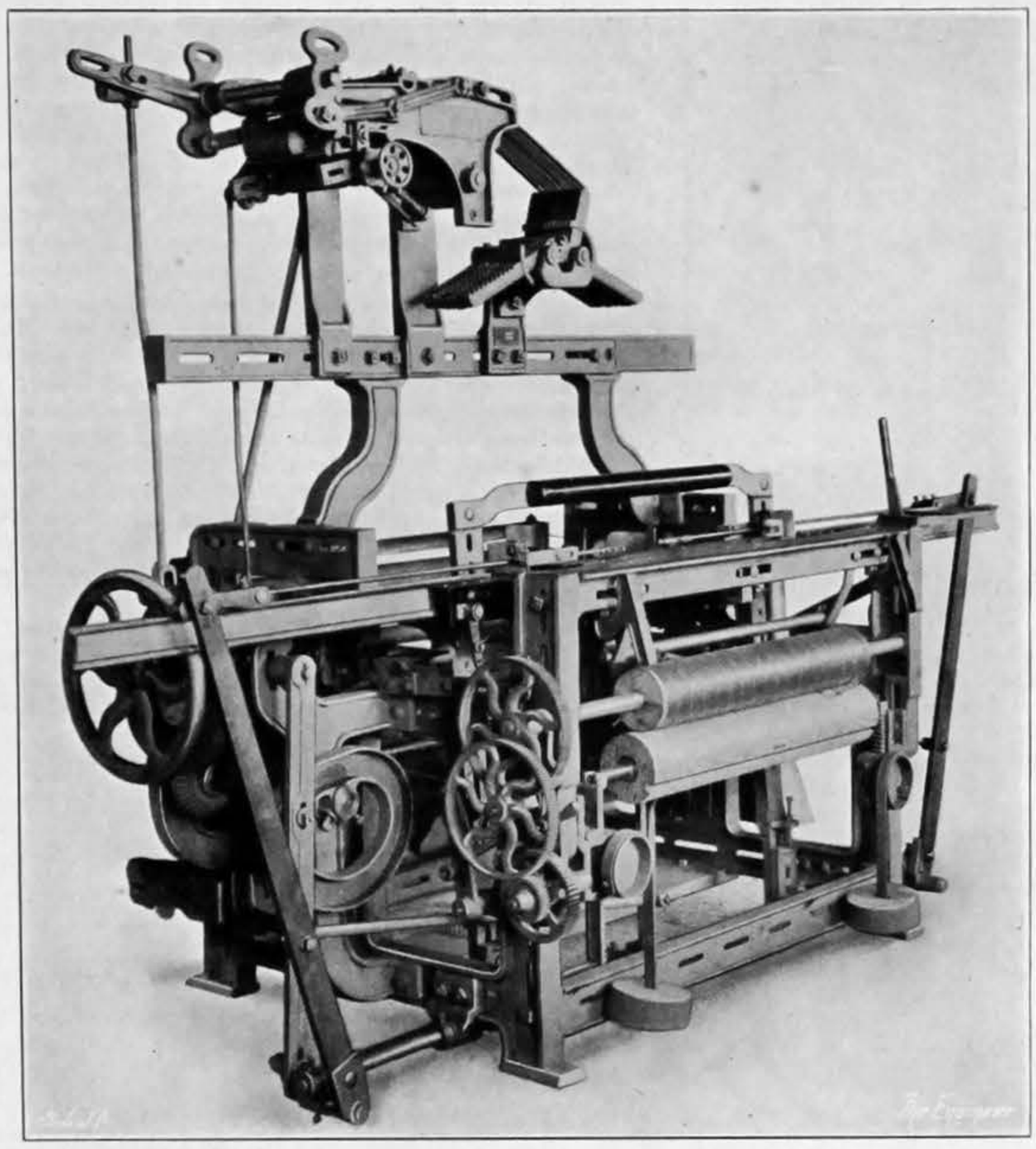


FIG. 445—LOOM FOR WEAVING SHORT HORSE HAIR—HALL

problem on which all other looms are designed, this loom has to build up its weft from comparatively short lengths of stiff hair for which neither shuttle nor bobbin would be of the slightest use. These are replaced by reciprocating "needles," which traverse alternately the warp threads from either side of the loom in the path usually followed by the shuttle, and at the end of its stroke each needle seizes a single horsehair

means of which the tappets do not turn if one of the needles should fail to catch a hair. For hairs which are sufficiently long to reach from one edge of the warp to the other only one needle is necessary, but one of the features of this machine is that by having needles at both sides short lengths of hair can be utilised and made to give a firm overlap in the centre of the cloth.

An interesting point about the double plush loom

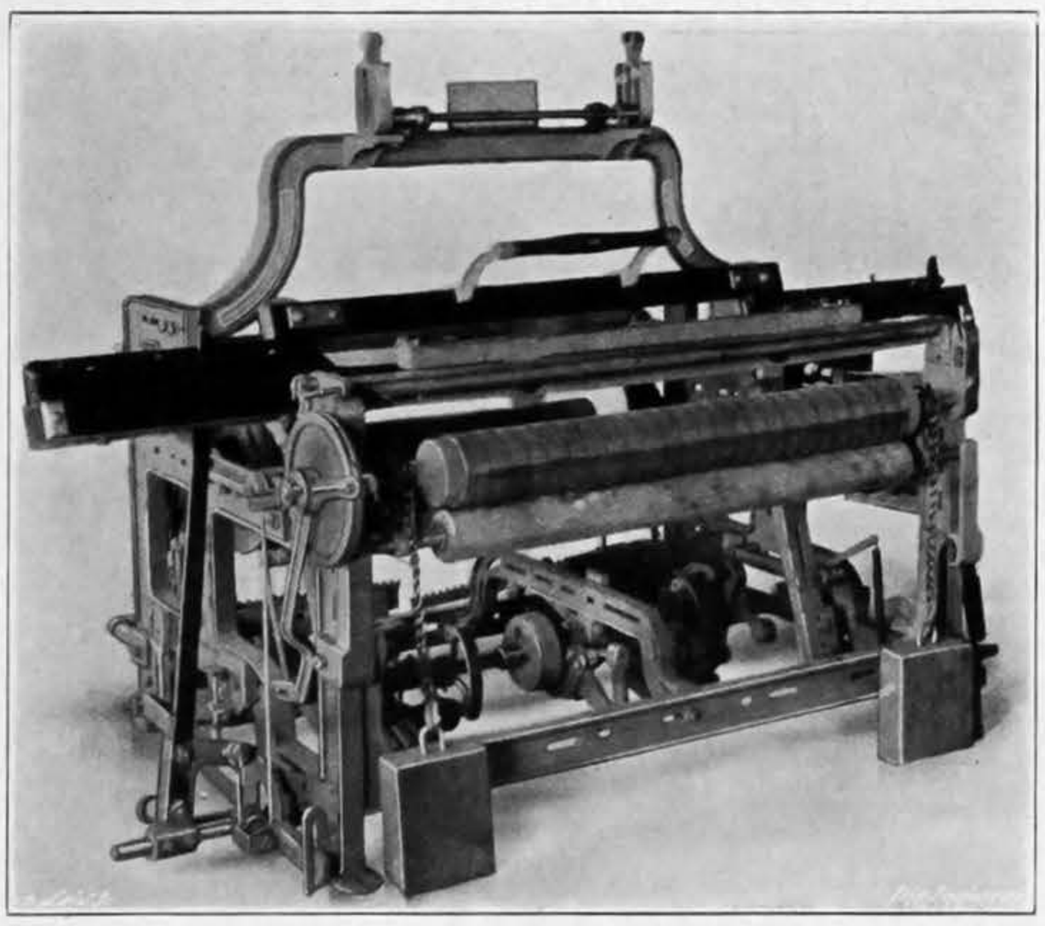


FIG. 448—SINGLE ACTION HAND LOOM FOR WOUNDED SOLDIERS—HALL

from a bunch, draws it through the warp threads and automatically releases it when it is properly placed. These "needles" are held in carriers, which are in effect long thin rods and are clearly shown in Fig. 445. Each needle has a slit against which fits a small flat piece of spring steel, kept in position by a spring which effects the grip. Pressure against the horsehair relieves the spring, which allows the grip to open and enables one or more hairs, according to the size of the slit, to be gripped and drawn across the

shown on this stand is that, while weaving simultaneously two fabrics one above the other and joined together by the pile of the thread, the knife blade which separates the two fabrics as the weaving proceeds is automatically sharpened at each reciprocation by passing at one end of each stroke between two abrasive surfaces.

The belting loom is also interesting, being capable of weaving simultaneously cotton or other fibre machine belts of any number of plies and binding them

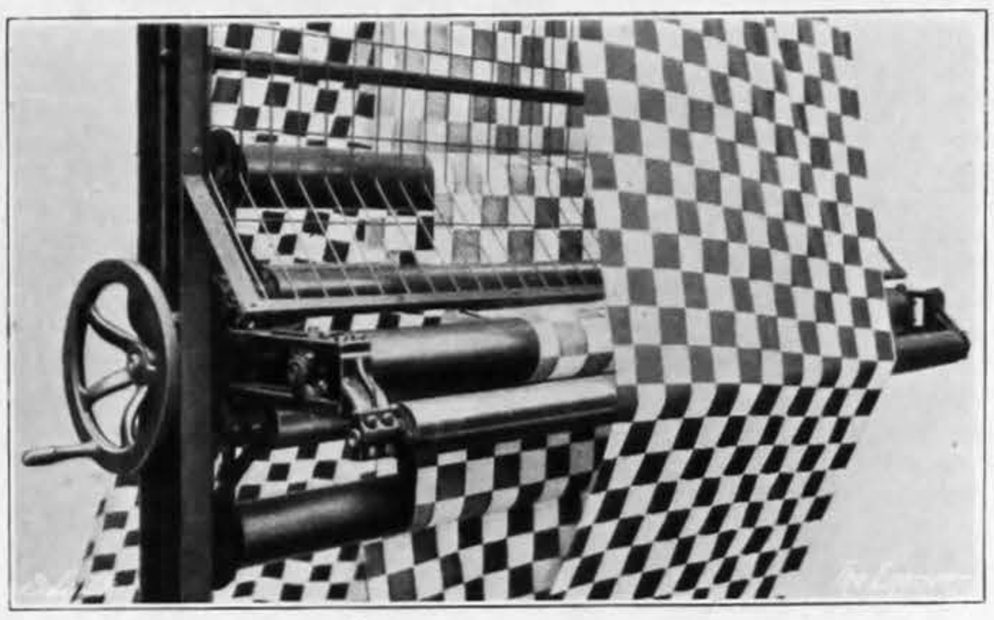


FIG. 446—MECHANISM OF WEFT STRAIGHTENER AND COMPENSATOR—MATHER AND PLATT

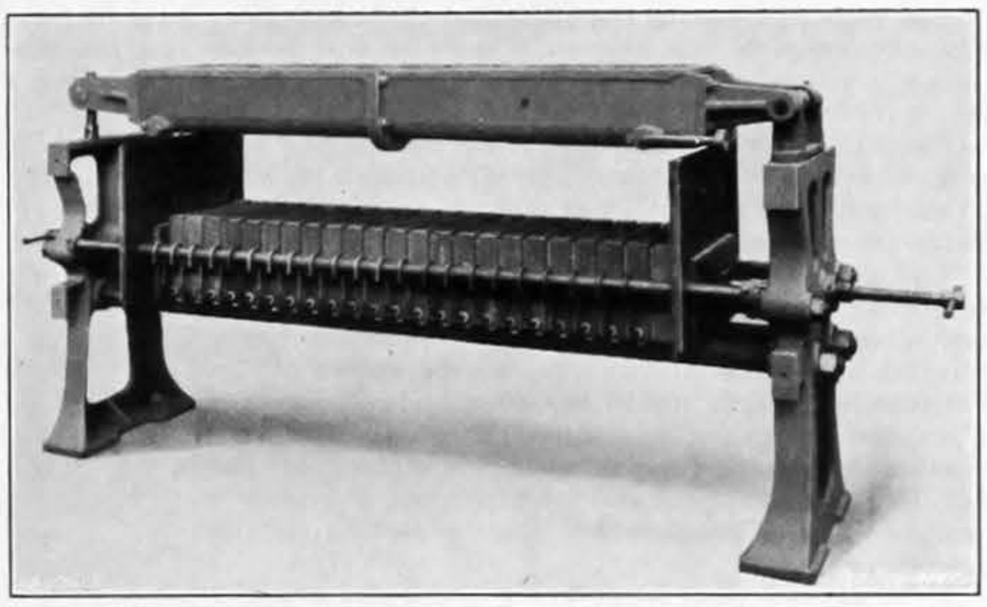


FIG. 447—BLEACHING SOLUTION ELECTROLISER—MATHER AND PLATT

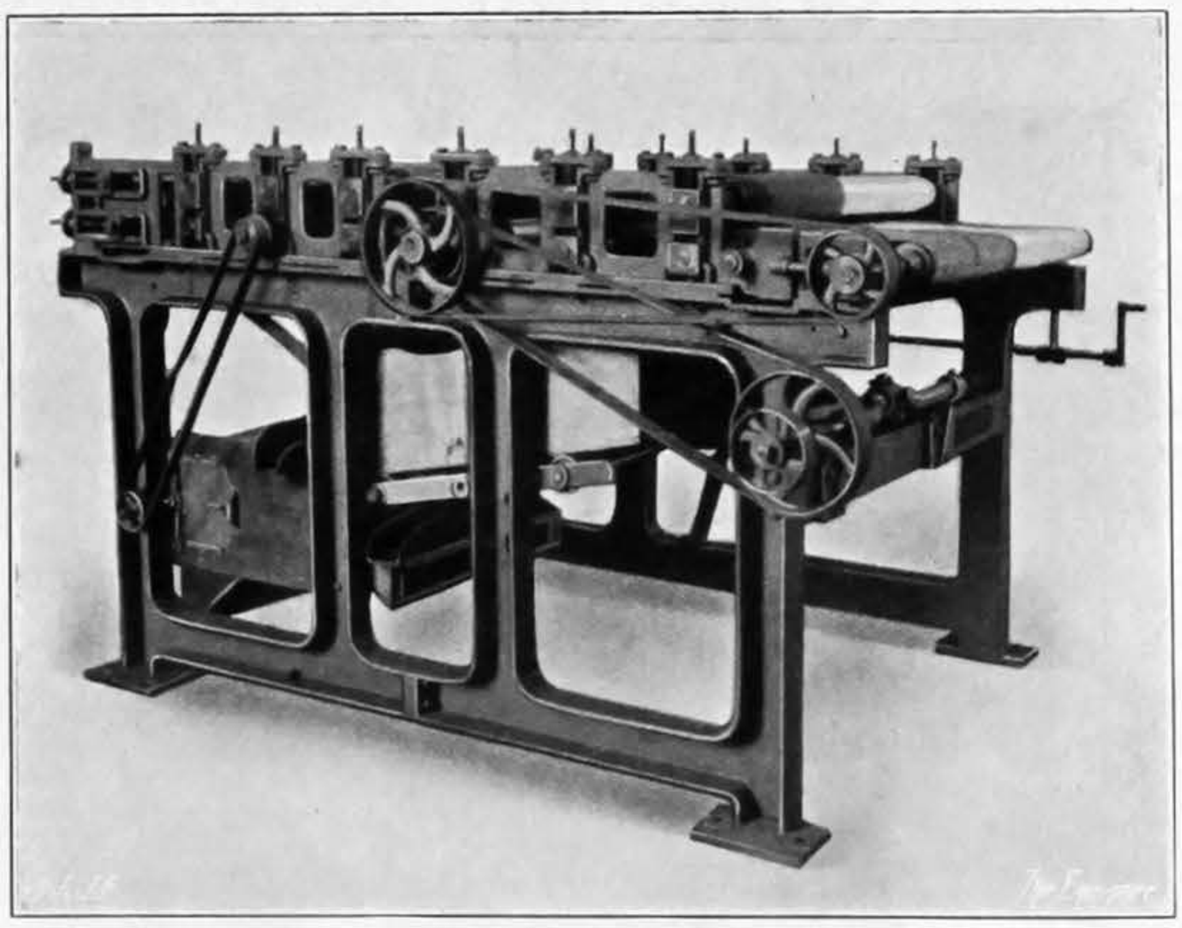


FIG. 449—LE GARDIAN FLAX DE-SEEDER—BOBY

which are required on the "selvidge" of certain fabrics. Others are of the 1320's tilting greffe, 100's open top double cylinder, and 400's single lift types. By the way, this firm is the maker of the Jacquards used on the Hattersley looms reviewed in a recent issue of THE ENGINEER. A wide range of Hardaker's border and pattern cutting machines for textile and other fabrics are also shown on this stand, as is also an ingenious self-centring "piano card" cutting machine.

JOHN T. HARDAKER, LIMITED.

Mr. John T. Hardaker, of Bradford, is showing a number of his latest Jacquard machines for fitting to various looms, of which the most ingenious is one for weaving the lettering, trade marks and other designs

MATHER AND PLATT, LIMITED.

Mather and Platt, Limited, of Manchester, who are exhibiting a representative range of their very varied lines, of which bleaching, printing, dyeing and finishing machinery for textile fabrics is one of the most important, are showing here four items in connection with this industry.

The first is a weft straightener and compensator, which we illustrate by Fig. 446. The work of this apparatus is to correct any irregularities as to the true rectangularity of the warp and the weft threads that may occur in the weaving. This is done by means of passing the cloth round a series of three rollers whose normal position is parallel with each other. They are so arranged, however, that by the turning of a single hand wheel each of the rollers can be thrown out of parallel with the others in either direction, drawing their axes nearer together at one end and increasing the distance between them at the other. In other words, the lines of the three rollers together can be adjusted so as to form a cone which may be

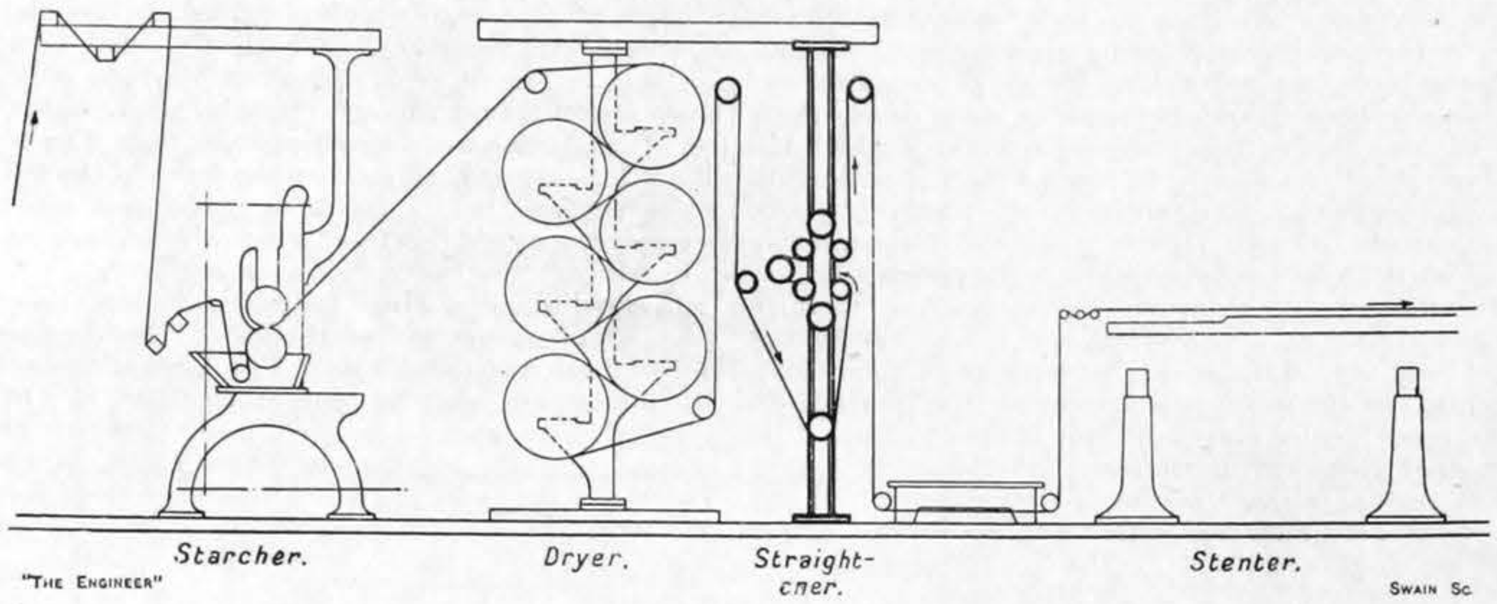


FIG. 450—SKETCH SHOWING WEFT STRAIGHTENER IN POSITION IN STENTERING PLANT—MATHER AND PLATT

accentuated more or less as required and may be made to taper in either direction. By this means the track to be followed by the two edges of the cloth as it passes round the rollers can be shortened or lengthened as required. Thus when properly adjusted the edge on which the threads are too advanced is given a longer travel than the other, which allows the retarded threads to overtake them and the weft is straightened. A slide roller is introduced to take up the slack of the cloth and act as a compensator.

Though totally independent of other machines, the ideal position for the combination weft straightener and compensator is to link it up between the starching and edging machines and the "stenter" as shown in the line sketch Fig. 450.

The Mather and Platt electroliser is a feature of this exhibit and is an invention of great importance to the textile industry. The machine exhibited is of the vertical flow type and is illustrated by Fig. 447. Its object is to replace the bleaching powder hitherto used for bleaching textile fabrics and fibres. This powder is expensive, deteriorates rapidly in strength when stored, and has the disadvantage of leaving a fine deposit of carbonate of lime on the fabric, which reduces the penetrating effect of a powder solution, thereby decreasing its efficiency as a bleaching agent.

Briefly, the function of this machine is to produce sodium hypochloride as and when required for immediate use by a simple electrolytic process. This is done by passing a continuous electric current through a solution of common salt. The effect is to decompose the salt solution, hydrogen gas being given off in the process at the negative electrode. When the sodium hypochloride comes in contact with the vegetable matter it parts with its oxygen and becomes an effective bleaching agent, possessed of great penetrating effect owing to the fact that it contains no lime to form a deposit. The electrodes are of graphite carbon. The brine has a forced and continuous circulation through the electrolytic cells, thus reducing the trouble from gas bubbles to a minimum, and all overheating of the hypochloride by stagnation of the liquor in the cells is avoided. The strength of the solution used generally varies between 10 and 15 per cent., the lower figure being advisable in localities where salt is expensive and current cheap, and the higher when these conditions are reversed.

The electroliser consists of a series of cells formed by insulating distance frames between graphite carbon plates. Syphon outlet tubes regulate the flow and levels. A brine pump delivers the solution to the upper tank, whence it passes by gravity to the cells below. When the current, which is periodically reversed, has imparted to the brine a sufficient degree of chlorine strength the solution is pumped into a storage tank.

This firm is also showing one of its compressed paper "bowls," *i.e.*, rollers used on the mangles and calenders which put a high finish on textile fabrics. These bowls are made of various fibres, usually of cotton or wood, compressed in blanket form in the process of manufacture by hydraulic presses exercising 3 tons per square inch, and are turned up and bored on special lathes, after which the final surface and accuracy are attained by means of a grinding machine.

The fourth exhibit is a complete model with movable parts of a three-colour calico printing machine.

ROBERT BOBY, LIMITED.

Robert Boby, Limited, of Bury St. Edmunds, is exhibiting two machines for the treatment of flax, namely, the Le Gardian patented flax de-seeder and a breaking and scutching machine. The first of them is illustrated by Fig. 449, and its purpose is to remove the husks and seeds from the straw, opening the husks and depositing the seeds and other extraneous matter below the machine. In the process of feeding the straw from one end of the machine to the other by means of a series of rollers and conveyors the heavier matter, such as seeds, grit and dirt, is deposited by gravity through a trough and the lighter particles, husks and chaff are sucked away by a fan, while the seeds are graded automatically and deposited through separate channels.

The first two pairs of rollers are fluted and it is here that the husks are opened. This is effected by driving the top rollers of each pair at a different speed (2 to 1) from that of the bottom rollers, thus causing a rubbing or tearing action. The straw is uninjured in the process, as the material is fed at right angles through the machine and only the seed-bearing ends pass through the rollers. The output of this machine is from 8 to 12 tons per day.

The Boby patented combined flax breaking and scutching machine separates the fibre from the straw without danger and without skilled labour. It is claimed that two of these machines will do the work of five of the ordinary scutching wheels. Further, this machine eliminates entirely the use of the separate and expensive "breaker" machine. It also has the advantage of being less brutal in its treatment of the fibre, thereby increasing the percentage of good fibre and reducing the quantity of tow.

As the straw enters the machine two pairs of rollers break the straw into short lengths and hold the material in tension while it is being scutched. The feed is effected by an endless reversible band which, when travelling forward, carries the straw first through the breaking rollers and thence to the scutching knives, advancing until about three-quarters of a length has been scutched. Then the conveyor is reversed, the material is turned end for end and the process repeated in the same manner.

HUGHES AND LANCASTER, LIMITED.

Hughes and Lancaster, Limited, of Ruabon, are showing an elaborate machine, some 24ft. in length,

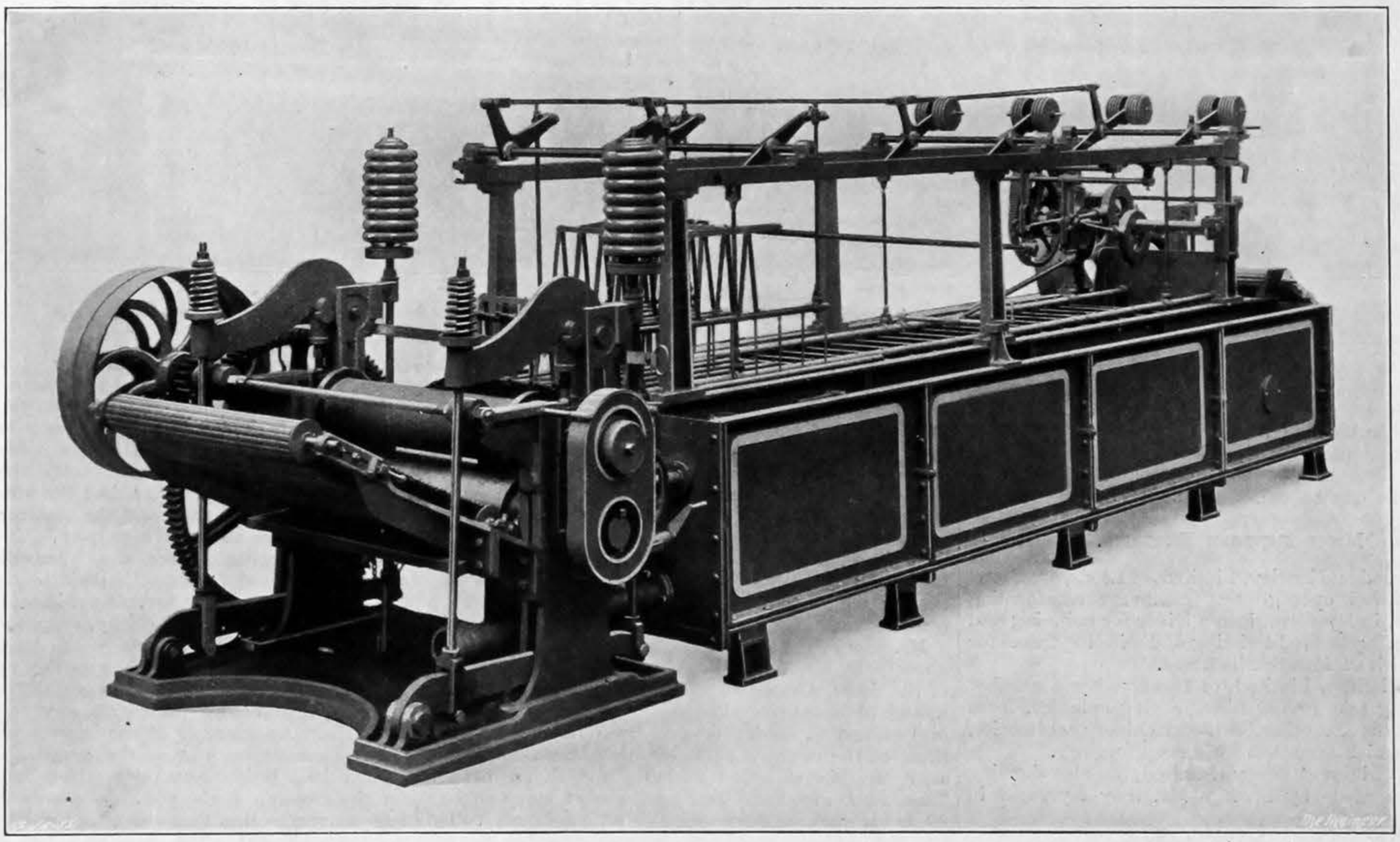


FIG. 451—WOOL WASHING MACHINE—HUGHES AND LANCASTER

and edging machines and the "stenter" as shown in the line sketch Fig. 450.

The Mather and Platt electroliser is a feature of this exhibit and is an invention of great importance to the textile industry. The machine exhibited is of the vertical flow type and is illustrated by Fig. 447. Its object is to replace the bleaching powder hitherto used for bleaching textile fabrics and fibres. This powder is expensive, deteriorates rapidly in strength when stored, and has the disadvantage of leaving a fine deposit of carbonate of lime on the fabric, which reduces the penetrating effect of a powder solution, thereby decreasing its efficiency as a bleaching agent.

Briefly, the function of this machine is to produce sodium hypochloride as and when required for

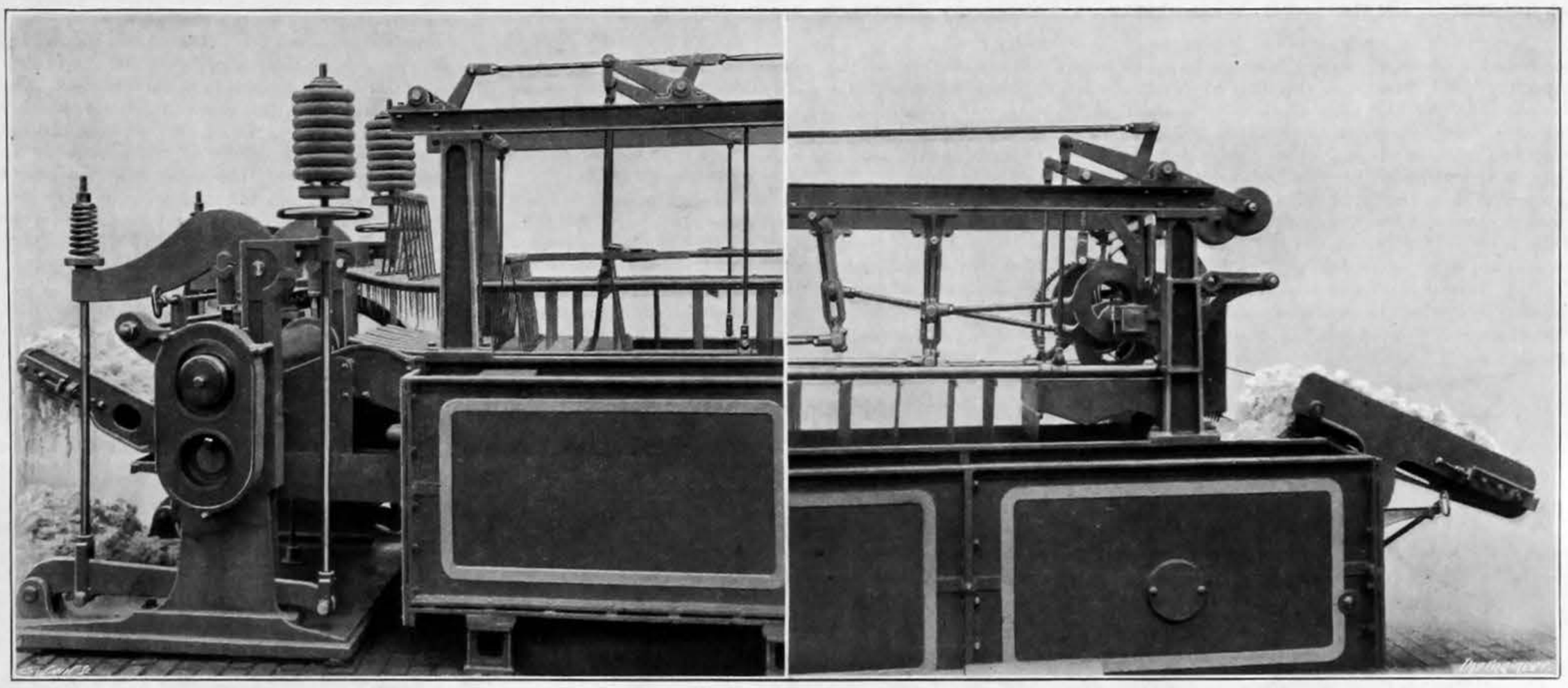
for wool washing. The machine shown—see Figs. 451, 452, and 453—is in reality one unit out of a series of four similar machines which comprise the complete plant and which are necessary for the thorough cleansing of the wool from its natural grease and foreign matter. This extraneous matter which has to be removed often represents from 50 to 75 per cent. of the raw product. It is of a very varied class—animal, vegetable and mineral, vermin, grass, sticks, burrs and grit—which adhere to the grease and get entangled in the fleece.

As the four units in the complete plant are identical in form and operation, varying only in their lengths, the unit exhibited serves to afford a complete demonstration of the entire plant. Briefly, one may say that

they clean the wool progressively, the material passing from one machine to the next, the worst of the dirt being removed by the first machine, while the last, which contains plain water, serves to give the wool a final rinsing.

This wool washing machine is known as the "harrow" type of machine as opposed to the earlier process of "forking," which was clumsy and inefficient, and to the "swinging rake" type, which is suitable only for the coarser wools. Save for the shape of the curved prongs which manipulate the wool, however, the process is not that of the harrow. It would, in fact, be better described as an intermittent raking process. The machine consists of a long bath or trough, a series of rows of "harrows," an overhead mechanism for operating them, and at the tailing out end of the trough a mangle or rotating wringer. The trough is built up of 5ft. panels, the first unit usually having six panels totalling in length 30ft., the lengths of the troughs of the successive units being progressively shorter, having five, four and three panels respectively. A set of four of these machines with troughs 3ft. 3in. wide will wash 1000 lb. of raw wool per hour.

The water used in the first three troughs contains a chemical cleansing agent, and the temperature of the solution can be varied to suit requirements. The action of the prongs, each series of which is governed by an excentric carried on a frame above the trough, is to dip into the wool-laden fluid, propel the wool forward for a few inches, rise clear of the surface, retire to their former position and repeat the process, the wool so propelled being carried further forward by the next row of prongs until it reaches the end of the trough, where it is lifted in the form of a saturated fleece and submitted to the rollers of the wringing attachment which squeezes out much of the water and dirt. The path of the harrows and the length of their stroke can be varied to suit requirements.



FIGS. 452 AND 453—WOOL WASHING MACHINE—HUGHES AND LANCASTER

MISCELLANEOUS EXHIBITS.

Greenwood and Batley, Limited, of Leeds, are showing one of their open gill sett frames for transforming silk ramie, in lap form, into a sliver for spinning and a "Climax" patented twisting and winding frame for dealing with various textile fibres.

P. D. Mitchell, Limited, of Dundee, has a number of spinning and roving fliers, roving spindles, loom picking studs and other textile machinery accessories, many of which are made from drop forgings.

White, Child and Beney, Limited, are also showing accessories made by firms whom they represent in London.

The Wilson Bros. Bobbin Company, Limited, of Liverpool, the bobbins and shuttles of which are used on many of the looms we have described, has also a very extensive and varied display of these articles.

Institute of Transport.

THE Conference of the Institute of Transport, which was held at the British Empire Exhibition, Wembley, on Friday, September 19th, was noteworthy through the representation of the three forms of transport—ships, railways and aircraft.

The meeting was held in the theatre of the Port of London Authority, at the end of the Palace of Engineering, which was entirely filled with the embers and visitors. The first item on the programme was a series of cinematograph films depicting the industries of the Port of London, which brought home to the audience the vast importance of seaborne traffic. It was followed by the Conference proper, under the chairmanship of Sir Henry P. Maybury.

Two papers were put down for discussion, the first, on "Imperial Communications," by Air Vice-Marshal Sir Sefton Brancker; and the second on "Transportation in Relation to the Development of South Africa," by Mr. F. B. Rees, of the South African Railways and Harbours Board.

In presenting his paper, Sir Sefton Brancker said that in his opinion, if we attempted to press our railways and steamships to higher speeds than those now in vogue, travelling by them would become so uncomfortable that the public would object. It thus became necessary to take to the air to speed up our communications, and he gave a brief description of the two five million cubic foot airships which the Government has ordered with the intention of developing a commercial service. These ships, he said, should be ready in three years, and in the interval the old R 33 was to be sent out to Egypt so that her officers might gain experience in handling airships in hot countries. Sir Sefton said it was hoped that the two new ships would provide a regular fortnightly service to India, covering the journey in 100 hours, with only one stop for re-fuelling. He declared that within the next ten years we might have regular airship services connecting up all our overseas dependencies, with aeroplane routes acting as feeders for them, while big flying boats would maintain communication between such places as Calcutta and Rangoon.

The cost of aerial transport was not great, when the saving in time was taken into consideration, as three passengers and their luggage could be carried at 100 miles per hour for about 2s. a mile, while goods could be conveyed for 4s. 6d. a ton-mile. Sir Sefton believed that the latter figure would soon be brought down to 2s. 6d. a ton-mile at 100 miles per hour, and Major G. H. Scott, who spoke in the discussion which followed, estimated the cost at 2s. a ton-mile with airships.

Mr. Rees' paper was presented, in the author's absence, by Mr. J. A. Harris, divisional superintendent of the South African Railways. It started with some historical data and then went on to consider the importance of feeder branch lines in the development of the country. The South African Railways, said Mr. Harris, lost £35,000 a month on branch lines, some of which had gradients as steep as 1 in 40, but it was considered good policy, as they helped in the development of the natural resources of the country, and provided extra traffic for the main lines. Experiments were, however, constantly being carried out with the object of reducing the working costs on branch lines.

Some trials had been made with a petrol coach, but it was not a great success, as it had only a 25 horse-power motor. A suction gas engine of 100 horse-power had also been tried, and another of 400 horse-power was being obtained for branch line work—see THE ENGINEER, September 19th, page 322. Another experiment was one made with a Sentinel steam coach, and the Road Rail system was being tested on a line 25 miles long, but it had the disadvantages that the speed was limited to from 10 to 15 miles per hour, and it involved a brake in the gauge. (A description of the Road Rail system was given in THE ENGINEER of June 28th, 1918, page 550.) In view of the capital cost of laying branch lines road transport with petrol lorries was being given a trial, and was found to be satisfactory so long as the traffic was not too heavy. The South African roads would stand up under comparatively small lorries, but if the traffic was more than two or three lorries could carry, the maintenance and wages costs became too high. It might, however, be advisable to employ large Thornycroft lorries and then the roads would have to be strengthened to carry the extra load.

The Road Rail line mentioned in the paper is being constructed in the Northern Transvaal from Naboomspruit, and is of 2ft. gauge. Over half its length has been completed, and on it two types of steam tractor are being tried. One is a Yorkshire steam tractor with reversible gears and fitted with a bogie at each end, which is extremely flexible and adaptable to variations in both the road and rail surfaces. The other is a convertible type of Yorkshire steam tractor, as used on the road, which has been fitted with two steam piston "legs" in front. These legs are used to jack up the front of the vehicle while the rail bogie is put in place, and are then retracted, leaving the front road wheels clear of the ground.

In the discussion which followed, General Freeman gave some particulars of the Road Rail system as it had been tried in India. The cost of main line, 5ft. 6in. gauge, was, he said, from £8500 to £10,000 a mile, metre gauge line cost from £6000 to £8000 a mile, and 2ft. 6in. gauge from £3500 to £5000. The Road Rail system, which had been tried for the past five years near Poona, only cost from £1100 to £1300, excluding the equipment of tractors and wagons. The construction of two more lines on the system was progressing rapidly, and it was hoped to open them this year, while surveys for 370 more miles had been made and others were projected. He said that he did not know exactly what the working costs of the system were, but the number of men was comparatively small and the maintenance of the track was lower than for a railway. The tracks for the driving wheels were soon consolidated, and after a few weeks needed little attention, so that one track-man per mile was sufficient. Sir T. R. Wynne, of the Bengal Railway, emphasised the importance of branch railways in the development of a country, and said that it was the policy of the Indian Government to encourage the construction of lines even before there was any real assurance of traffic. An example of the benefit accruing from railway construction was the growth of the Tata Ironworks. Before any preparation had been made for the erection of the works, the railway was asked to construct a line 60 miles long, and to agree to a very low freight. The line was laid, and it had proved profitable to carry freight for the ironworks at one-sixth of a penny a ton-mile.

At a luncheon, held after the Conference in the Regent Restaurant, Mr. Gosling gave assurance as to the Government's sympathy towards all efforts for improving means of communication throughout the Empire.

A DRIVER named James Lamb has just retired from the London, Midland and Scottish service after being in that company's and the former London and North-Western service for fifty-three years. He claims to have equalled or broken "records" in having never been late for work, never having had a complaint made against him by his superiors, never having had an accident, and having made the fastest running time between Manchester and Euston—185½ miles, in three hours.

British Wire-drawing and Wire-working Machinery.

No. X.—WIRE FACTORIES.*

WE continue below our description of the Bradford Ironworks, Manchester, of Richard Johnson and Nephew, Ltd. On reference to the plan of the works—Fig. 71—it will be seen that the conveyor, which brings the coiled rods away from the mill, delivers towards the cleaning house, where the rods are pickled and coated in the usual manner. The material is handled by a system of overhead runways and high-speed electric cranes, and the motors of these cranes are the only motors in the works which give rise to any anxiety, as they have to work in an atmosphere heavily laden with acid fumes. It would, however, be very difficult to handle the large amount of rods—some 1200 tons a week—by any other means. The engraving—Fig. 73—gives a good impression of the interior of the cleaning house. The rods are pointed by rotary swaging machines, and are then issued to the wire-drawing shops—see Fig. 74.

The general equipment of these shops needs no detailed description, as it follows orthodox practice. There are some 260 blocks all told, driven by electric motors and ranging in diameter from 30in. downwards. The maximum speed for these blocks is 100 revolutions per minute, but when doing the more difficult work, such as section drawing, the speed is reduced to about 34 revolutions per minute.

In the patenting department there are half a-dozen gas-fired furnaces of the scaling and non-scaling types. There is some difference of opinion among wire drawers as to the relative merits of the two types of furnace, and it is based on a variety of reasons. The loss of metal has, for instance, to be set against the increased cost involved to prevent scaling and the value of the scale itself, while it is urged by some wire drawers that the wire is actually improved by letting it scale, as the process removes the outer skin.

* No. IX. appeared September 19th, 1924.

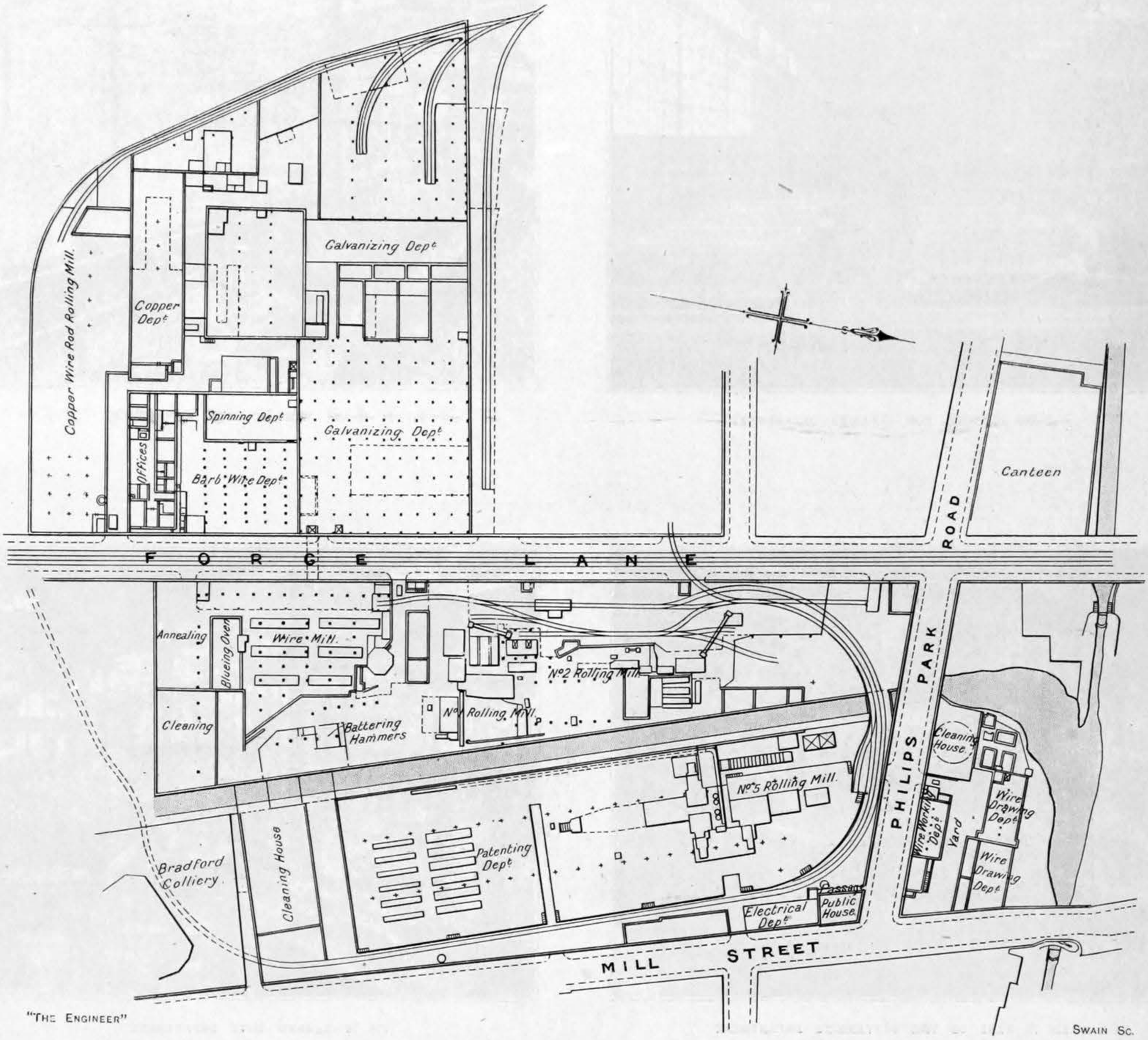


FIG. 71—PLAN OF THE BRADFORD IRONWORKS

The patenting furnaces at the Bradford works have 10 tubes each for the passage of the wires, but the number naturally depends upon the gauge of the material being handled. The raw wire is held on a group of swifts at the inlet end of the furnace, and after having been patented is re-coiled on a patenting frame.

A patenting frame by George Crossley, of Cleckheaton, is shown in Fig. 72, from which it will be seen that a series of horizontal drums is driven, by worm gearing, off a longitudinal shaft. The drums are provided with clutches, so that they may be stopped individually for the removal of the coils of wire, while retractable stops are arranged to prevent the coils falling off prematurely. The wires coming from the furnace are led over guide pulleys on a gallows at one end of the machine, and then over triple guide pulleys directly above the winding drums, which straighten out any kinks and keep a slight tension on the wire.

The process of patenting naturally depends to a large extent on the speed at which the wire is drawn through the furnace, and it is consequently desirable that the speed of the drums should be adjustable. One method of effecting this adjustment is illustrated by Figs. 79 and 80, which show a Crossley frame It should be pointed out, however, that this type of drive is not used at the Bradford Ironworks,

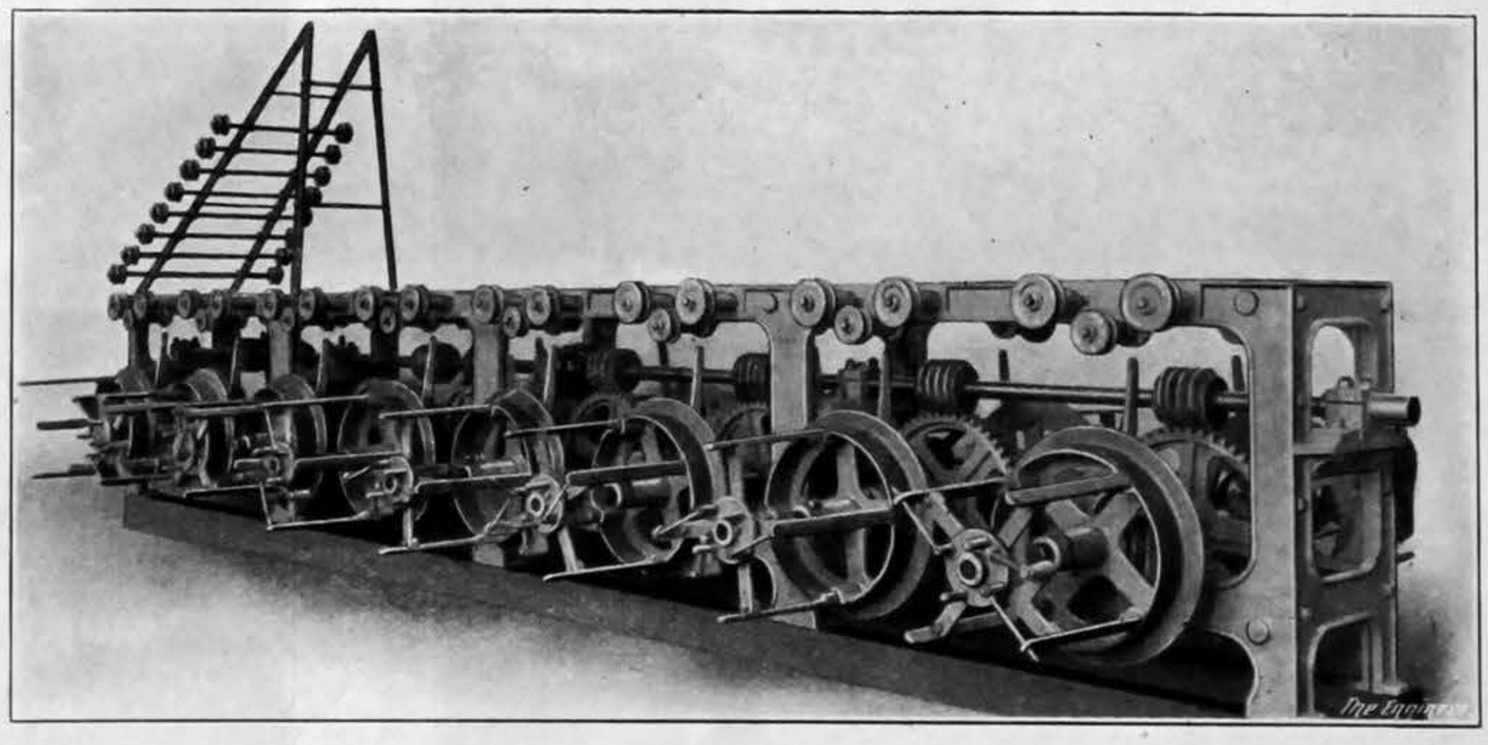


FIG. 72—WIRE PATENTING FRAME

THE WIRE WORKS OF RICHARD JOHNSON AND NEPHEW, LIMITED, MANCHESTER

FIG. 73—WIRE ROD CLEANING DEPARTMENT

FIG. 74—HEAVY WIRE DRAWING DEPARTMENT

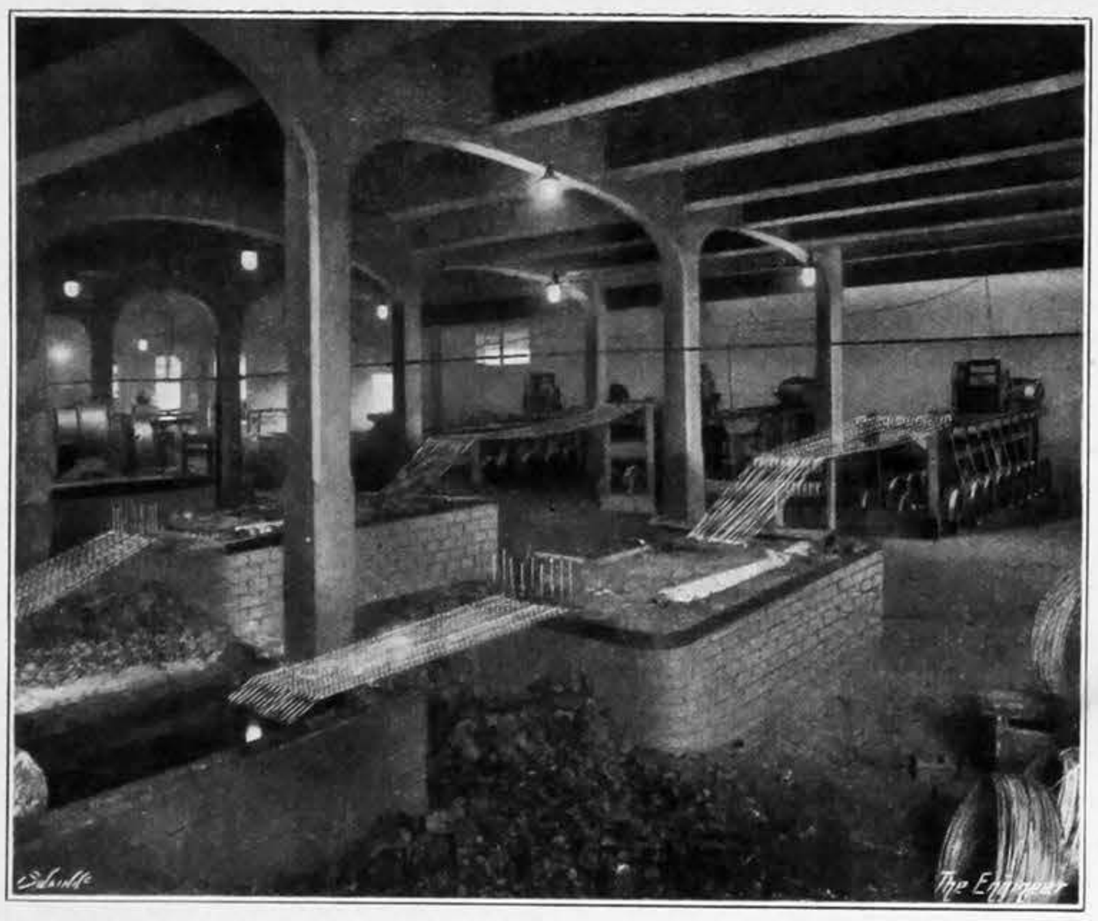


FIG. 75—PART OF THE GALVANISING DEPARTMENT

FIG. 76—BARBED WIRE DEPARTMENT

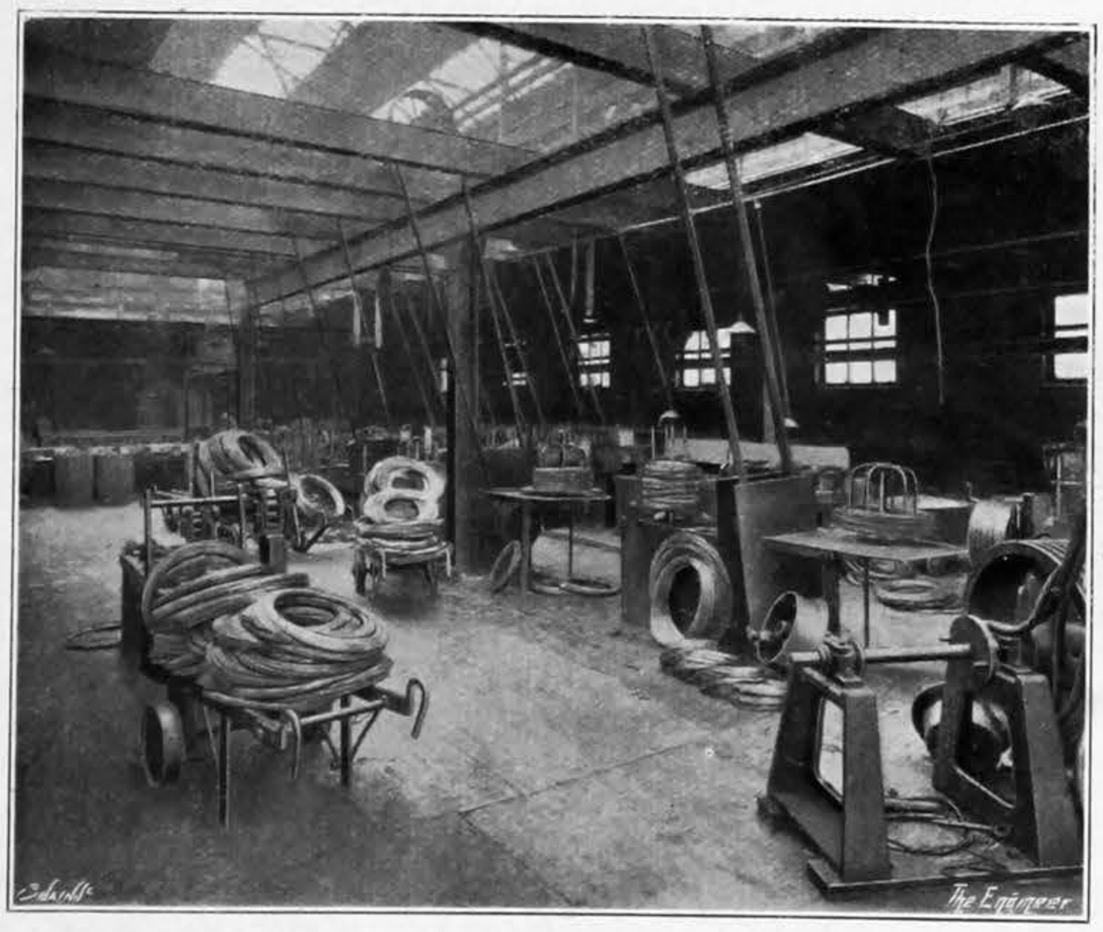


FIG. 77—FINE COPPER WIRE SHOP

FIG. 78—HEAVY COPPER WIRE SHOP

THE SENNAR DAM ON THE BLUE NILE

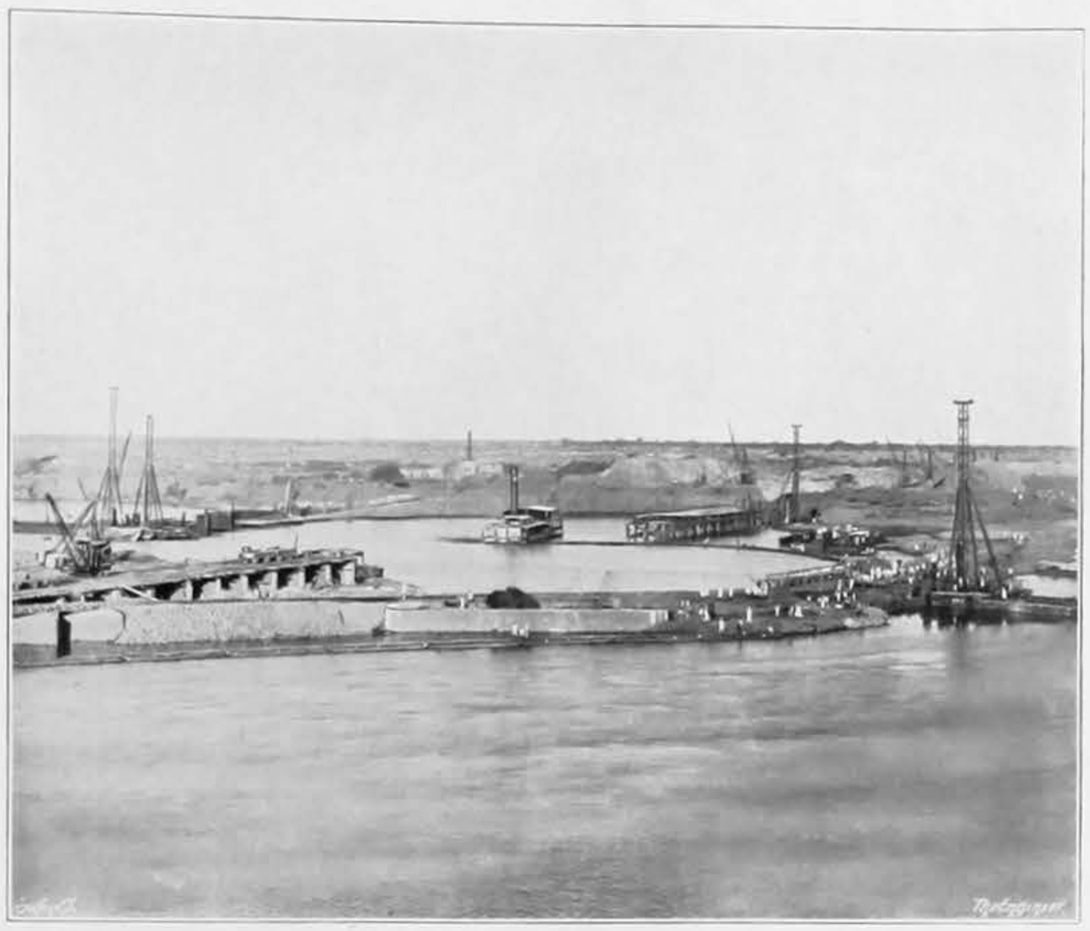


FIG. I.—CLOSING THE UP-STREAM SUDD—DECEMBER 19, 1923

FIG. II.—VIEW LOOKING EASTWARDS ALONG LINE OF DAM—MARCH 3, 1924

FIG. III.—LOOKING EASTWARD ACROSS PARTIALLY DE-WATERED DEEP CHANNEL—APRIL 1, 1924

FIG. IV.—PROGRESS OF MASONRY ABOVE DEEP CHANNEL—APRIL 16, 1924

FIG. V.—DEEP CHANNEL NEARLY FILLED IN—MAY 6, 1924

FIG. VI.—DOWN-STREAM FACE OF EASTERN PORTION OF DAM—JULY 1, 1924

as Messrs. Johnson prefer to install a variable speed motor. The electric motor mounted on the top of the frame drives the longitudinal shaft through a pair of expanding pulleys, like those fitted to the Lang lathe, and a chain and double-helical gearing. The expanding pulleys enable the speed to be adjusted, whilst the machine is running, with exactitude.

Galvanised wire represents an important proportion of the product of the works under review, and there is an equipment of 19 baths, the total output being about 900 tons a week. It is noteworthy that this firm was the first to introduce the continuous process of galvanising, in 1860. Before that time galvanised iron wire was generally in bad repute, as it was often very brittle. This brittleness was to be accounted for by the practice then in vogue, of leaving the coils of wire standing on the swifts wet with weak acid from the cleaning bath. The surface also sometimes dried with a thin film of oxide, and would not then take the zinc properly.

In order to overcome these difficulties Mr. Bedson devised the continuous process, which has since been adopted universally. The wire is taken directly from the drawing machines, in its bright state, to the swifts of the galvanising plant, and is led through a long furnace in which it is annealed, or tempered if necessary. It then goes through a bath of hydrochloric acid, to remove the scale formed in annealing, and thence to the bath of molten zinc. The wires coming out of the zinc pass through a bed of sand, to wipe off any surplus metal, and are wound into coils on a long frame. Two of the galvanising baths, together with their acid tanks and frames, are shown in Fig. 75—their corresponding furnaces are out of view on the left—while Fig. 81 shows a galvanising frame.

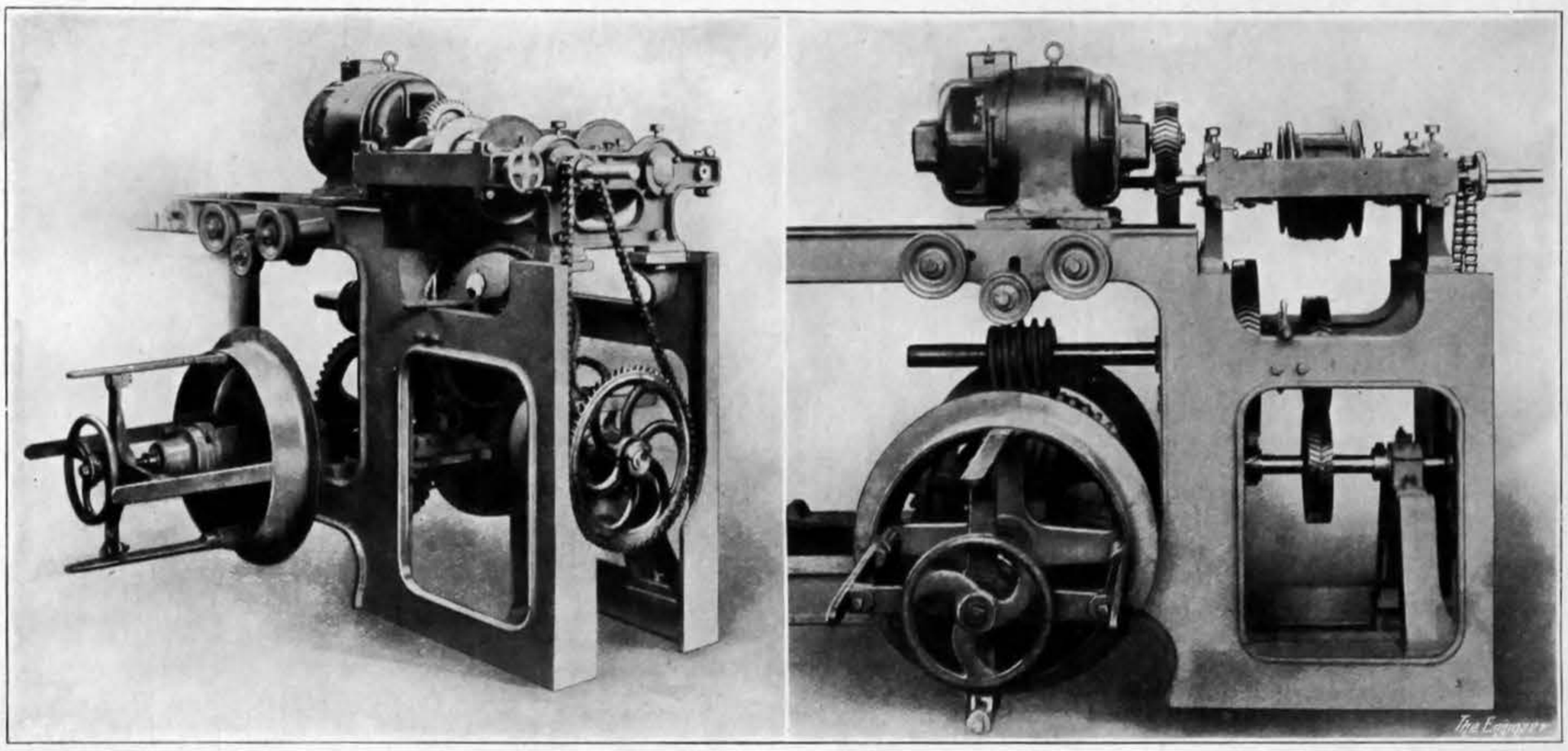
The wire is led over the guide pulleys shown, and is wound into coils on the deeply-grooved drums. These drums are split in two and held together by quick-opening clamps, so that the front half can be easily unshipped and a completed coil taken off with a minimum of delay and labour. The drums are provided with clutches for stopping them when they are being unloaded.

A large part of the galvanised wire made in the works is used in the manufacture of barbed fencing wire, and a view of the barb wire department is given in Fig. 76, but a description of the machines themselves must be reserved for a future occasion.

The Bradford Ironworks also include a department for manufacturing copper, bronze and cadmium copper wire, commutator bars, bus-bars, strip, &c. It is equipped with a rolling mill, which hot-rolls the wire bars weighing 250 lb. each into wire rods ¼in. in diameter, or of such larger sizes as the work in hand may require.

The drawing mills are very fully equipped with blocks and continuous machines for drawing the copper or alloy rods down to sizes ranging from as much as 1in. square to as little as a diameter of $^1/_{100}$in.

Two views of the copper drawing mill, which has a capacity of about 250 tons a week, are given in Figs. 77 and 78.



FIGS. 79 AND 80—VARIABLE SPEED DRIVE FOR PATENTING FRAME

The New Witbank Power Station.

AN outline of the design of the new Witbank power station in the Transvaal Province of the Union of South Africa was recently given by the President of the South African Institute of Engineers, and some extracts may be of interest.

The station site is about 5½ miles from the Oliphants River, and a gravity dam is being built across the river to impound a maximum of 211 million cubic feet, say, 1320 million gallons of water. A pumping station is being incorporated with the dam to allow 6.28 cusecs, or 2360 gallons per minute, to be pumped against a static head of 627ft., or a total head, including friction, of 860ft., to a storage reservoir above the power station. The pipe line will be 15in. in diameter. From the reservoir the water will flow by gravity to the cooling ponds.

The station is being designed to accommodate five 20,000 kilowatt (23,500 kilovolt-ampère) turbine generators, and, in addition, what are known as house turbines to insure continuity of supply to the electrical auxiliaries. The first three turbines to be installed will be manufactured and supplied by C. A. Parsons and Co., Limited, of Newcastle-on-Tyne, and will be of the double-cylinder reaction type, running at 3000 revolutions per minute. Each machine will be provided with two condensers, with steam ejectors for removing air and the ordinary electrically driven centrifugal cooling pumps. The circulating water will be cooled by passing through sprays. The amount of circulating water per machine will be 1,200,000 gallons per hour, and the spray cooling plant will reduce the temperature from 85 deg. to 65 deg. Fah. The turbines will be supplied with steam at about 250 lb. gauge pressure and at a temperature of 350 deg. Cent. The boiler house is being laid out to accommodate twenty Babcock and Wilcox marine type boilers. These will be very similar to those installed as standard throughout the Victoria Falls system, and will be fitted with chain grate stokers of the latest design. The leading particulars of the boilers are :—Boiler heating surface, 9352 square feet ; superheating surface, 3760 square feet ; economiser surface, 6500 square feet ; grate area, 288 square feet ; normal capacity, 70,000 lb. per hour (actual), to a pressure of 250 lb. per square inch and a total temperature of 350 deg. Cent.

The stokers will be worked with forced as well as straight induced draught. Although the output is put at 70,000 lb. (actual) per hour, it is believed that in actual working and with Witbank duff coal, something like 85,000 lb. to 95,000 lb. per hour will be obtained, and that the guaranteed efficiency of 80 per cent. at normal full load will be reached.

The ash-handling plant is of particular interest. As the result of experience with the Vereeniging station, in particular, the company has developed a very ingenious device, consisting of a tank in the ash basement in which a paddle wheel slowly revolves. The ashes are led into this tank by a chute, which is sealed at the bottom, and as the ashes are slacked in the tank they are slowly and continuously discharged by the paddle wheel on to a rubber conveyor belt, which takes them to a bunker from which they are carried to the ash dump by endless haulage. It may be remarked that this invention has been taken over by Messrs. Babcock and Wilcox, who have installed it on the boilers supplying the power station at the British Empire Exhibition.

Current will be generated at 6000 volts three-phase, and stepped up to 132,000 volts, the transformers and switchgear being placed in an outdoor switch house. A transmission line carrying two circuits will convey the 132,000-volt current to Brakpan power station, a distance of approximately 65 miles, where it will be again transformed down to 40,000 and 20,000 volts, at which pressure it will be distributed through the existing network of the Victoria Falls Power Company.

The Power Company has negotiated a contract with the Associated Collieries in the Witbank district for a supply of coal at a price of 1s. 9d. per ton at pit's mouth, for a period of twenty years, and Mr. Otley, President of the South African Institution of Engineers, believes that the total costs of generation at the station will be the lowest of any steam power station in the world. The magnitude of the business resulting from the demands of the mining industry will enable the plant to be run at the highest possible load factor. When tuned up, the output from the three machines at the Witbank station will be 468 million units in the year, and the coal consumption will be about 460,000 to 480,000 tons per annum. In designing the Witbank generating station there was no striving to obtain world's record results as regards thermal efficiency, and the reason is obvious, namely, coal is cheap and plant, erected 6000 miles from the factory, is dear. The reason the company has not gone in for the very latest improvements, such as pulverised fuel, air heaters or very high steam pressures, is simply that they would not pay, even bearing in mind the fact that the station will be run at a very high load factor.

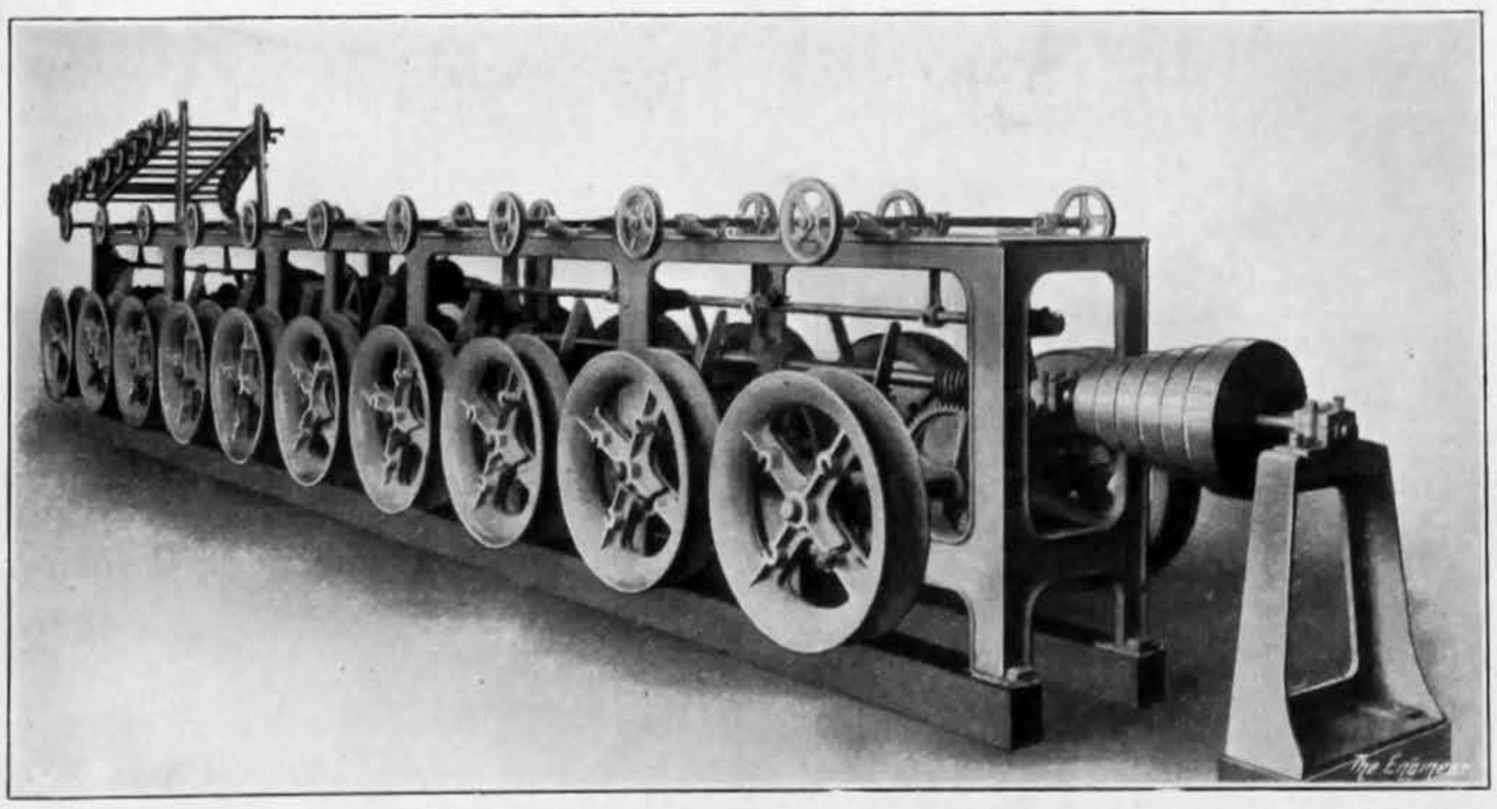


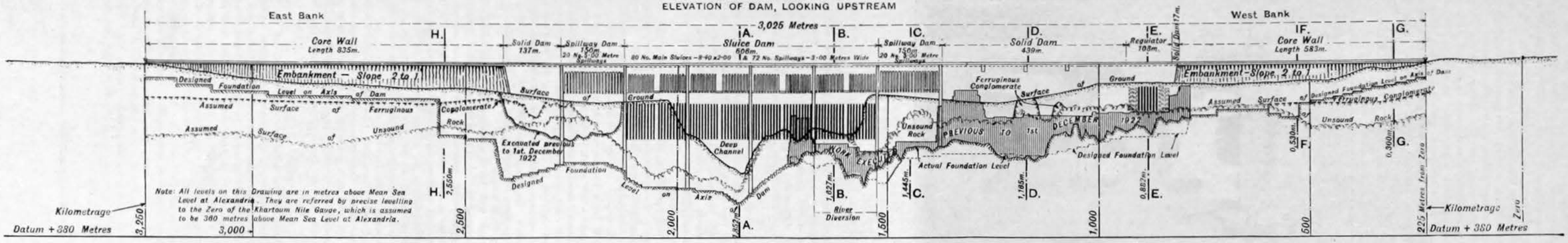
FIG. 81—WIRE GALVANISING FRAME

A SUGAR mill which has just been completed in the Glasgow shops of Duncan Stewart and Co., for the Jamaica Sugar Estates, has a capacity of 800 tons of cane a day, and will, it is hoped, be erected in time to deal with next year's crop.

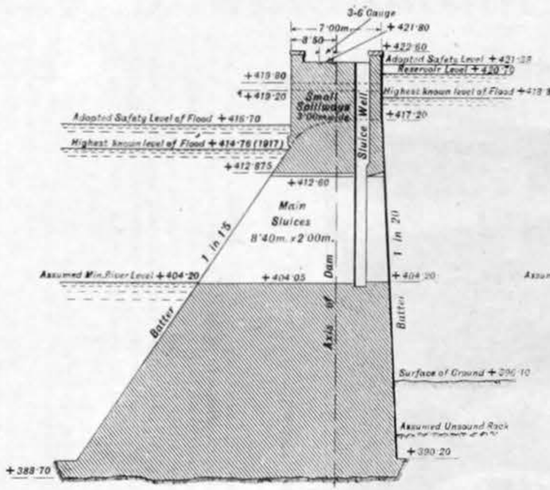
PROFILE, CROSS SECTIONS AND PROGRESS CHART OF THE SENNAR DAM

(For description see opposite page)

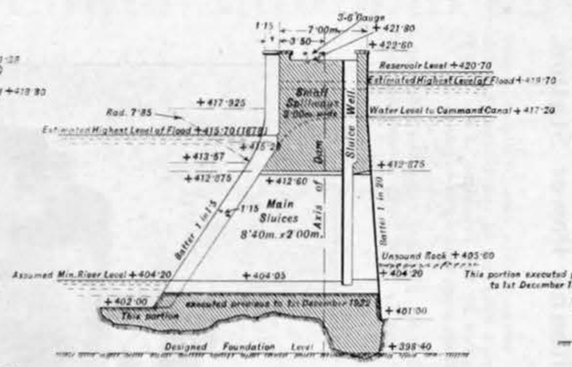
ELEVATION OF DAM, LOOKING UPSTREAM



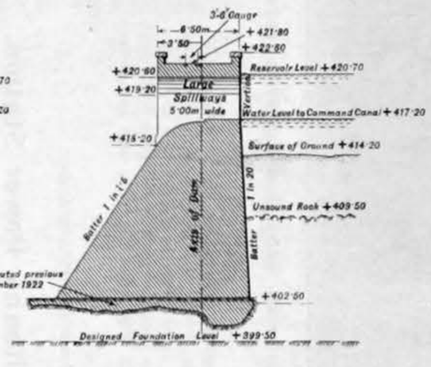
SECTION OF SLUICE DAM ON LINE A.A



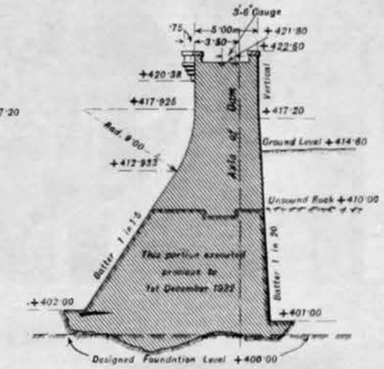
SECTION OF SLUICE DAM ON LINE B.B.



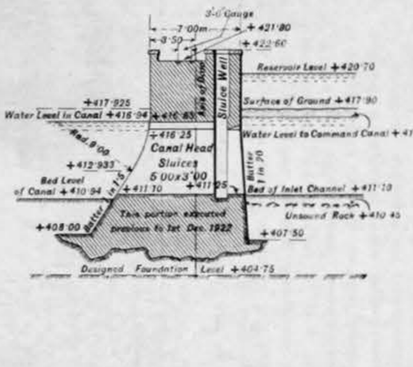
SECTION OF SPILLWAY DAM ON LINE C.C.



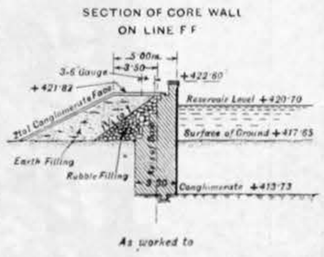
SECTION OF SOLID DAM ON LINE D.D.



SECTION OF REGULATOR ON LINE E.E.

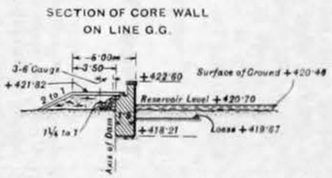


SECTION OF CORE WALL ON LINE F.F



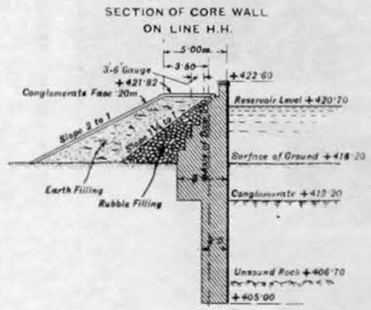
As worked to

SECTION OF CORE WALL ON LINE G.G.

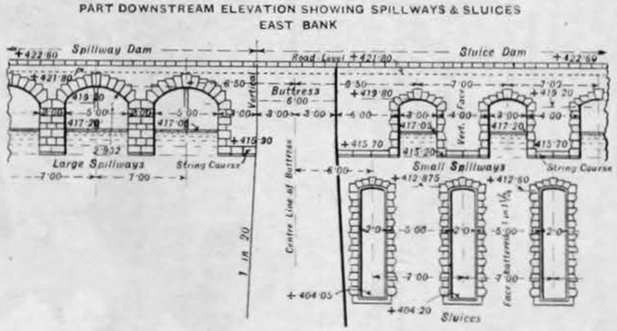


As worked to

SECTION OF CORE WALL ON LINE H.H.



PART DOWNSTREAM ELEVATION SHOWING SPILLWAYS & SLUICES EAST BANK



HORIZONTAL SCALE FOR MAIN ELEVATIONS

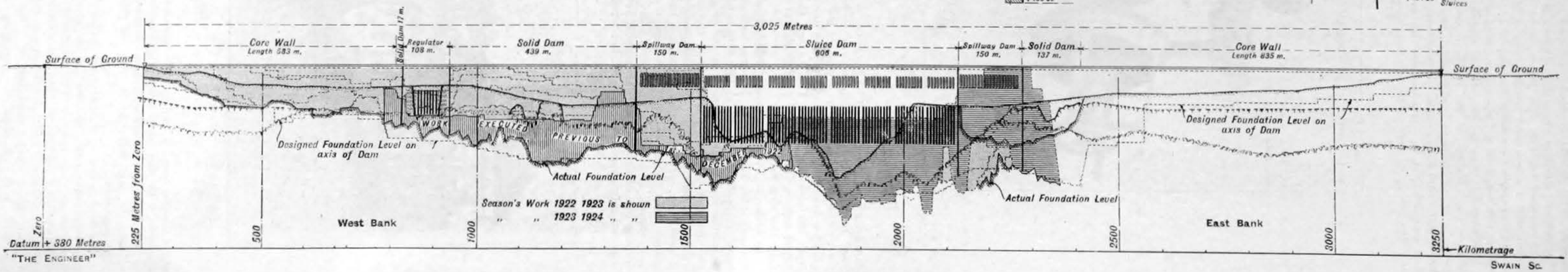
METRES 100 60 0 100 200 300 400 METRES

VERTICAL SCALE FOR MAIN ELEVATIONS

METRES 10 5 0 10 20 30 40 METRES

SCALE FOR CROSS SECTIONS

METRES 10 5 0 10 20 METRES



"THE ENGINEER"

SWAIN Sc.

The Sennar Dam and the Gezira Irrigation Scheme.

IN our issue of May 23rd, 1919, we gave an illustrated description of the Sennar Dam, which it was proposed to build on the Blue Nile and which had been designed by Sir Murdoch Macdonald, M. Inst C.E., K.C.M.G., when he was adviser to the Public Works Ministry of the Egyptian Government. The purpose of the dam was to provide water for the irrigation of the Gezira Plain, which lies south of Khartoum on the tongue of land formed by the confluence of the Blue and White Niles. We explained that definite plans for the irrigation scheme had been put forward as long ago as the year 1913, and had been referred by the Sudan Government to the Public Works Ministry at Cairo for consideration and advice. The plans included the construction of:—(1) A dam at Makwar, some five miles south of Sennar and 170 miles from Khartoum, for which several alternative projects had been prepared; and (2) a canal of 99 kiloms. in length, with numerous branches, taking off from above the dam for the irrigation of 300,000 feddâns* in the Gezira Plain. At the date mentioned borings had been carried out on the proposed site of the dam, and the centre line of the canal has been finally located on the ground and levelled.

In July, 1913, Sir Murdoch Macdonald, acting on instructions from the late Lord Kitchener, then British Agent at Cairo, invited Sir William Garstin, Mr. McClure and Sir Arthur Webb to meet him in consultation in London for the purpose of examining the plans. Early in the next year the proposed site was examined by this commission of engineers and, after careful study, the definite conclusion was come to that the deep channel which lay towards the Eastern Bank of the river and which, it was realised, would present the most serious difficulty in constructing the dam, could be laid dry if due and sufficient preparation were previously made. On the basis of this and other conclusions arrived at, plans and estimates were got out, and the scheme was adopted.

Then came the Great War, and the works were almost entirely suspended, the only part of the scheme proceeded with being a small amount of excavation of the main canal, the average depth of digging being 6 m., or nearly 20ft. This work was carried out entirely by hand labour, for it was not till some time after the conclusion of the war that mechanical excavators could be obtained.

The war period was not entirely lost time, however, for during the three years of forced suspension of constructional operations, the questions of discharges, leve's, sluice waterways, materials and

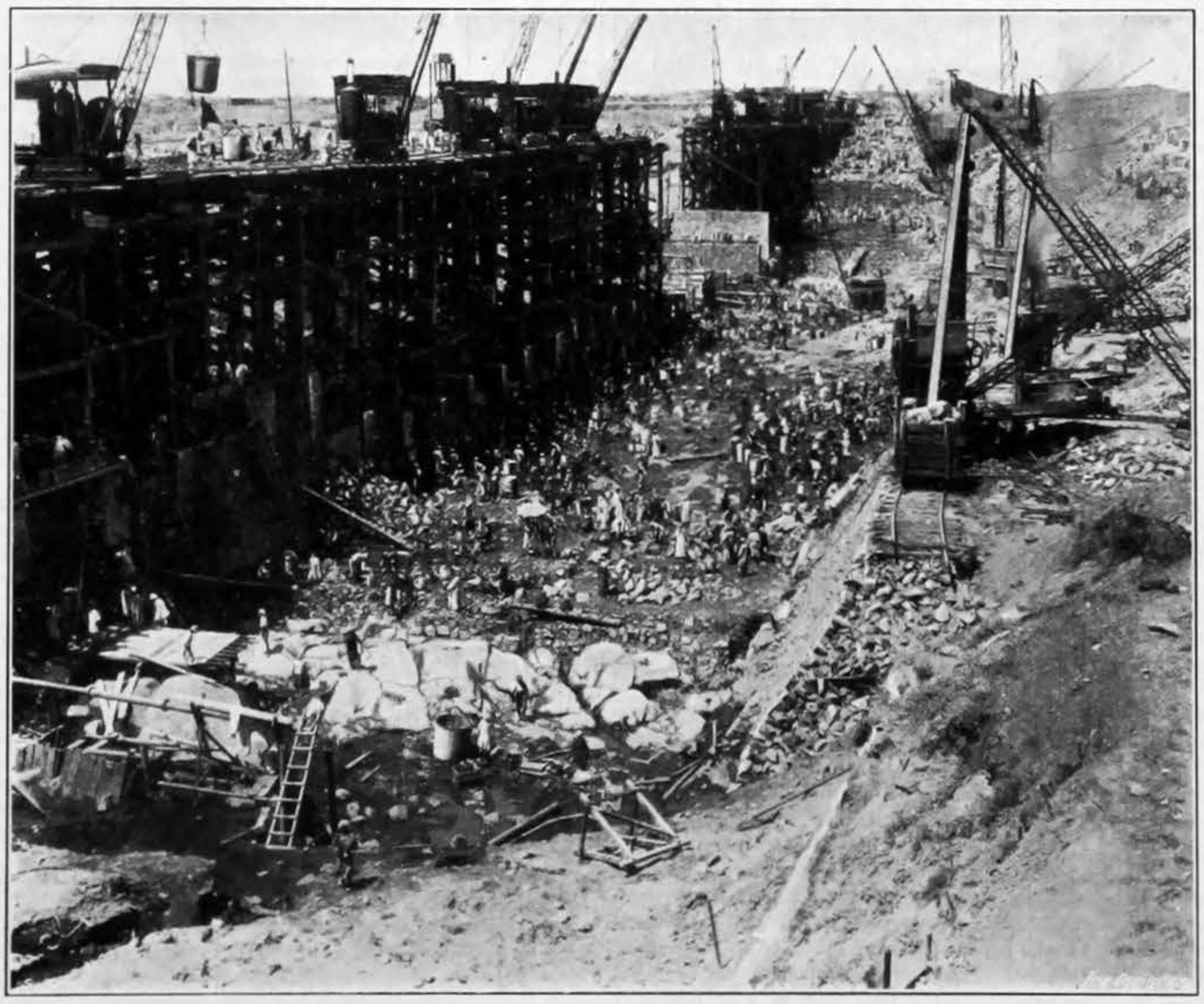


FIG. 1—LOOKING WESTWARD—DEEP CHANNEL IN LEFT FOREGROUND—MARCH 25, 1924

many other engineering problems were thoroughly gone into.

As a matter of fact, actual construction work on the dam itself was not begun until April, 1921, the contract having been entrusted in 1919 to the Sudan Construction Company—Messrs. Alessandrini and Perry—on a percentage basis.

* 1 feddân = 1.04 acres.

The dam when it is completed, which, it is hoped, will be in time for next year's crop, will be a most imposing structure. It will have a total length of 3·025 kiloms., or, say, 9925ft., and a height from the lowest point in the foundations to the top of the parapet of 39.60 m., or, say, 130ft. The major part of the length of the dam is composed of rubble masonry set in "red cement" mortar, referred to later, with mosaic facing set in Portland cement on the up and downstream sides, the sluice openings being lined with dressed ashlar. At the ends of the masonry portion the dam is continued on each side by an earth embankment having a heavy concrete facing wall on the upstream side, the width of which varies according to the depth of the foundations. As at present constructed, there is a canal head regulator, near the west end of the dam, which is designed to serve one million feddâns of land. It contains 14 sluices each 3.0 m. wide and 5.0 m. high to the springers, the cill level being 411.25 m. above mean sea level at Alexandria, which is the datum to which all levels are referred. The water level in the reservoir necessary to command the canal system is + 417.20 m. Seven of the 14 sluices are to be used in the first instance, the remaining seven openings, which are blocked with concrete partitions, being held in reserve for future developments. Eastward of the regulator there is a length of 439 m. of solid dam. Then comes a spillway dam 150 m.

FIG. 2—PROGRESS OF DEEP CHANNEL—APRIL 15, 1924

long and containing 20 large spillways, each 5.0 m. wide and 2.0 m. high to the springers with cills at + 417.20 m. Next there is to be what is termed the "sluice dam," which is to be no less than 606 m., or 1988ft. long, and is to be pierced with two sets of openings arranged one row below the other. The lower row will consist of 80 openings for sluice gates, 2.0 m. wide and 8.40 m. high to the springers, and having their cill levels at + 404.20 m., situated at the assumed lowest river level, or 18.40 m. below the top of the parapet of the dam. The upper row of openings will comprise 72 small spillways, each 3.0 m. wide and 2.0 m. high to the springers, the cill level of which will be + 417.20 m. We may mention in passing that the highest recorded flood level in the river prior to the construction of the dam was + 414.76 m. in 1917, and the estimated highest flood level was + 415.70 in 1878. Beyond the "sluice dam" there is to be another spillway dam, which is 150 m. long and is a replica of that already described. Next comes a length of 137 m. of solid dam, and finally the eastern earth embankment, which is 835 m. long. The length of the western earth embankment is 583 m. Along the whole length of the dam there is to be a roadway standing at + 421.80 m., which varies in width according to the sections of the work. This roadway will also accommodate a line of 3ft. 6in. gauge railway to be used by the Sudan Government Railways, which will be extended to Kassala at a later date. The maximum reservoir level is arranged to come at + 420.70 m. or 1.10 m. below the roadway and 1.90 m. below the top of the parapet.

The accompanying diagram shows by different hatch linings (*a*) the work done between April, 1921, and December 1st, 1922, when Messrs. S. Pearson and Son took over the works; (*b*) the work done between December 1st, 1922, and July, 1923; and (*c*) the work done between October, 1923, and the beginning of July of this year. It may be explained that flooding in the Blue Nile commences in May, reaches its climax about the end of August or beginning of September, and does not fall sufficiently for any work to be done until about the middle of October. It is only possible, therefore, for operations to be in progress on the dam during some nine months of the year.

The Sudan Construction Company began work on the western end of the dam, and completed the lower hatched portion. The company also built a village for the workmen and staff, erected a complete cement factory, dug a number of canals, opened quarries, laid railways, cut sleepers and firewood, built barges, and carried out a great deal of other preliminary work. For financial reasons into which it is not necessary to enter here, the arrangement with this company was concluded in 1922, and in October of that year another contract was entered into with S. Pearson and Son (Contracting Department), Limited,

to complete the work on a fixed rate basis, the order being obtained after competition with other British firms. At the same time Messrs. Coode, Fitzmaurice, Wilson and Mitchell, of Westminster, were appointed consulting engineers to the undertaking. Sir Maurice Fitzmaurice, it will be remembered, was in charge as Resident Engineer during the construction of the original Aswân Dam.

During the season 1922–1923 a considerable amount of progress was made on the western portion of the dam, as will be realised from the upper hatching at that end, and a short length of foundations was also completed on the east bank. The dam was completed to the full height for a length of some 1700.0 m., and partially completed for a further 330.0 m., leaving an opening 130.0 m. in width, through which the river was diverted during the ensuing working season, so that when the 1923 flood came down this opening and the original river bed at the eastern end of the structure were available for the discharge of the flood waters.

Work on the construction of the eastern portion of the dam was begun when the river began to fall in the middle of October of last year, and the season's operations, which were brought to a most satisfactory termination on July 5th last, and which are shown separately hatched in the drawing, are regarded as being the most important of the whole, since the deep eastern channel, which, as above stated, was looked upon as being the crux of the problem, was successfully negotiated. For the following description of the enormous amount of work which has been done in a surprisingly short time, we are indebted partly to Mr. O. L. Prowde, M. Inst. C.E., who has been resident engineer during the whole course of it, and who is now on leave in this country, and partly to the consulting engineers, who have been good enough to prepare the accompanying progress diagram and to give much additional help and information.

The first thing to be done was to construct temporary earthen dams or "sudds," both upstream and downstream of the site, so that the latter might be freed from water. The cores of these dams were formed by driving lines of steel sheet piling between the east bank and what, at low water, was an island in the river. The piling for both upstream and downstream dams was driven from both ends, and as the work progressed, bags of earth were thrown against both sides of the lines of piling and spoil dredged from the river bed was pumped against them by two suction dredgers, one of them an 18in. and the other a 24in., both built by Lobnitz, of Renfrew. The upstream, or southern, sudd was closed first. When the piling had been advanced so that the gap between the ends was only some 40 m. (say, 131ft. wide), a steel barge was arranged to span the gap. Trucks of granite rubble were then run on to the top of the barge, and the stone dumped into the river upstream of the barge until the whole flow of the river was diverted into the western channel through the opening in the masonry previously referred to. The closing was effected on December 17th of last year, and Fig. I. in our Supplement of to-day shows the state of affairs two days later. In the foreground of the engraving the whole discharge of the river, which was at that time 550 cubic metres per second, or, say, 10,454,400,000 gallons per day, will be observed passing in the western channel. Various other things will be seen in this view. For instance, there is the partly constructed gantry, which, later, was used in the building of the dam. Then there is one of the suction dredgers—actually, it was the 18in. one—engaged in pumping silt and sand from the bed of the river, thus, in one operation, excavating for the dam and forming the sudd by pumping material to it through a floating pipe line. Then there is a pile driver at work on the right of the picture driving sheet piles in front of the stone, which had been thrown from the lighter to fill in the gap in the sudd. Then there are other pile drivers at work, driving the piles to form the northern, or downstream, sudd, which, at the date of the photograph from which our engraving was made, was not completed.

The remaining engravings in our Supplement are all reproduced from photographs taken looking eastwards from the western side of the deep channel. They will repay close study, as showing the surprisingly rapid progress in construction which was achieved. Thus, view No. II. was taken on March 3rd last—eleven weeks and five days after the date of view No. I. In the intervening period, the northern sudd had to be completed, the whole site dewatered—the sudds being subject to a maximum head of about 23 m. (say, 75ft. 6in.)—much excavation carried out, and not a little of the rubble masonry and ashlar of the dam got into place. The pool of water seen in the middle distance is the deepest part of the deep channel of which mention has several times been made, and in the background can be seen the eastern portion of the dam.

View No. III. in the Supplement, which was taken a little nearer the eastern bank of the river than was view No. II., shows the progress made in three weeks, for the photograph was exposed on April 1st last. The deep channel is seen in the immediate foreground, and it will be observed that it is nearly unwatered. While the water was being lowered by means of two 12in. pumps, the loose material at the bottom was partly removed by means of grabs and partly by hand. Much of the rock bottom on which the foundations of the dam were built had been uncovered, and its character can be appreciated. A careful comparison between views Nos. II. and III. shows the progress made in the twenty-one days in various directions. The progress made during the following fortnight—between April 1st and April 16th, to be exact—is even more marked, and is, in fact, really astonishing. The view No. IV. was taken looking right across what was once the deep channel. The two pipes indicate where it came, but much of it has now been filled up practically solid, and other portions of work have gone forward many steps. View No. V. was taken on May 6th, or twenty days after view No. IV. Still further progress is visible, though it will be seen that the deep channel—the dark portion in the left bottom corner—was even then not quite filled in. The downstream slope of the dam with its mosaic facing will be observed on the left-hand side in the background.

The last view of the series—No. VI.—which has been reproduced from a photograph taken on July 1st, shows this downstream face taken up to the height at which it is to be left until the river begins to fall again and the final phase of the work is entered upon. The level reached is + 410.23 m., and it is such that for the remainder of the work along this length it will not be necessary to construct sudds. There was only just time to get in all the masonry required, and that the work was actually completed within the period available reflects very considerable credit on everyone concerned. It must have entailed an enormous amount of thought, preparation and organisation. The length of the dam in the deep-water channel is 400 m. and the amount of masonry put in during the past season was 100,000 cubic metres. In addition, a large amount of masonry was built on the east bank while the sudds were being constructed. Three hundred and fifty Egyptian masons were employed. They worked in two shifts of 8½ hours each. The first shift started at 5.30 a.m., while the second went on until 12.30 a.m. About 1000 cubic metres of masonry was built in daily. The unskilled labour consisted of about half and half local Sudanese and Egyptians from Upper Egypt. The latter are engaged on six months' contracts and are brought up to the dam, a distance of some 1500 miles, by rail and river steamer. Some of the engravings give an idea of the large numbers employed. Altogether on the whole of the works, including the canals, which will be referred to later, a force of about 20,000 men were employed throughout last season.

The bulk of the dam is, as has been explained above, built of rubble masonry in mortar. The mortar is composed of a mixture of what is termed "red cement" and sand in the proportions of 1 of cement to 4 of sand. The "red cement" is prepared locally. It consists of a mixture of 70 per cent. ordinary Portland cement, which is manufactured on the site, and 30 per cent. burnt clay. The mixture is actually brought about in the tube mills in which the cement clinker is ground. When the estimates for the dam were first got out it was assumed that the cement would be imported, but the price of the commodity subsequently rose so considerably that it was found that it would be cheaper in the end to install cement-making machinery and to make the cement on the spot, even in face of the fact that when the dam is finished the plant will probably have to be scrapped because there will be an insufficient local demand for cement. The mixture of cement and burnt clay is said to produce mortar of excellent quality, the burnt clay taking up any free lime left in the cement and acting much in the same way as does trass when used in a similar manner. For the ashlar masonry and mosaic facing plain Portland cement mortar is used. There was plenty of raw material for making the ashlar facing, the rubble bodywork, the cement and the burnt clay within economic distance of the site. About 1200 tons of cement are made per week. It is of interest to note that, when completed, the dam will contain no less than 425,000 cubic metres of masonry.

The series of engravings which are given herewith and on page 352 is equally interesting as that in the Supplement, as it embraces views taken looking westward from very nearly a similar position on the east to that from which the views were taken looking eastward. In Fig. 1, which is dated March 25th last, excavation and masonry work is seen in progress and a view obtained of the end of the western portion of the dam completed last season. Fig. 2, taken nearly from the same point, shows the progress made by April 15th—three weeks later. Figs. 3 and 4 were taken on May 20th and June 3rd respectively, while Fig. 5 was taken on June 10th. It will be seen that even at that date there was still a good bit of masonry to put in to bring it up to the predetermined level, but it was actually got in to time.

It is to be understood that the water during the flood period will not only flow over the temporary sudds, but over the top of the partially completed masonry as well. The sudds will, of course, be demolished by the flow of water, but unless some unforeseen and most unlikely catastrophe intervenes the masonry will stand. Then when the river has fallen sufficiently, probably by the end of October next, work will be re-started and the whole superstructure completed and the sluices got into position before the next flood stops work in the beginning of July next year. Small sudds will have to be constructed upstream and downstream of the 130 m. opening left in the western channel for the diversion of the river in order that this portion of the work can be completed, the river being rediverted and passed through the sluice openings in the eastern channel.

During the progress of the dam the work of forming the irrigation canals has continued. In its way the irrigation undertaking is as big as, if, indeed, it is not bigger, than that of the dam. It is sought, first of all, to irrigate 300,000 feddâns, though it is estimated that sufficient water can be obtained from the Blue Nile by flow and another storage dam to irrigate eventually no less than 3,000,000 feddâns. The main regulator in the dam at present provided has been designed to pass sufficient water to irrigate 1,000,000 feddâns. The excavation of the canals is being carried out in the large channels by Bucyrus and Ruston dragline excavators, and in the smaller branches by hand labour. There are to be in all some 99 kiloms. of main canal and 900 kiloms. of branch canals. The total volume of soil which will have to be removed is as much as 15,000,000 cubic metres.

The soil is of what is known as the "black cotton" variety, and it has been proved to be admirably suited to growing cotton, it being estimated that with careful cultivation it will produce as much as 350 lb. per feddân. It is proposed that the water shall be distributed and the cotton disposed of in the following manner:—The Government will maintain the main canals in good condition and will keep them charged to a specified level with water. The distribution will be in the hands of a body known as the Sudan Plantations Syndicate, which will cut field irrigation ditches, superintend the growth of the cotton, and do all that is necessary to the material before it is marketed, including ginning and baling, and will finally sell it. Of the proceeds, the Government for its part will receive 35 per cent. of the total proceeds; the cultivator will receive 40 per cent. and the Syndicate will take the remainder, *i.e.*, 25 per cent. It is proposed that of the 300,000 feddâns to be irrigated at first 100,000 shall be placed under cotton, 100,000 devoted to a green crop, such as the lubia, a bean which is used for food for cattle, while the third 100,000 would be allowed to lie fallow. The crops would be sown in a three-year rotation, so that only in every third year would cotton be grown on the same soil.

In conclusion, we may say that the director in charge of the work on behalf of Messrs. Pearsons is Mr. F. T. Hopkinson, M. Inst. C.E., and that their agent on the site is Mr. J. W. Gibson. The supply and erection of the steelwork for the sluice gates, and the operating machines in connection with them, is being carried out by Ransomes and Rapier, Limited, of Ipswich, acting as sub-contractors to Messrs. Pearsons. Mr. Russell is chief engineer at the site on behalf of the Ipswich firm.

SPANISH RAILWAYS.

A solution of Spain's railway difficulties seems likely, it is thought, to result from the Railway Council's nationalisation scheme. Less opposition to the project of compulsory co-partnership is now being manifested, the State's good faith in offering to provide fresh capital and to carry out much-needed improvements being recognised. On the other hand, the sacrifice imposed upon foreign-owned companies is considerable, entailing practical loss of individual action and of independence of management. October 12th is the latest day upon which entrance to the new *régime* is possible, and it is thought that by that date the whole of the foreign companies, mainly French, will have signified their adhesion. Notification to this effect has already been received from British and Belgian companies, while German support has all along been assured. As a result of the new arrangements, a large amount of new construction will be begun. The State stands pledged to find the funds necessary to complete at once six new lines and to commence work upon three others. The sum of 1530 million pesetas has been allocated to existing companies for improvements, while within the next twenty years 12,853 kiloms. of new line, to cost 4868 million pesetas, have been arranged for.

Hitherto railway construction in Spain has been very slow. Within the six-year period 1918–1923 less than 250 miles of new track were opened for service. During the past year 32 miles only were built and opened, consisting of one narrow-gauge line of 25 miles and one electric line of 7 miles, the total mileage of the national system now standing at 9965 miles.

The financial position of the various railways has slightly improved within the last twelve months, the total revenue having reached 98,953,084 gold dollars. These figures represent an increase in the income for the financial year of 4,769,964 gold dollars on about 70 per cent. of the total mileage.

The Stationery Office has recently published the Ministry of Transport's railway statistics for June. They show that the number of passenger journeys that month was greater than that of June, 1923, by 3.5 per cent. This improvement was, however, entirely due to the fact that six and-a half millions more passengers were carried at reduced fares—passengers at ordinary fares being nearly three million less in number. The receipts were 16.6 per cent. more, and it is gratifying to notice that the increase was carried with only 2.5 per cent. more passenger train miles.

Railway Matters.

THE Soviet Government authorities have approved the programme for the construction of 161 new locomotives in Russia during the coming fiscal year.

A TRAIN now runs in each direction non-stop between St. Pancras and Nottingham, 123½ miles in 135 minutes, or an average of 54.89 miles per hour.

THE Ministry of Transport inquiry into the collision of the 13th inst. at Metropolitan Junction, London Bridge, was held by Lieut.-Colonel Mount on Monday last. The driver of the light engine concerned admitted that he misread a "clear" signal for another train as applicable to him.

THE Minister of Railways in the South Australian Government has proposed that the railways in the Adelaide area shall be converted to electrical operation. The Government has had the question under review for some time, but a decision has been delayed because of the financial outlay entailed.

THERE was a buffer stop collision on the London, Midland and Scottish on Friday morning last at London-road station, Manchester. Not only were the buffer stops destroyed but the stationmaster's office and a lavatory were knocked down. A passenger and one of the company's servants were injured.

THE Swedish Railway Board is requesting an appropriation of Kr. 16,380,000 for the State Railways in the next Budget. Of this sum, Kr. 10,630,000 is designed for the improvement of the lines and buildings already existing, and Kr. 5,750,000 for the construction of new railways, as follows:—For further constructional work on the incompleted Jokkmokk-Stensele section, Kr. 2,500,000; for the junction lines Forsmo-Hoting, Kr. 750,000; Haellnaes-Stensele, Kr. 1,500,000; and Joern–Gubblijaure, Kr. 1,000,000.

A CORRESPONDENT has sent us a handbill for a day excursion from his district, which shows that we were in error in saying in this column on the 22nd ult. that no passengers were conveyed at less than a single fare for the double journey. The rates quoted suggest that they are nearer two-thirds of the single fare. Whilst thus we have made a mistake there remains the important fact that excursionists no longer are conveyed to London and back and for other journeys of from 100 to 150 miles for 4s. or 5s. which was the pre-war excursion fare.

THE Bureau of Locomotive Inspection of the United States Interstate Commerce Commission has recently published some significant figures. Of 5460 locomotives inspected during July, 2553, or 46.8 per cent., were found defective, and 282 were ordered out of service. During the first six months of 1924, of 34,174 locomotives inspected, 17,482, or 51 per cent., were found defective, and 2842 were ordered out of service. Of 95,047 freight cars inspected by the Bureau of Safety during July, 3692, or 3.9 per cent. were found defective, and of 2162 passenger cars, 25 were found defective. During the month 40 cases, involving 123 violations of the safety appliance acts, were transmitted to various United States attorneys for prosecution.

MUCH success, we learn, has attended the running of motor-rail cars on country railway lines in Australia, and the New Zealand Government railways now propose to introduce them on their lines to meet the competition from road motor cars. Mr. S. H. Jenkinson, of the New Zealand railways, is at present on a visit to Australia in order to ascertain the results of the running of the motor-rail cars, and he has, we understand, been favourably impressed by a rail car while running on the Bairnsdale-Orbost line in Victoria. Mr. Jenkinson has expressed preference for the single-ended type of car—which runs in one direction only, and which has, consequently, to be put on a turntable when it reaches a terminus. The motor-rail cars in Australia appear to be giving entire satisfaction, for official reports would serve to show that where the volume of traffic is small they can be operated at a profit, whereas the steam trains which they have replaced were involving the railways in a loss.

ONE reads occasionally, in connection with Canadian Railways, of the Crow's Nest Pass agreement. It is, for instance, under discussion at the present time, and it may, therefore, be of interest to relate its history. In 1897 the Canadian Pacific Company acquired a State subsidy, and in return for it agreed never to raise above a certain level its eastbound rates for grain nor its westbound rates for commodities useful to the farmer. The Canadian National system had no such agreement, but competition compelled it to adopt the same rates. Since 1897, however, the Canadian Pacific has added thousands of miles to its system, and to them the agreement does not apply, and the rates are, therefore, uncontrolled. As a consequence the trader using the old roads has a cheaper rate than a man using the later lines, and the Government is being urged to have this difference adjusted. The companies maintain, apparently with justice, that the Crow's Nest Pass rates are quite inadequate in view of the existing prices of labour and material.

SINCE we mentioned, a week ago, the rejection by the Legislative Assembly of the Indian Government's proposals as to separating the railway budget from the general budget, *Reuter* has cabled that on Saturday the Assembly accepted a compromise, proposed by Sir Charles Innes, regarding the separation of railway and general finances. The compromise stated that the Assembly adheres to the resolution provided that the East Indian, the Great Indian Peninsular, and other State Railways remain under State management, and the Assembly has facilities for considering any proposal for the transfer of any railway company management, and if any contract for the same is concluded against the Assembly's advice, the Assembly can terminate the arrangements. In this resolution the Government also agrees to the railway services being rapidly Indianised, to Indians being appointed in due course to the railway board, and to stores being purchased through the Purchase Department of the Government. Sir Charles Innes said that this latter question would be immediately taken up.

Notes and Memoranda.

IT has been decided to burn, at sea, a number of the wooden ships built in America during the war. A salvage company has purchased 218 of them for 262,000 dollars—they originally cost 235,000,000 dollars—and is going to break up such of them as can be hauled up out of the water. To get rid of the remainder they are to be burnt.

IN the construction of the Appleton Dock at Melbourne 3,000,000 cubic yards of soil will have to be excavated. The earth will be taken out to a depth of 14ft., and a retaining wall 12ft. in thickness will be left between the cut and the river. When a uniform depth of 14ft. has been attained over the area required, the end of the new dock will be opened, and it will be flooded. The Harbour Trust will then undertake the work of dredging away the retaining bank of earth; and, finally, the whole dock will be dredged to a depth of 32ft.

A PAPER by Axel Hultgren, chief metallurgist of a company in Gothenburg, Sweden, was contributed to the American Society for Testing Materials, entitled "The Carrying Capacity of Ball Bearings made of Stainless Steel." A comparison was made of balls made of low chromium steels of American, British and Swedish production. The hope of the investigation was a solution of the problem of rust-resisting ball bearings. The results are announced as far from promising, the carrying capacity of the stainless steel bearing being only 10 to 20 per cent. of that of ordinary ball bearings.

THE proposals for the enlargement of the Hume reservoir, on the Murray River, Australia, involve an increase of the concrete core of the dam from 84ft.—the original dimensions—to 115ft., and the raising of the wall from 95ft. to 125ft. In the meantime, work has been proceeding on the foundations according to the dimensions set out in the former specifications, and construction has now reached such a stage that a decision regarding the proposal to provide for a possible increase in capacity must be reached with as little delay as possible. The scheme would make the Hume reservoir the largest artificial lake in the world. It would cover many square miles of country, and many valuable properties would be submerged. There is not, however, any likelihood of the scheme being carried out in its entirety for many years.

IN a paper read before the Society of Engineers, Mr. T. G. Hunter said that the average annual export of plumbago from Ceylon for the years 1909 to 1919 was 24,404 tons, the export value for all grades being £23 per ton at Colombo, the port of shipment. A maximum of 668,216 cwt. was exported in 1916, and during the years 1916 and 1917 as much as £100 per ton was realised for some of the best grades of lumps. The latest returns showed that 213,383 cwt. were exported during 1923. The industry has been subjected to periodic depressions and inflations, the most prosperous periods coinciding with war times. The present is probably the worst depression it has ever had to experience. The more important mines are now equipped with steam hoisting and pumping plants, and have adopted improved methods of mining.

IN connection with the Arapuni hydro-electric scheme in New Zealand, referred to in THE ENGINEER of July 18th, we learn from the *Industrial Australian* that the first work to be undertaken will be the construction of a diversion tunnel, 25ft. internal diameter, which is intended to take the entire flow of the Waikato River. Simultaneously, the excavation of the power-house site, of the head-race channel and also of the dam foundations above water level can be proceeded with. Before the actual construction of the concrete dam can be begun, the quarry site, 12 miles upstream of the dam site, is to be opened, and it is intended to provide a ropeway between the two points, capable of delivering stone at the rate of 50 tons an hour. It is expected that it will be quite twelve months before this arrangement is complete, after which the concrete in the main dam will be placed at the rate of about 300 cubic yards a day.

COMMENTING on the American flight round the world, *Nature* says that in drawing technical conclusions from the flight, no account can be taken of the great personal effort of the pilots and mechanics in thus facing successfully every sort of condition along 24,000 miles of route, unknown to them. The quasi-sporting condition that the same aeroplane bodies should circle the earth, albeit with new engines, wings and other parts, is also irrelevant. In a strictly utilitarian organisation, fresh machines and pilots familiar with the route would be available for each five-hour stage, and two such stages a day would be feasible. When it is found possible to maintain permanent airway organisation along such regions as the northern entrances of the Atlantic and Pacific oceans, it may become possible, flying ten hours a day at 100 miles per hour, to circumnavigate the world by air in about twenty-four days as a matter of routine travelling.

AT the critical or first vibrating speed of a turbine the period of vibration equals that of the speed, so that a shaft that vibrates 2000 times per minute if standing still and subjected to a mechanical shock, would also, says *Power*, present critical vibration at a speed of 2000 revolutions per minute. On the other hand, at the critical speed the relation of centrifugal force, due to any unbalance and the resulting resistance of shaft deflection, is such that the centrifugal pull would increase the shaft deflection to an infinitely large amount. After critical speed, or in other words, at a few revolutions above, there would tend to be an infinitely large shaft deflection in the opposite, or negative, direction. In the latter case, the heavy or unbalanced part of the wheel would tend to run out of truth, so the light side of the rotor would be marked with a stationary pencil. These points are so close together that if a turbine is brought up fast through the critical speed, there will be little deflection or vibration noticeable, as there is not time for vibration to build up and the shaft to take an abnormal deflection. Many turbines are operated below the critical speed, so that this point is not reached. An evenly loaded shaft would tend to have an infinite number of critical speeds higher than the fundamental. Any shaft provided with a rotor strong enough may reach other points of critical vibration higher than the first one.

Miscellanea.

IT is proposed to put up another beet sugar factory on the Wissey River, near Feltwell and Southery. The plant is to be supplied by John McNeil, of Glasgow.

A WHARF, alongside which it will be possible to berth 5000-ton ships, is to be constructed on the site of the old City of London Brewery, beside Cannon-street Station. The scheme, it is said, will cost £1,000,000

AN expenditure of £170,000 is contemplated by the Mersey Docks and Harbour Board in the construction of the north wall of the new Gladstone Dock from the north-west corner of the present graving dock riverwise, making provision for one entrance. The new wall will provide a loading berth about 600ft. long.

OF the four trunk highways in China mapped out for construction in Western Hupeh, two, the Siangyang-Shasi and the Siangyang-Hwayuan highways, have been completed. They are of great commercial importance. The Siangyang-Hwayuan highway connects with the Kin-Han Railway, while the Siangyang-Shasi road brings Siangyang within easy reach of the Yangtze ports.

ANOTHER record has been established by M. Œmichen, the inventor of the helicopter constructed by the Société Peugeot at its Valentigney works. Starting with a load of 100 kilos., he increased it to 150 kilos. on a second attempt, and finally rose 1.10 m. with a load of 200 kilos., remaining perfectly stable in that position for more than a minute. M. Œmichen therefore secures the prize of 40,000f. offered by the Technical Section of the Aéronautique Française.

THE Brazilian Government has authorised the disbursement of 1,400,000 milreis, to be expended at once upon port improvements at Ceará (800,000 milreis); Natal (400,000); and Parahyba (200,000). Contracts for the whole of the construction materials and for part of the engineering work will be allotted to foreign tenderers, who may communicate with the chief engineers in charge of the works at each of the three ports mentioned. Correspondence should in all cases be in Portuguese.

COMPLETE figures relating to Australia's mineral production for the year 1922 have now been issued. During that term the value of minerals produced was £20,316,160, or £338,776 above the figure for the previous year. In 1913 Australia's gold output was valued at £9,376,573; in 1915, £8,269,938; in 1917, £6,185,410; in 1919, £5,454,806; in 1921, £4,018,685; in 1922, £3,545,173; and in 1923, £3,134,114. Over the ten years 1912 to 1922 the mineral production of the country fell from £25,474,528 in the former year to £20,316,160 in 1922.

WE are informed that the Council of the British Cast Iron Research Association has appointed Mr. J. G. A. Skerl, M.Sc., to take charge of an investigation on moulding sands. Mr. Skerl has for nearly three years been research assistant to Professor P. G. H. Boswell, of the University of Liverpool, who has done so much work on moulding sands. The new work will be conducted in the Refractories Department of the University of Sheffield (Mr. W. J. Rees, F.I.C.), and in the foundries of members of the Association. The investigations contemplated are of such a character that the results may be made of immediate and practical utility to the ironfounding industry.

THE Sheffield City Council proposes to expend nearly half a million, during the coming winter, on works which will provide relief for unemployment. Besides large amounts which are to go towards road widening and sewage schemes, electrical extensions are to cost £61,459, and will comprise the following items:—Extra high-tension feeder mains in Abbeydale-road South, £28,500; extra high-tension feeder main between Manor Estate sub-station and Handsworth sub-station, £7559; extra high-tension main from Blackburn Meadows power station to High Hazels Colliery, £15,810; extra high-tension feeder mains between Crookesmoor and Hangingwater-road sub-station, £9590.

ACCORDING to a monthly return made by the National Federation of Iron and Steel Manufacturers, the production of pig iron in August amounted to 588,900 tons, compared with 615,600 tons in July and 599,800 tons in August, 1923. The number of furnaces in blast at the end of the month was 173, a decrease of two since the beginning of the month and the lowest number in blast since December, 1922. The production included 187,400 tons of hematite, 183,700 tons of basic, 155,800 tons of foundry, and 33,800 tons of forge pig iron. The output of steel ingots and castings amounted to 527,500 tons, compared with 689,300 tons in July and 567,500 tons in August, 1923. The low output in August is to a considerable extent due to holidays.

A NEW type of double-acting Diesel engine has recently been completed by the Worthington Pump and Machinery Corporation, New York. The first single-cylinder unit is conservatively rated, we understand, at 600 to 800 brake horse-power, and it is designed for this output at a normal speed of from 90 to 120 revolutions per minute. There are three fuel valves to each cylinder, one in the upper cylinder cover and two in the lower cylinder cover, which are slightly inclined to give better fuel distribution. The chief feature of the design, it is stated, is the manner in which heat stresses have been avoided. A new type of manœuvring gear is used, whereby the engine is started, controlled and stopped by a single lever. Reversal is accomplished by means of an oil-operated hydraulic gear.

THE Mexican Government has granted a concession for the construction of a large irrigation dam to impound the waters of Lake Santiaguillo which in time of flood averages 2 to 2½ miles in width. The waters of the Guatimape River are also to be impounded, and utilised to irrigate a section of land exceeding 30,000 acres. The same Government is to enter into a contract for the construction of a concrete pier at the port of Manzanillo, with a length of 220 m. and a width of 68 m. at the base and 25 m. at the outer end, equipped with cranes for loading and unloading. Four railway tracks and three reinforced concrete warehouses will provide a combined capacity of 40,000 tons. A separate contract will be entered into for dredging in the vicinity of the wharf to a uniform depth of 10 m.

THE SENNAR DAM ON THE BLUE NILE

(*For description see page* 349)

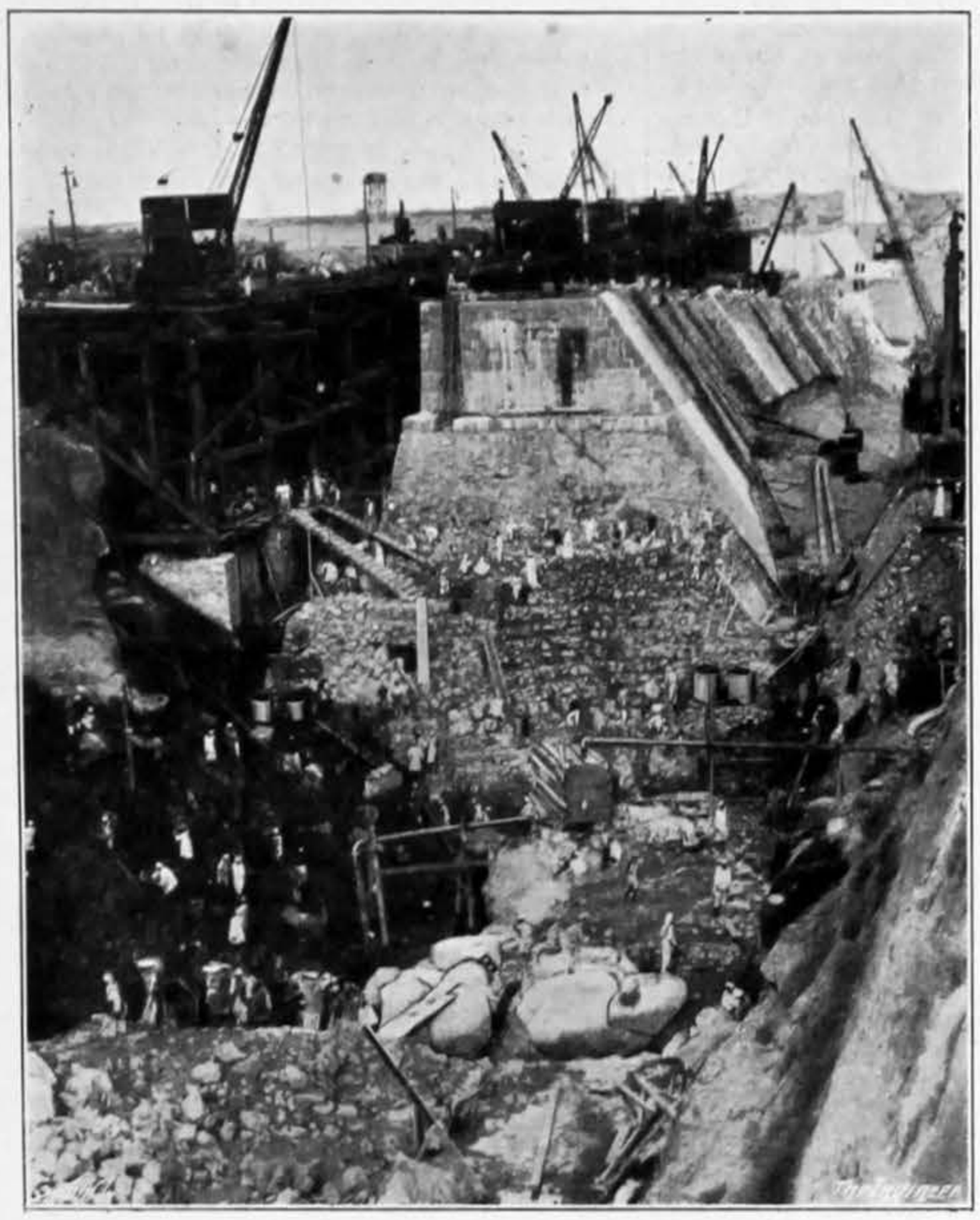


FIG. 3—DEEP CHANNEL PRACTICALLY CLOSED—MAY 20, 1924

FIG. 4—MASONRY ABOVE DEEP CHANNEL—JUNE 3, 1924

FIG. 5—CONDITION OF MASONRY ABOVE DEEP CHANNEL—JUNE 10, 1924

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TWO-PAGE SUPPLEMENT—THE SENNAR DAM ON THE BLUE NILE.

THE ENGINEER.

SEPTEMBER 26, 1924.

The British Machine Tool Industry.

IT is a little difficult to form a just opinion of the success or otherwise of the third Machine Tool Exhibition, which closes at Olympia to-morrow. Some of the exhibitors are delighted with the amount of business—resulting in the immediate sale of the machines on their stands—which they have done, some are not dissatisfied, and some are frankly disappointed. All seem united, however, in expressing the opinion that the visitors, although relatively few in number, have been of the right kind. Buyers or potential buyers of machine tools have attended in excellent proportion. Students, foremen and mechanics, classes of visitors to be encouraged as being likely to influence the selection of tools, now or in the future, have been fairly well represented. The mere sightseer and the "literature" hunter have been conspicuously absent, finding, no doubt, the charms of Wembley more attractive and the opportunities for satisfying their quest greater than those at Olympia. We have heard it said that there have been many absent faces from the Exhibition, that not a few well-known figures in the engineering industry who might have been expected to visit it have refrained from doing so, on the ground, it has been suggested to us, that a visit would have left them dissatisfied with their present inability to take advantage of modern machine tool developments. On the whole, however, it seems certain that the Machine Tool Trades Association's policy of not exhibiting at Wembley and of organising a separate short-period Exhibition of its own has secured one of its chief objects, the attraction of actual purchasers or possible purchasers and the exclusion of hordes of idle gazers.

On inquiry we find that less interest has been taken by potential purchasers in new designs of machine tools than could have been desired. Some may infer from this fact that machine tool development has now reached a stage at which the gain from new designs is not great enough to compensate for the cost of replacing existing less efficient machines by them. We cannot, however, bring ourselves to believe that such a state of equilibrium has yet been generally reached, or indeed that it is at all likely to be reached for many years to come. The reason for the observed fact lies, we suggest, in a lack of capital and a lack of confidence in the immediate prospects of the engineering industry as a whole. Lack of capital is debarring many engineering firms from adopting improved processes in spite of their conviction that by modernising their machine equipment more trade could be secured. Lack of confidence is hampering progress, because improved patterns of machines are regarded in the present circumstances as luxuries and not necessities, and anything like a show of increased prosperity is met by a resort to night-shift working or at the most by the installation of new machines of the types already employed. These unfortunate conditions obviously do not encourage the machine tool maker to develop new ideas, and, moreover, deprive him of the opportunity to do so. The production of a novel type of machine tool is generally a very expensive undertaking, and can only be faced by most firms when sales of established designs are flourishing. In general terms it may be said that the British machine tool trade is at present working full time, but short-handed—on the average with about half the number of workpeople ordinarily employed. The work is being done in fulfillment of orders principally received from British firms—a hopeful sign if, as we ought, we regard the machine tool trade as the barometer of the engineering industry. On the export side the position is curiously assorted. One firm reports that about half the machines on order are for overseas purchasers, but it would appear to be exceptional, the export orders held by most of the machine tool works being but a small proportion of the total in hand. We have heard of some British firms which are actually exporting machine tools to the United States, in spite of the 30 per cent. adverse tariff. On closer investigation, however, it would appear that little store is to be set by this interesting fact. In one instance the Transatlantic business would seem to represent genuine trade, the machines despatched having been ordered by manufacturing engineering establishments in the States to meet requirements which, it is said, cannot be fulfilled by the tools of American makers. In a second instance, however, we find that no more than a single machine has been despatched, while in a third—the last we have discovered—the trade, although active, is confined to a small, cheap, amateur's lathe distinguished by the large use of aluminium in its construction.

But if trade in machine tools with America is not exactly bright, it is at least consoling to note that the American builders are finding it increasingly difficult to secure British orders. This change is no doubt partly due to the reduced industrial activity, but it is also in part to be ascribed to the fact that in design, workmanship and finish the British machine is at least the equal of the American, whilst it may be as much as 10 per cent. cheaper. An exception, we have heard it said, is to be found in the case of the universal milling machine, the development of which, it was remarked, has not yet been carried sufficiently far in this country. On the other hand, there are at least two machines of this type at the Exhibition of thoroughly British origin which unprejudiced critics consider as good as, or even better than, any similar American machines. The position as regards Germany deserves close attention. There have been a few German visitors to the Exhibition, but they have come, it is thought, rather to discover new ideas to copy than as possible customers. While the widely held opinion that little business is to be expected from Germany, even if a loan be granted to that country, is probably soundly based, it is wrong and possibly dangerous to take the view that the Germans are still largely copyists. Unlike this and other countries, Germany has had during the past ten years an uninterrupted period of industrial activity and has been continuously developing her machine tools. Cut off, as the Germans were during the war, from the inspiration provided by foreign designs, they learned to rely upon themselves, and as a result are now producing first-class original designs. We have, no doubt, little to fear from German machine tool competition in our own markets, but in overseas markets their active competition will have to be met. In the absence of any possibility of transacting business either with the United States or Germany, certain authorities in the British machine tool industry are looking hopefully towards Russia. If a loan be granted to that country, it is argued, it might help the industry considerably, for while the Russians have been brought up on German machine tools, they have the greatest respect for those of British origin, and would seize the opportunity to acquire them. On the labour issues involved in the machine tool industry we have only one important fact to record. In common with other branches of the engineering industries, the trade has lost some of its most skilled workers by emigration during the past year or two. Some firms have been but lightly touched in this respect, but at least one—a well-known Scottish firm—has suffered severely. The outlook

in this connection, it has been remarked to us, is very serious and will continue to be so as long as the economic conditions are such that higher wages cannot be paid in the British engineering industry.

Turning to the purely technical side, our impression is that the industry is steadily advancing. In the middle of last century the technique of machine tool design and construction in this country was satisfactory for the needs of the time. Subsequently it appears to have been lost or become less satisfactory. Some time ago we began to regain it, and in most respects have now little to fear from the designers in other countries. The improvement began slowly with the advent of the safety bicycle and the demand for improved tools which its manufacture in large numbers created. The motor car added its influence to the progress. To-day no small amount of impetus is being exerted by the Diesel engine. Among the broad tendencies of the progress being made the chief one, as revealed at Olympia, is undoubtedly the adaptation and development of grinding processes. Grinding, chronologically amongst the earliest methods of working metals, has long occupied a unique position as an accurate finishing process. To-day, however, it is rapidly becoming both a roughing and a finishing process in complete replacement, in many instances, of all machining with a cutting tool. At one end of the scale we have the centreless grinding of small rollers and other cylindrical bodies directly from stock as received. At the other there is the face grinding of large castings in machines having segmental wheels to which a planetary motion is given. As a class grinding machines are more numerous at the Exhibition than any other type of tool, lathes not excepted. Moreover, they are shown to be applicable to a range of work surpassing that within the compass of any other class. In addition to the examples we have just mentioned they are to be found at work machining the bore of aero-engine cylinders, finishing motor car spline shafts, grinding worms and correcting the teeth of gear wheels after case-hardening, by a generating method.

It is also noteworthy as a broad tendency that in spite of the rage for specialisation, machines adaptable to meet a wide range of work as distinct from the restricted duty type of tool seem to be attracting more rather than less attention. The universal machine, fulfilling at will the functions of a lathe, a boring machine, a grinder, a drilling machine, a miller and a gear cutter, continues to be developed by the addition of fresh forms of attachment. Among the grinding machines we find examples arranged to operate at will on external or internal work. The universal milling machine capable of operating vertically, horizontally or at an angle—as for the machining of milling cutters—is, as we have already indicated, being actively developed by, at least, two firms. Again among the radial drilling machines this "universalising" tendency is being perpetuated, for one of this class is to be seen with the saddle arranged to swivel on the arm, whilst the arm, in addition to the ordinary radial motion, is arranged to rotate about a horizontal axis passing through its own length, thus permitting the drill to be presented to the work vertically downwards or upwards or inclined to the vertical plane. Then again, the largest of the planing machines exhibited is of the class in which the power motions fitted are such as to increase the range far beyond that of the ordinary planer. Thus the power traverse of the tool-boxes on the horizontal slide is under such control that what is a mere adjustment in an ordinary machine is converted at will into a cutting stroke, enabling the work to be planed at right angles to the orthodox direction. Furthermore, the vertical traverse of the side boxes on the standards is such that it can serve as a cutting stroke for slotting purposes. It will be gathered, then, that the demand for machines having very wide ranges is far from extinct, and that the prophesied time when all machine tools will be of the single purpose type has not yet arrived. Another well-marked general tendency is the adoption in many classes of machines of the principle of centralised control and of devices or details that will simplify the operator's work and reduce the likelihood of mistakes being made. Some of the boring mills, while they no doubt have a very good measure of centralised control, seem to us to suffer from a superfluity of control handles, and from the fact that the centralisation of these handles has been secured by sacrificing the obviousness of the movements which they control. But that centralised control can be combined with simplicity is amply illustrated among the radial drilling machines, and by the fact that in another type of machine improved centralisation is accompanied by a reduction in the number of control handles from seven to four. In connection with this question of centralised control and simplification of the selecting movements we notice that it is almost a universal custom to describe these features as being provided to relieve the operator of trouble and fatigue. That they do so incidentally is all to the good, but as a principle of design we would prefer to hear the more candid and truer description of them as features designed to reduce mistakes and to make the attainment of increased production and increased accuracy less dependent upon the skill of the operator.

Since the previous Exhibition at Olympia the British machine tool industry has undoubtedly passed through a very trying period, for, in addition to the natural consequences of bad trade throughout the country, it has had to face the depressing effects of the large stocks of machines produced or accumulated in this country during the war. Those stocks have now practically all been absorbed, and if the impressions we have gathered at the Exhibition do not mislead us, there is a general air of hope and buoyancy about the industry and a really surprising feeling of fresh flowing life. More than one maker has told us that clear signs of activity have been noticed within the past few months. No sign could be more welcome to all branches of the engineering industry, for it implies that better times are in store for all. Of one thing we are fully assured: the outlook in the British machine tool trade from the technical point of view is thoroughly healthy. Let the revival of general prosperity come soon or late, British engineers will not find themselves hampered in taking advantage of it by any deficiency on the part of British machine tool designers and constructors.

One Hundred Years of British Railways.

No. XIII.*

PART II.—THE FIRST HALF CENTURY.

THE LONDON AND NORTH-WESTERN.

OUR last issue brought the history of the London and North-Western line up to 1851. That year saw two bad accidents. One happened in the Sutton Tunnel of the Birkenhead, Lancashire and Cheshire Junction—later owned jointly by the London and North-Western and Great Western. A train returning from Chester on April 30th, in connection with Chester Races, broke down in the tunnel and a following train ran into it. Six passengers were killed. On September 6th, at Bicester, on the Buckinghamshire Railway, there was a serious derailment of several carriages of an excursion train and six passengers were killed. The line was single and Bicester was a passing place. The train was one of those run for the Great Exhibition and was returning from Euston to Oxford, and timed to cover the 78 miles in 135 min., including the reversal of the train at Bletchley. It was derailed at the single line facing points owing to excessive speed, but Captain Laffan, the Inspecting Officer, said with reference to the driver, "great excuse must be made for a man in his position, encouraged to make all possible haste, by the evident wish of all parties to conduct the traffic between Oxford and London at the highest attainable speed."

The Shrewsbury and Hereford line was sanctioned by 9 & 10 Vic., c. 325, 1846. It was opened from Shrewsbury to Ludlow on April 26th, 1852, and from Ludlow to Hereford on December 5th, 1853. In the latter year the Great Western unsuccessfully promoted a Bill to compel it to lay down a third rail so as to accommodate the broad-gauge stock. The line continued its independent existence until 1870, when, by 33 & 34 Vic., c. 112, it was leased to the London and North-Western and Great Western jointly.

The Birmingham, Wolverhampton and Stour Valley Railway ran from the Grand Junction at Bushbury through Wolverhampton to Birmingham, and gave direct access to the last named from the North instead of by the somewhat circuitous route taken by the Grand Junction. It was authorised by 9 & 10 Vic., c. 328, 1846, in 1847 was leased to the London and North-Western, and was opened on June 1st, 1852. Its Birmingham terminus was in the present New-street Station—then called Navigation-street—which is entered through the North Tunnel, 760 yards long, and on a gradient falling 1 in 77. Only sufficient of the station was brought into use to accommodate the Stour Valley trains, but the station was opened fully on July 1st, 1854, and then used by London and North-Western trains from London and the North and by Midland trains from Derby and Bristol. The southern approach to the station was made under 9 & 10 Vic., c. 359, 1846. The tunnel at the south end of the station is 266 yards long and the gradient rises towards New-street 1 in 58.

On July 1st, 1852, the Bangor and Carnarvon Railway—14 & 15 Vic., c. 21, 1851—was opened. It began at Menai Bridge Station and had twin tunnels. each 497⅔ yards long, ½ mile west of Treborth Station. It was transferred to the Chester and Holyhead in 1854. On July 1st there was also brought into use the line from Runcorn to Garston, sanctioned by 9 & 10 Vic., c. 183, 1846. This line was part of the St. Helens Canal and Railway, which, by 8 & 9 Vic., c. 117, 1845, amalgamated the Sankey Brook Navigation and St. Helens and Runcorn Gap Railway, mentioned in Article XI. The present docks at Garston formed part of this scheme and they were opened on July 21st, 1853. The St. Helens Company obtained powers by 10 & 11 Vic., c. 271, 1847, to continue the Runcorn-Garston line in an eastwards direction to Warrington, and the new portion was brought into use on February 1st, 1853. The Warrington and Altrincham Junction Railway—14 & 15 Vic., c. 71, 1851—which became the Warrington and Stockport by 16 & 17 Vic., c. 122, 1853—extended this line to Broadheath on November 1st, 1853, and to Timperley, so joining the Manchester South Junction and Altrincham, on May 1st, 1854. The line between Garston and Warrington was leased to the London and North-Western in 1860. The Birstal branch, which leaves the Dewsbury and Leeds line at a point east of Batley, was opened on September 20th, 1852.

Not until June 9th, 1857, was another line opened. On that date there was brought into use the portion between Edgeley Junction, Stockport, and Whaley Bridge of the Stockport, Disley and Whaley Bridge. This line was sanctioned by 17 & 18 Vic., c. 200, 1854, and by 18 & 19 Vic., c. 130, 1855, an extension was authorised so as to join the Cromford and High Peak Railway, and by 20 & 21 Vic., c. 98, 1857, the line was to be continued to Buxton. The extension to the High Peak was opened on August 17th 1857, to Buxton on June 15th, 1864, and in 1866 the property was transferred to the London and North-Western. The line from Whaley Bridge rises for 7 miles on gradients of 1 in 58 and 1 in 70, and then falls into Buxton on 2 miles of 1 in 66. At Disley there is a tunnel 212 yards long and, between Chapel-en-le-Frith and Doveholes, one 431 yards long and one 111 yards long. The summit is 1 mile south of Dove Holes Station and there the line is 1140ft. above Ordnance Datum.

In 1858 four lines were opened:—(1) The South Staffordshire extensions to Cannock and to Norton—17 & 18 Vic., c. 53, 1854, in February; (2) the Watford and St. Albans branch—16 & 17 Vic., c. 161, 1853—on May 5th; (3) the Crewe and Shrewsbury—16 & 17 Vic., c. 216, 1853—on September 2nd; and the Vale of Clwyd from Rhyl to Denbigh, on October 5th. The last-named was absorbed in 1868. The Northampton-Market Harborough—16 & 17 Vic., c. 160, 1853—was brought into use in February, 1859, and the above-mentioned South Staffordshire line to Cannock was extended by the Cannock Mineral Railway—18 & 19 Vic., c. 192, 1855—to Rugeley and joined the Trent Valley Railway on November 7th, 1859.

Mention should here be made of the fact that on February 1st, 1859, the "limited mail" was started. It was only allowed to take three passenger-carrying coaches, one each for Glasgow, Edinburgh, and Perth, but the Postmaster-General was always willing to allow a fourth coach to be added, provided the increased weight did not cause time to be lost in running. In 1864 the fourth coach was added permanently. The train left Euston at 8.30 p.m. and continued to doso until the postal train—wholly of Post Office vehicles—was instituted in 1885. No passes, not even the gold passes of the directors and chief officers, were available by the "limited mail," and when it was imperative that an officer should travel by it he had to pay his fare.

Two lines were opened in 1860. The first was the Hampstead Junction, which ran from the Kentish Town Junction of the North London to Willesden. The terminus at the latter place was in the main line station, as the high-level station was not opened until September, 1867. It was sanctioned by 16 & 17 Vic., c. 222, 1853, as the North and South-Western, Hampstead and City Junction Railway, opened on January 2nd, 1860, and acquired in 1863 by the London and North-Western Railway. The tunnel under Hampstead Heath is 1166 yards long. The junction at Kentish Town was noteworthy in that interlocking of signals to prevent the actuation of conflicting levers was introduced there for the first time. In 1856 Saxby and Farmer had provided a locking device whereby point levers released their respective signal levers, so that the point lever had to be in position before its signal lever could be moved. But Austin Chambers, in December, 1859, provided conflicting as well as sympathetic locking. On this line, just past Kentish Town Junction, there was a serious collision on September 2nd, 1861. A ballast train came out of a siding on to the main line without the signalman's permission and without the trainmen taking any action to protect the movement. An excursion train from Kew ran past the signals and collided with the ballast train. Fourteen passengers and two servants were killed.

The other line opened during 1860 was the first

* No. XII. appeared September 19th.

stage of the Central Wales Railway, which eventually was to run from Craven Arms on the Shrewsbury and Hereford to Llandovery, where it joined the Vale of Towy Railway. The first section—Craven Arms to Knighton—was built by the Knighton—21 & 22 Vic., c. 19, 1858; from Knighton to Llandrindod by the Central Wales—22 & 23 Vic., c. 121, 1859; and from Llandrindod to Llandovery by the Central Wales Extension—23 & 24 Vic., c. 141, 1860. The line was opened as follows:—Craven Arms-Bucknell, October 1st, 1860; Bucknell-Knighton, March 6th, 1861; Knighton-Crossgates, in October, 1864; Crossgates-Llandrindod, October 17th, 1865; Llandrindod-Builth Road, November 1st, 1866; Builth Road-Garth, December 9th, 1866; Garth-Llanwrtyd, May 6th, 1867; and Llanwrtyd-Llandovery, June 1st, 1868. The Knighton was absorbed by the Central Wales in 1853, and the latter and the Central Wales Extension were acquired by the London and North-Western in 1868. A very interesting engineering feat on the line is the Knucklas Viaduct, which has thirteen arches, each of a span of 30ft. West of Builth Road the line crosses the river Wye by a girder bridge with two spans of 100ft. each. Near to Llandovery is a viaduct of eighteen arches of 36ft. span each and 102ft. above the valley. At Knucklas the line, when going west, rises 1 in 60 for 4 miles. At the summit is Llangunlld Tunnel, 637 yards long; east of Penybont is Penybont Tunnel, 402 yards long; and, after leaving Garth, the line rises for nearly 8 miles on gradients varying from 1 in 70 to 1 in 100 to the summit, which is 890ft. above sea level. Here is the Sugar Loaf Tunnel, 1000 yards long. The line then falls 1 in 60 for 5 miles and from 1 in 80 to 1 in 120 for 8 miles to Llandovery.

It was in 1860 that Ramsbottom introduced the water trough. His patent specification was No. 1527 of June 23rd, 1860. The first troughs were fixed on the piece of level road between Llanfairfechan and Aber. In that year also the "Bangor Mail" began to run. The station of Normanton in Yorkshire was, until quite recent years, a very important mail-exchanging place, and mails from Leeds, Bradford, and many parts of Yorkshire were handed into the Newcastle-Bristol and Newcastle-London *viâ* Derby mail and *vice versâ*. A connecting train was the "Bangor Mail," which ran from Normanton over the Lancashire and Yorkshire to Heaton Lodge and thence over the London and North-Western to Bangor *viâ* Huddersfield, Stockport and Crewe. Some years ago Leeds was made an important mail-exchanging place and the "Bangor Mail" was then abandoned. It was a great institution in its day and merits mention here.

Two accidents which occurred during the year 1860 call for attention. The first happened on August 27th near Craven Arms on the Shrewsbury and Hereford. The line at that point was single and was worked to a time-table. On the morning in question traffic was abnormal for two reasons: (1) the running of an excursion train, and (2) the breakdown of a goods train. The locomotive superintendent was with the special, and when he heard of the breakdown he wired to the station-master at Shrewsbury to instruct the trainmen with No. 8 down train to "pass Onibury." The telegram, when handed to the driver, read "pass at Onibury." This down train was shown in the time-table as to pass No. 3 up goods at Church Stretton, and it was assumed that the telegram meant that the train was to pass No. 3 at Onibury instead of at Church Stretton, so the men ran through the latter station and when approaching Craven Arms met the goods train. One passenger was killed, and it was fortunate that the results were not much more serious. In the other accident the up Irish night mail overtook and ran into a cattle train at Atherstone on November 16th. The fireman of the pilot engine of the mail and nine drovers in the cattle train were killed.

By 19 & 20 Vic., c. 132, 1856, the Shrewsbury and Welshpool Company was authorised to build a line from Shrewsbury to join Oswestry and Newtown at Buttington, together with a branch from Hanwood to Minsterley. The branch was ready first and was opened on June 1st, 1861; the main line was completed on January 27th, 1862. The London and North-Western worked the line, but in 1864 it was transferred to that company and the Great Western jointly.

A railway with a very interesting history is the Ingleton branch of the Lancaster and Carlisle. The North-Western Railway which ran from Skipton to Morecambe, and was generally known as the "Little North-Western," had a branch from its Green Ayre Station in Lancaster to the Castle Station of the Lancaster and Carlisle, which was opened on December 19th, 1849. The North-Western had powers also to make a branch from Clapham to the Lancaster and Carlisle at Orton near Tebay. It was only constructed through to Ingleton and under 20 & 21 Vic., c. 151, 1857, the latter company was given authority to complete the work, but by 21 & 22 Vic., c. 178, the proposed line was shortened and the junction was made at Low Gill and opened on October 1st, 1861. When on two occasions later, as will be recorded in the articles on the Midland Railway, it was proposed that the Midland should run over the Lancaster and Carlisle instead of having its own line from Settle to Carlisle, the usefulness of this branch was much in evidence. It has, however, never reached the importance that was expected of it, and it is only when the Settle and Carlisle is blocked by snow or accident that traffic is promptly and conveniently diverted *viâ* Ingleton. During a couple of summers before the war a train from and to Leeds and Bradford journeyed that way, but mainly in order to connect with Keswick at Penrith.

In 1861, by 24 & 25 Vic., c. 166, the Carlisle Citadel Station Joint Committee was formed to administer the interests of the owning companies—the Lancaster and Carlisle and the Caledonian—and of their tenants—the Maryport and Carlisle, Glasgow and South-Western, and North British. The North-Eastern had not then used the Citadel Station, but did so in 1863.

None of the railways hitherto mentioned as having steep gradients can equal in that respect the Merthyr, Tredegar and Abergavenny, which was sanctioned by 22 & 23 Vic., c. 59, 1859, and which was acquired by the London and North-Western in 1865. The ascent begins soon after leaving Brecon-road Station, Abergavenny, and in less than 9 miles the road rises 1140ft., the gradient generally being 1 in 38. West of Clydach Station there are twin tunnels 308 and 340 yards long respectively, and about a mile further west one 368 yards long. The line was opened as follows:—Abergavenny-Brynmawr, September 29th, 1862; Brynmawr-Nantybwch, March 1st, 1864; Nantybwch-Tredegar and junction with the Sirhowy Railway, November 1st, 1866; branch from Brynmawr to Blaenavon, January 1st, 1870; Ebbw Vale branch, September, 1871; Nantybwch-Rhymney, September, 1871; and Rhymney Bridge-Dowlais, January 1st, 1873. The Sirhowy Railway was one of the pre-Stockton and Darlington railways. It was sanctioned in 1802 and ran from Nine Mile Point, Newport, to Sirhowy. It was modernised under 23 & 24 Vic., c. 71, 1860, and in 1876 was acquired by the London and North-Western.

Five short lines were opened in 1862:—(1) The Nuneaton-Hinckley section of the South Leicestershire, authorised as the Nuneaton and Hinckley by 22 & 23 Vic., c. 104, 1859, and by 23 & 24 Vic., c. 91, 1860, changed to South Leicestershire. It was opened on January 1st, 1862, and was extended to the Midland main line at Wigston, whence access to Leicester was effected on January 1st, 1864; (2) the line of the Denbigh, Ruthin and Corwen—23 & 24 Vic., c. 144, 1860—from the Vale of Clwyd at Denbigh to Ruthin, on March 1st, which line was extended to Corwen on the Llangollen and Corwen on September 22nd, 1864; (3) the Aston and Sutton Coldfield branch—22 & 23 Vic., c. 88, 1859—on June 2nd; (4) the Bedford and Cambridge, sanctioned by 23 & 24 Vic., c. 183, 1860, to build a line between the points named, on August 1st; (5) the Watford and Rickmansworth—23 & 24 Vic., c. 111, 1860—on October 1st. None of these lines possess any special engineering features, unless it be the severe gradients of the Denbigh, Ruthin and Corwen. The South Leicestershire was acquired in 1867, the Denbigh, Ruthin and Corwen in 1879, the Bedford and Cambridge in 1864, and the Watford and Rickmansworth in 1891, all by the London and North-Western.

An event of interest to the public and to railways was the agreement made on March 13th, 1862, between the London and North-Western and the Lancashire and Yorkshire companies as to the pooling and division of the receipts from competitive traffic. These two companies competed at many points in Lancashire and the West Riding, and they were among the first of the principal companies to take this step. The agreement took effect from January 1st, 1862, and held for fourteen years. It was renewed from time to time, was considerably strengthened in the late 'nineties, and then, in 1904, came a working agreement which led in 1908 to similar relations between the London and North-Western and the Midland, and in 1909 to the tripartite agreement between those two companies and the Lancashire and Yorkshire.

Another event of 1862, and of a more national character, was the run made from Holyhead to Euston with only one stop—Stafford—on January 7th, bearing the Queen's Messenger with dispatches for Lord Lyons, the British Ambassador to the United States Government, on the "Trent affair." These dispatches were anxiously awaited, and when the Cunard ss. Europa was due a special train was waiting at Cork to convey the Messenger to Kingstown, whence he crossed by a City of Dublin steamer to Holyhead and thence was conveyed to London. The train consisted of three four-wheeled coaches and, drawn by No. 229 of the "Lady of the Lake" class, ran to Stafford, 130½ miles, in 2 h. 24 min., or at an average speed of 51.3 miles per hour. A stop of 1½ min. was made at Stafford to change engines, and, with No. 372 of the "Bloomer" class, the run of 133½ miles to Euston was made in 2 h. 19½ min., or at 57.3 miles per hour. The non-stop run to Stafford was made possible by the water trough at Aber, already mentioned as having been laid down in 1860.

Yet another event of interest was the establishment of the 10 a.m. from Euston. That train began to run in June, 1862, and for 54½ years thereafter, on every weekday except during the railway strike of 1911 and the coal strike of 1912, it left at the hour named. The restrictions on travel imposed as from January 1st, 1917, spoilt this record, as the departure time was altered to 9.30 a.m.

The Conway and Llanwrst Railway was sanctioned by 23 & 24 Vic., c. 149, 1860, was opened on June 17th, 1863, and in the latter year was transferred to the London and North-Western Company. An extension to Bettws-y-coed was sanctioned and brought into use on April 6th, 1868.

An alternative route between Liverpool and Manchester became available on February 15th, 1864, when the Edge Hill-Garston line was opened. A yet more valuable connection was that, opened on August 1st, 1864, between Winwick and Golborne, which allowed the main line to the North to proceed direct from north of Warrington to south of Wigan without going through Earlestown and fouling the Liverpool-Manchester lines. The new lines cross over the latter. Yet another improvement of the same character and in the same district was the line, opened on September 1st, 1864, from Eccles on the Liverpool and Manchester to Springs Branch Junction, Wigan. On October 16th, 1864, a branch from Bare Lane to Morecambe was brought into use. It ran into the Midland station at Morecambe.

In 1863, by 26 & 27 Vic., c. 128, the Anglesey Central was sanctioned. It ran from Gaerwen on the Chester and Holyhead to Amlwch on the northern shore of Anglesey. It was opened to Llangefni in March, 1865, to Llanerchymedd on February 1st, 1866, and to Amlwch on June 3rd, 1867. The gradients on this line are fairly severe, for there are several stretches of 1 in 65, 1 in 66, and 1 in 77. The Anglesey Central became part of the London and North-Western in 1876. Another railway in North Wales was the Carnarvonshire, which, under 25 & 26 Vic., c. 202, 1862, runs from the Bangor and Carnarvon at the latter place to the Aberystwyth and Welsh Coast Railway—later the Cambrian—at Afon Wen. Under 30 & 31 Vic., c. 152, 1867, the Carnarvonshire absorbed the Nantlle—a railway, authorised in 1825 by 6 Geo. IV., c. 63, which ran from Gloddfarlon slate quarries to the quay at Carnarvon—and connected it up at Penygroes. The Carnarvonshire abounds in curves and has some steep gradients—1½ mile of 1 in 49 and sundry lengths of 1 in 50, 1 in 51, and several of 1 in 60. The main section was opened throughout on September 2nd, 1867, and the Nantlle branch was modernised and reopened on October 1st, 1872. The Carnarvonshire was acquired by the London and North-Western in 1870. The Wolverton-Newport Pagnell line of the Newport Pagnell Railway—26 & 27 Vic., c. 110, 1863—was also opened on September 2nd, 1867, and the line was acquired by the London and North-Western in 1875. The Hillhouse-Kirkburton branch was opened on the 8th of the following month (October).

The year 1868 saw only one new line opened—the branch from Sandbach to Northwich, on July 1st, 1868. That year was, however, eventful because of the Abergele disaster of August 20th. This was one of the most horrible railway accidents that have occurred in this country. The last three vehicles of a goods train engaged in shunting at Llysfaen lime sidings, just east of Llandulas Station, were a brake van and two wagons containing together fifty casks of paraffin. These and four other wagons were left standing on the down line, which rises from 1 in 100 to 1 in 147, whilst shunting was done with the rest of the train. Two trucks laden with timber were then fly-shunted against the standing wagons, which, although the brakes were on in the van, ran back and met the down day Irish mail. The engine, tender, guard's van and three front coaches appeared to have been enveloped in dense smoke and flames instantly after the collision, and the fourth carriage and the front of the Post Office van were involved a few moments afterwards. The fireman and 32 passengers were killed. The block system was not in force, but there was a rule, the breach of which mainly led to the disaster. It was that there should be no shunting within ten minutes of the time when a passenger train was due. The report was very critical of some of the arrangements on the London and North-Western Railway, but Colonel Rich said he believed "that their line is one of the best in this country and that its general management and arrangements are as good, on the whole, as those of any of the other lines."

Two railways in North Wales were opened in 1869. The Carnarvon and Llanberis was sanctioned by 27 & 28 Vic., c. 186, 1864, opened on July 1st, and, under the act of incorporation vested in the London and North-Western. The Mold and Denbigh was an extension of the Chester and Mold Railway, which had been opened in September, 1849. The extension was brought into use on September 6th, 1869. The Mold and Denbigh retained its independent existence until 1922. On January 1st, 1870, the Lancashire Union lines were opened. They ran from Cherry Tree, near Blackburn, to Chorley, from Adlington to Boar's Head, near Wigan, and from Haigh Junction on the latter line, through Whelley Junction, Amberswood Junction, and Ince Moss Junction to St. Helens. In March, 1870, a junction was put in at Acton to run to the Cheshire Lines Committee's railway to Northwich. A line in the Liverpool suburban area was opened on July 1st. It ran from Edge Hill in a north-westerly direction to Bootle and thence to Canada Dock. At Bootle a junction was made with the Liverpool-Southport line of the Lancashire and Yorkshire. It gave the London and North-Western access to Southport and allowed through carriages to be run between that town and London.

The second half of the year 1870 saw three serious

accidents on the London and North-Western. The first occurred at St. Nicholas crossing, Carlisle, where the Lancaster and Carlisle crossed on the level the goods lines of the North-Eastern leading to the Maryport and Carlisle and the North British. All signals were at "clear" for the up mail, but when it was passing over the level crossing the sixth and seventh coaches were struck by a North-Eastern goods train. Five passengers were killed. The fireman who had taken charge of the engine over-ran the crossing signals. In the re-arrangement of the station necessitated by the opening of the Settle and Carlisle line of the Midland in 1875 this crossing was dispensed with.

The second accident was that which happened at Tamworth to the up night Irish mail on September 14th. This train was, in error, turned off the up through line into the up platform line. The signalman thought it was a light engine and had his distant and intermediate signals at "clear," as also the junction signal to the platform line. The two former evidently misled the driver of the mail, who had only 608 yards view of the junction signal. He could not pull up in time, but ran into the buffer stops and thence into the river Anker. Both enginemen and one passenger were killed.

The third accident happened on November 26th at Harrow, and was due to the 5 p.m. express from Euston to Manchester and Liverpool running into a train of empty wagons. The passenger train had an assisting engine, and its driver and seven passengers were killed. A fog prevailed and the passenger train was not run with the care such conditions called for, and so over-ran the signals that protected the empty wagon train. The latter had been delayed owing to the breaking of a coupling.

Until the first day of 1872 passengers between Liverpool and St. Helens had to travel *viâ* St. Helens Junction, but by the opening on January 1st of the Huyton and St. Helens line direct communication between the two towns was given. Of perhaps equal importance was the fact that the line also shortened the distance to Wigan and improved the service from Lime-street, Liverpool, to the North. On October 2nd of the same year the line from Whitchurch, on the Crewe and Shrewsbury, to Tattenhall on the Crewe and Chester, was opened. It provided a route between Shrewsbury and Chester competitive with the Great Western.

The year 1873 was somewhat eventful. On January 1st a short line from Allerton to Garston was opened, and on May 1st the line between Frodsham and Runcorn. The latter included the viaduct over the river Mersey—three spans of 305ft. each—and gave a quick route between Liverpool and Chester. On May 1st a steamship service between Holyhead and Greenore, together with the Greenore-Dundalk Railway, was brought into use. The Ashby and Nuneaton Railway, jointly owned with the Midland, was opened on September 1st, and on October 1st the first sleeping carriage ran between Euston and Glasgow. It was put on the "limited mail" and ran three nights a week in each direction. On February 1st, 1874, a second carriage was provided and the service was then run nightly.

Two important Acts were obtained during the year. One—36 & 37 Vic., c. 225—gave powers for the improvement and enlargement of the old harbour at Holyhead. The other—36 & 37 Vic., c. 187—gave powers to enlarge the Citadel Station, Carlisle, to provide independent lines for goods traffic and to erect other works in anticipation of the opening of the Settle and Carlisle line of the Midland.

A very serious accident occurred at Wigan to the down "Tourist Express" on August 2nd. The rear portion of the train was very badly derailed and ten passengers were killed. The accident was inquired into by Captain—afterwards Sir Henry—Tyler, who dismissed the idea that the facing points at which the derailment occurred were moved under the train, and concluded that the oscillation set up by the excessive speed was responsible. In this conclusion the Inspecting Officer was aided by the fact that the wheel base of the coaches was so short that it was practically impossible for the signalman to move the points between the wheels. The inquiry was, however, in a sense reopened in June, 1875, when the executors of one of the passengers who were killed sued the railway company, and evidence was then given that the signalman was anxious to deal with a train for Stalybridge as soon as the express had passed. The former train would have to go into the loop, and it was suggested that in his anxiety he restored the signal for the "Tourist" before it had passed and then unconsciously opened the points. The jury would seem to have been impressed by this opinion, as they returned a verdict against the company.

The only event to be noted in relation to the year 1874 is that the Harborne branch was opened on August 10th. It was constructed by a private company under 29 & 30 Vic., c. 101, 1866, and was worked by the London and North-Western Company. It retained its independence until 1922.

WITH the reduction in the number of night expresses by the West Coast route now that the holiday traffic is over, the sleeping car train to Stranraer for the North of Ireland is again departing from Euston and not from St. Pancras.

The Boxer Indemnity.

(*From a Correspondent in China.*)

MOST of the Powers concerned have now agreed to remit the Boxer Indemnity to the Chinese Government under certain conditions. The American Government has decided to apply its share to educational purposes in China, but no definite arrangement has yet been made by the British Government. There is a very strong feeling amongst the British community resident in China that the remaining British share should be applied to purposes other than education, and it is known that several branches of the British Chambers of Commerce in this country are in favour of this money being used for railway construction. Quite apart from any feeling as to the advisability or otherwise of education of the Chinese on Western lines it is a fact that the communications are urgently needed, and in the present unsettled conditions of the country there can be little hope of the Chinese Government being able to raise money for railway construction by means of foreign loans.

The outstanding Indemnity, which, with accrued interest would amount to about £11,000,000, would be sufficient for the construction and equipment of about 1000 miles of railways in China. The work would provide employment for thousands of Chinese labourers and would necessitate large sums of money being spent in Great Britain for the necessary material.

Various suggestions have been made as to the terms under which such a scheme should be carried into effect. No one contemplates handing this large sum of money over to the Chinese Government under a promise to build railways, because not a penny would ever be used for such purposes. The most practical method would appear to be to let the Chinese Government decide on the location of the railways and then to construct them under the supervision of British engineers. When the lines had been completed they would be taken over by the Chinese Government subject to the retention of the necessary British engineers and accountants, who should have complete control over expenditure for a definite number of years. Such safeguards are absolutely essential whilst the military element is in control of the country. Railways properly administered pay handsomely in China, and it is fairly safe to predict a return of at least 10 per cent. on such railways. They would eventually yield, say, £1,000,000 per annum profit, and to satisfy the Chinese idea of utilising these funds for education, a portion of the profits could be devoted to that purpose; a portion handed over to the Chinese Government; and the balance used for construction of additional railways. That the amount to be used for educational purposes should be reduced to the lowest possible minimum is undoubtedly in accordance with British opinion in China. A certain amount of good can be done in technical education, but it should be done in China. The number of students sent abroad should be limited to a very few picked men, so that employment could be found for them on their return to their native country.

In the debate prior to the second reading of the China Indemnity Application Bill in the House of Commons on June 16th, some curious remarks were expressed on the terms under which this money should be remitted, and it is a great pity that so little light was thrown on actual conditions in China to-day. It is not possible to compare the position of Great Britain with the other Powers, particularly America, in this matter, one reason being that Britain was the only nation that put in a claim for actual losses.

The ordinary Chinese student who has received his education abroad is not the trade emissary that one would suppose. If he has been sent abroad by an organisation, such as a railway, and is immediately given a post on his return, his education is a good investment so long as he does not aspire to the highest posts. The temptation, however, is for him to go into politics immediately on his return, because, with political influence, he is able to get the big highly paid jobs. The ordinary student who is sent abroad by the Government invariably drifts into politics on his return for the same reason, and his foreign education is of little value to him except that he obtains a slight knowledge of a foreign language and generally picks up some of the evils of a foreign country. The Chinese who have been educated on Western lines, either in China or in a foreign country, are not exactly a credit to this country. They generally constitute the anti-foreign element—which exists in an alarming degree to-day—but what have they done for their own country?

It must not be supposed that the advocates of railway and industrial expansion are enemies to education; on the contrary, they are its supporters, but sound development must proceed in more than one direction. While it is accepted that the value of education is axiomatic, to regard it as the only or even the most important factor in the country's development is economic heresy. It must proceed *pari passu* with economic and industrial development.

With a Labour Government in office in Great Britain it is difficult to understand its even contemplating spending £400,000 per annum on educating Chinese when there are over 1,000,000 unemployed persons, and British factories crying out for orders.

Here we understand that it is the intention of the British Government to utilise these funds "for purposes mutually beneficial to China and Great Britain." If that be the case there can be no question as to which scheme should be selected. It is up to the engineering firms in Great Britain to take a firm stand in this matter and insist upon consideration at least being given to a scheme other than education. In that they will undoubtedly have the full support of many, if not all, of the British Chambers of Commerce in China.

Electrification of British Main Line Railways.

AN interesting presentation of the case for the electrification of main lines on British railways was made by Lieut.-Colonel E. O'Brien before a meeting of the Institution of Locomotive Engineers at the Engineers' Club last night (Thursday).

The author said that to make the comparison of steam and electric operation as clear as possible, he had divided the costs under two main heads. In the case of steam operation he had taken:—(1) The cost of energy, *i.e.*, of coal delivered to the locomotive running shed; (2) the costs of maintenance and operation, including repairs, cleaning, drivers' and firemen's wages, lubricants, water, stores. The cost of the operation of the same services by electric locomotives was similarly considered under two heads:—(1) Cost of current delivered to the locomotive, including all losses in transmission and conversion, and the mechanical and electrical deficiency of the locomotive itself, and also including all fixed and maintenance charges on the plant necessary for transmission of current from the generating station to the current collector of the locomotive; (2) the cost of maintenance and operation on exactly analogous lines to those of the steam services. The results of British suburban electrification operation showed that the cost of maintenance of the electrical and the mechanical portions of the rolling stock was less than the average cost for analogous charges per steam engine mile for a whole main line system, and that the cost of electric operation would be very much less than that of a steam service run at the same speed and frequency as the electric services. As the duty imposed on the electrical and mechanical equipment of rolling stock for suburban services was much more severe than that imposed on an electric locomotive for main line work, it would follow, even were no other data available, that the cost of repairs of main line electric locomotives would be substantially less than the analogous cost for steam locomotives. The average mileage per annum run by the equipment of a suburban electric train was also more than double that run by the average steam locomotive. But it was now known by evidence from electrified portions of main lines in America, France, Great Britain and elsewhere, that not only was the electric locomotive capable of double the mileage per annum of the steam locomotive, but also that the costs of repairs per electric engine mile were from one-third to one-seventh that of the repairs per steam engine mile. It was also known that the progress of electric locomotive design had been such in recent years that the electric locomotive was superior as a tractor in every respect to the steam locomotive, and could be constructed within the British loading gauge to give double the drawbar horse-power of the most powerful steam locomotive and yet without exceeding the weight per foot run necessary for traversing the bridges on any main line in Great Britain. Excluding the cost of fuel in the case of steam or of energy in the case of electricity, the very large economy of about 10d. per engine mile should be effected by substituting the electric for the steam locomotive. If this economy were not modified by other factors it would represent a very large annual increase in net revenue if applied to the whole of the British railways. The engine miles per annum in Great Britain on standard gauge railways were 504,916,311 in 1922. An economy of 10d. per mile represented approximately £21,000,000 per annum.

One modifying factor was the cost of siding electrification; but of much more importance was the density of traffic. On this density expressed in ton-miles per track mile per annum depended the cost of electrical energy supplied to the electric locomotive. The density of traffic was calculated by dividing ton-mileage per annum by the number of single track miles of the railway. This gave an expression of ton-miles per track mile per annum, and these ton-miles based on weight of trains and load behind the drawbar were termed the trailing ton-mile which he had taken as a basis.

STRONG CASE FOR CONVERSION.

The cost of the track equipment and the cost of electrical energy were also factors which affected the net economy to be realised.

If the cost of electrical energy could be reduced so that the cost of electricity per electric engine mile was no higher than the cost of fuel per steam engine mile the ultimate electrification of the bigger part

of the British railway mileage would be practically assured. A curve had been drawn which should show that at a traffic density of about 2,300,000 trailing ton-miles per track mile per annum the locomotive costs of operation by electricity were about the same as by steam. This density was, however much exceeded by the density on most of the more heavily trafficked systems of Great Britain now amalgamated. If his very conservative figures were correct the five largest railway systems in Great Britain prior to the amalgamations all had sufficient average densities of traffic to warrant the electrification of the whole system. The density on the main line arteries of traffic on these systems must obviously be much greater than the average for the whole system, which included many branch lines with sparse and light traffic; it was probably capable of proof that the ton-miles per track mile density on the four-track main lines radiating from London was at least 5,000,000 to 6,000,000 trailing ton-miles per track mile per annum, and the consequent net increase in revenue per engine mile for an area extending about 150 miles from London would be at least 5d. per engine mile.

To obtain a basis for cost of current in relation to density of traffic the train services on a typical 100 miles of route of double track main line had been examined. The amount of current required had been estimated on the basis of 30-watt hours per ton-mile; the calculated load factor of the supply being approximately 50 per cent. A careful estimate of the total ton mileage per annum combined with the known engine mileage indicated an average weight of train hauled of 250 tons, which seemed to be representative of the average traffic of a large railway system. The average weight of electric locomotive required for such an average weight of train had been taken empirically at 70 tons.

The cost of replacement of the steam locomotives by electric locomotives did not affect the question of capital expenditure, as an electric locomotive could easily perform six times the mileage per annum of a steam locomotive, but the ratio of cost of an electric locomotive and of a steam locomotive capable of equal duty was only 1.7/1; if the engine workings could, therefore, be so arranged as to provide only 1.7 times the annual mileage of the steam locomotive for the electric locomotive the cost of the change should be borne by the renewal fund or from revenue and without diminishing the new revenue of the railway.

It seemed probable from the above considerations that the electrification of the main lines deserved rather closer investigation and more attention than had hitherto been accorded to it. Most other countries, with far lower density of traffic on their railways than obtained in Great Britain, were making rapid progress with electrification, and happily were placing orders for a considerable proportion of the plant required in this country or to British designs.

SAVINGS IN OPERATING COSTS.

He had confined himself strictly to economies obtainable in regard to locomotive operation only, but it must not be forgotten that other economies less easily convertible to a definite money value, would accrue, arising from:—(*a*) Elimination of necessity for bridge renewals to meet the heavy weights of steam locomotives; (*b*) reduction of wagon stock due to quicker wagon movement and elimination of locomotive coal traffic; (*c*) reduction in painting of rolling stock, stations and structures; (*d*) reduced wear and tear of permanent way due to absence of reciprocating parts on locomotives and lighter axle loads; (*e*) reduction in total expenditure on goods guards due to quicker movement of stock; (*f*) increased capacity of terminals and stations due to elimination of engine movements; (*g*) increase in capacity of line due to equalisation of freight and passenger train speeds; to heavier freight trains being haulable; to higher speeds on up gradients, and to the elimination of engine duties.

Literature.

Der elektrische Zugbetrieb der Deutschen Reichsbahn. By WILHELM WECHMANN. Publisher: R. Otto Mittelbach (Rom Verlag). Berlin: Charlottenburg 5. Price £3 10s.

ALTHOUGH railway electrification is a subject upon which innumerable books and papers have been written, there is no question that this new and extensive volume, which deals with the work that has been carried out in Germany, will be read with interest by a large number of railway and electrical engineers. Continental practice does not, of course, conform entirely with British practice, but that does not imply that we in this country can afford to ignore all that has been done abroad.

The system which is adopted does not alter all the details of an electrified line. Methods of supporting overhead contact wires and transmission lines, for instance, are not affected by the particular kind of current that is used for propelling the trains. A book which contains so much detail as the one now before us must of necessity appeal to those who are in any way interested in the electrification of railways, and especially main line railways. It gives a comprehensive account of the construction and operation of the German electric railways up to 1924, and its twelve sections have been written by specialists who are connected with the various parts of the German State Railway system.

The ground covered includes, among other things, the economic reasons for electrification, the early electrification schemes, steam and water power stations, the sources of power in Württemberg and their use for electrification purposes, overhead transmission lines, the 110-kilowatt distribution system in South Germany, details of masts and insulators, transformers, switchgear, overhead traction lines, and methods of supporting them over as many as sixteen tracks, methods of erecting overhead wires without stopping the traffic, maintenance of overhead lines, safety precautions, the choice of electric locomotives for given outputs, mechanical methods of driving electric locomotives, modern express and goods locomotives, electric train heating, dynamometer cars, locomotive sheds and their design, &c.

Incidentally, some information is given relating to the application of Lentz gear to electric locomotives, a scheme which some have predicted will ultimately enable electric locomotives to be operated with constant-speed motors. Another branch of the subject to which considerable attention is paid is that of overcoming telephone troubles, resulting from the use of alternating current. Although for the most part the book deals with alternating-current traction considerable attention is paid in the latter part of the volume to the direct-current system as used on some of the urban and interurban railways.

Perhaps the most praiseworthy point about the book is that it is thoroughly practical. Its main drawback from the English engineer's point of view is that it is printed in the German language. A great deal can, however, be learnt from the drawings, diagrams of connections, and other pictures. In all there are 662 illustrations and 462 pages.

SHORT NOTICES.

1700 *Miles in Open Boats.* By Cecil Foster. London: Martin Hopkinson and Co., Limited. 1924. Price 10s. 6d. —In this volume Captain Cecil Foster describes the voyages of the two lifeboats which left the ill-fated Trevessa, of the Hain Steamship Company, when she sank in mid-ocean on June 4th, 1923, and arrived at Rodriguez and Mauritius on June 26th and 29th respectively. Captain Foster commanded one of the boats and First Officer James Stewart Smith the other. In the first, or No. 1, boat there were in all twenty men; in the second, or No. 3, boat, there were twenty-four men. The boats carried the ordinary provisions prescribed by the Board of Trade, sufficient indeed for a day or two, but far too little for the long voyage which the captain decided to make. How he eked out the supplies of ship's biscuits and tinned milk, how he caught rain water whenever he could, how matches were economised, but how, above all, he maintained discipline and even cheerfulness in an exhausted and emaciated crew, and brought them safely to land with the loss of relatively few hands, is told in his own log and that of Chief Officer Smith, extended by many notes compiled from memory, refreshed by conversation with the crews of the two little vessels. Here we have an epic of the sea, told in simple language, with no attempt at high writing, and depending for its effect simply upon the statement of undecorated facts. It is a wonderful book, a book for everyone to read, a book of which it is safe to prophesy that years hence, when the loss of the Trevessa is forgotten, it will be read and read again by all who love a stirring narrative and who are moved by the conquest of man over the adversities of the sea. Our admiration for British seamanship is increased a hundred-fold when we read this story of splendid endurance and final triumph. Of technicalities there are but few in the volume, and it does nothing whatever to clear up the mystery of why the Trevessa, a well-found ship, sank. All that can be said is that No. 1 hold filled rapidly with water, that that water for some reason or another failed to find access to the sumps, and that the pumps therefore, which might have saved the vessel, were useless. The cargo was zinc concentrates. Whether as the result of the accident a different method of stowing these concentrates from that which has obtained for many years will be found desirable, we cannot say. For the moment we are far more interested in Captain Foster's volume as an addition to the glorious history of the sea than in any technical consideration it may raise. It is a book for everyone, boy and man, girl and woman, to read.

SIXTY YEARS AGO.

IN our issue of September 30th, 1864, we recorded that a Mr. M'Laine, a Belfast naval architect, had submitted to the Admiralty a "bold and revolutionary" scheme for the construction of warships. The main feature of Mr. M'Laine's scheme lay in the abandonment of broadside guns and revolving turrets, and the substitution of fore and aft guns "to fire only on the line of the keel." A ship thus armed would present to the enemy a target only a fifth of the extent presented by her length. Moreover, the scheme, it was held, would permit the guns carried to be enormously increased in weight. It was proposed that the "captain of the gun" should retain control over its elevation, but that it should be pointed by the steersman of the vessel. To facilitate bringing the guns to bear, the ship was to be fitted with twin screws, and farther to help towards rapidity of turning, a centrifugal pump was to be fitted at the bow to act as a supplementary motor. In its main principle, Mr. M'Laine's idea is to be seen applied to-day in connection with the discharge of torpedoes from submarines, and with the firing of automatic guns through the tractor screws of aeroplanes. . . . In a note elsewhere in the same issue we gave some particulars of the Clyde shipbuilding industry. There were at the date thirty-one shipbuilding yards on the Clyde, thirteen of which had been established since 1860. Ninety vessels were on the stocks, representing a total of about 70,000 tons, which, with some forty steamers in course of being fitted out or prepared for sea, gave a total of 130 vessels in hand, with an aggregate burden of about 100,000 tons. During the preceding nine months 150 steamers, with a total of 117,000 tons, had been launched on the Clyde. It is interesting to note that during the past eight months of the current year the Clyde yards have launched almost exactly the same number of vessels, 148, although the total tonnage was nearly three times as great, 330,885. . . . In another paragraph we recorded that an iron floating dock, built at Glasgow and taken out to Java, had sunk upon the first occasion of its being used. Persevering efforts were made to salve it, the final scheme tried being to drive the centrifugal pumps attached to the dock by chain from the shaft of a small steamer moored above. Partial success attended these efforts, but they had finally to be abandoned because the small steamer capsized and sank on top of the dock.

MACHINERY FOR SOUTH AFRICAN COTTON.

SOUTH AFRICAN engineering firms are making a strong bid for the business that will result from the development of the cotton growing industry. A large Johannesburg firm has just constructed a cotton press "tramper," which is used for "tramping" the cotton down into the press. In American plants this work is performed by steam pressure, but steam not being available at Rustenburg (Transvaal Province), where the plant in question is now in successful operation, an alternative device, electrically driven, was designed and built by the engineering firm.

The rate at which the demand for cotton machinery in the way of ginneries, &c., is increasing can be gauged from the following figures, giving the quantities of cotton lint produced yearly:—1910–11, 13,623 lb.; 1914–15, 215,990 lb.; 1918–19, 764,584 lb.; 1919–20, 1,094,763 lb. 1921–22, 1,096,182 lb.; 1922–23, 2,609,068 lb.

The quantity of seed produced in 1922–23 was 5,509,544 lb., linters 64,389 lb. For the 1923–24 season the quantity is estimated at 7000 bales of lint at 500 lb. per bale, or 3,500,000 lb. But for the drought in some parts and locust ravages in others the crop would have been at least half a million pounds more. So large is the additional acreage being broken for sowing cotton at present that it is estimated that, making full allowance for vagaries of the weather and other drawbacks, next season's crop should be not less than 10,000 bales. Within the next twenty years, Mr. Keatinge, the Empire cotton growing expert, who has recently been on an extensive tour through the Union, estimates, as the result of what he saw and the enterprises which are under way, that there should be an annual crop of 500,000 bales. Rhodesia is also going in for cotton growing on a big scale. Following last season's successful experiment, when approximately 3000 acres were estimated to produce nearly 1200 bales valued at £35,000, it is calculated that between 50,000 and 70,000 acres will be planted to cotton next season. It is obvious therefore that the demand for machinery will be on a very large scale.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

EDUCATION AND TRAINING OF ENGINEERS.

SIR,—Your timely article on the above subject will, I trust, induce some representative body to convene a conference such as you outline.

In studying the various courses offered by our universities and technical colleges, I have frequently been struck with the entire lack of any co-ordinating influence in the engineering training offered by such institutions. The different standards of education and length of training demanded by engineering firms also provide convincing evidence of this lack of uniformity.

If the outcome of such a conference as you foreshadow were the formation of a representative committee to inquire into, and make suggestions in connection with, the possibility of co-ordination of engineering training on a more comprehensive basis than obtains to-day, its existence would be thoroughly justified.

Another question which should claim the attention of such a conference is the absolute need in the training of an engineer for a knowledge of the human as well as of the mechanical machine. You mention mass production as being one of the factors which has brought about a need for change in engineering training. Although the technical side of an engineer's training plays a great part in the introduction of mass production methods, the majority of problems involved come under the category of a new science which has been termed "humanics." To this side of an engineer's training it would seem that more and more attention will need to be paid in the future.

C. HASLETT,
Editor, *Woman Engineer.*

London, September 24th.

ALUMINIUM BRONZE.

SIR,—In your leading article on "Aluminium Bronze," in your issue of the 19th inst., you state that "at the present time there is no British firm producing these aluminium bronze alloys as a regular part of its output." May we point out that this is not quite correct, as this firm produces for certain of its regular customers cold rolled aluminium bronze strip of the "straight" alloys of copper to which you refer, viz., with 8 or 10 per cent. of aluminium.

THOMAS BOLTON AND SONS, LTD.,
H. C. ANSTEY, Local Director.

Froghall, North Staffordshire, September 23rd.

Machine Tool and Engineering Exhibition at Olympia.

No. IV.*

B. AND S. MASSEY, LIMITED.

Forging Machine.—A wide range of power hammers and kindred machinery is to be seen on the stand of B. and S. Massey, Limited, Manchester, severa' of the exhibits embracing features which have not hitherto been shown. This remark applies particularly to a model of a newly invented forging machine which embodies the qualities of both the hammer and the hydraulic press. We have had an opportunity of witnessing the first of these machines in actual operation at the builders' works and were impressed by the ingenuity displayed in its construction and its silence in action. An illustration of the actual machine is given in Fig. 50. It consists essentially of a hollow ram containing a piston worked from a crank at the top of the machine, the reciprocating motion of the piston being communicated to the ram through oil contained in the cylinder. The crank is provided with a heavy fly-wheel driven by a belt, but for the latter a motor mounted on the machine itself can be substituted. The crank revolves at about 120 revolutions per minute, and the reciprocating movement of the ram is about 2½in. The position of the ram can be varied at will by means of a valve which allows the oil to flow from one side of the piston to the other; in other words, the distance between the palletts, when the ram is at the bottom of the stroke, is

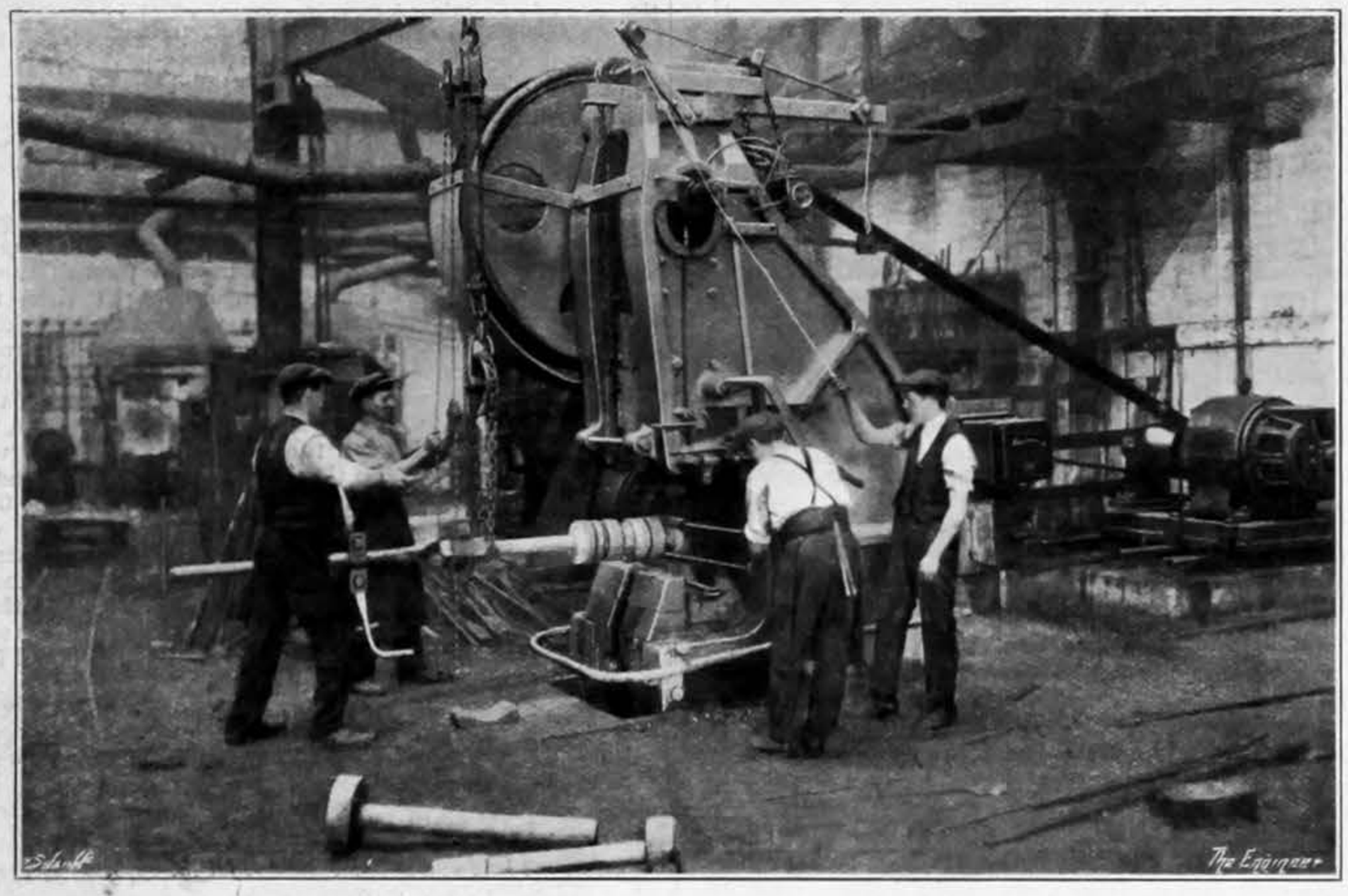


FIG. 50—HAMMER TYPE FORGING MACHINE—MASSEY

capable of quick and accurate adjustment. Thus the ram, whilst giving always the same reciprocating stroke, can be raised and lowered instantaneously to the extent of 7in., and the height of the work to be dealt with is limited only by the height of the anvil pallett. The latter is arranged to slide sideways in the block and is provided with a special seating on which tools can be readily placed, or, if desired, the pallett can be slipped out of position and replaced by special tools. The valve which controls the position of the ram can be operated either by a foot lever or by a cord running from the top of the machine. In the example which we had an opportunity of inspecting at the makers' works, the oil pressure was about 3 tons per square inch and the total force on the ram 150 tons. Two handles conveniently operated by hand adjust the reciprocation of the ram and enable accurate sizing of the work to be effected. Thus, in repetition work time is saved by reducing the gauging which might be otherwise necessary. One of the advantages claimed for this machine is its capability for dealing with special jobs which are ordinarily outside the range of a hammer or a press, as well as the more common types of smithy and forge work. For articles required in large quantities it is stated to be particularly suitable, since it is designed to hold a number of tools at once, any one of which can be quickly brought into position. Unlike the ordinary power hammer, the machine requires only an inexpensive foundation.

Portable Planing Machine.—Another new appliance which will be found useful in works which employ a number of hammers and drop stamps is shown in Figs. 51 and 52. It is a patented portable planing machine for truing-up the faces of anvil blocks and tups of hammers and stamps. In the illustration Fig. 52 the machine is shown planing the block of a drop stamp. The machine is securely keyed into the dovetail of the tup. By tightening the guide bars of the stamp on to the tup by means of the screw adjustment ordinarily provided, the tup is held firmly in position and the machine is further steadied by means of four adjustable pillars supported from the block. To prevent movement of the machine along the dovetail, provision is made for wedging from the tup. Means for adjusting the belt shipper gear to suit any direction of drive are provided. The tool-box, which is arranged to swivel into any desired position, has a vertical movement of 5in. and will take a tool 1in. square and the feeds, both vertical and horizontal, are by hand. A good average cutting speed is 20ft. per minute, and the machine will cut cast iron $\frac{3}{8}$in. deep by $\frac{1}{32}$in. feed, the power required under these conditions being from 3 to 5 brake horse-power.

Pneumatic Hammer.—Another useful machine shown by Messrs. Massey is a pneumatic hammer,

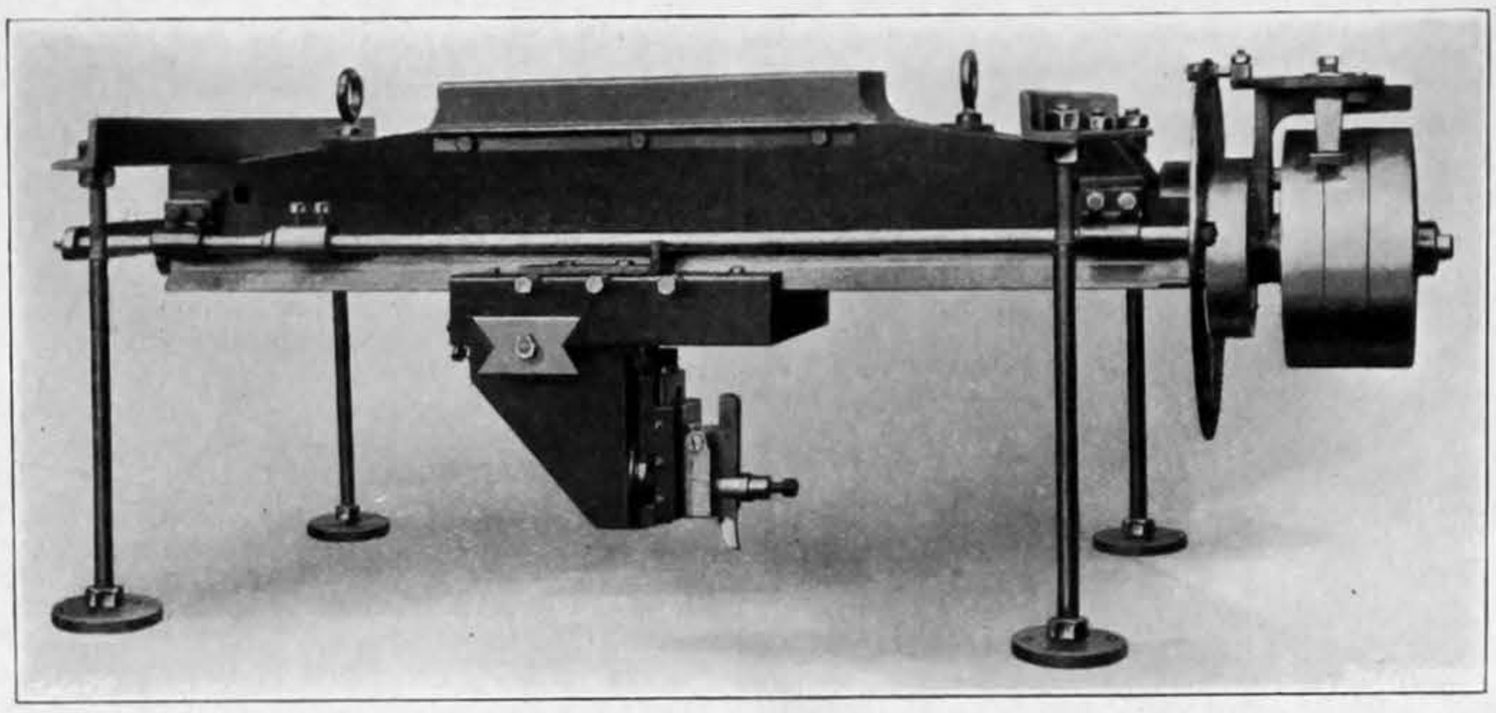


FIG. 51—PORTABLE PLANING MACHINE—MASSEY

by means of which it is possible to strike powerful single blows either from the top of the stroke or from any intermediate position. In this hammer a reservoir is formed in the cylinder casting, which is charged with air by means of a pump. The maximum air pressure in the reservoir is fixed by a system of clearance governing. In addition to these single blows, for each of which a separate movement of the hand or foot lever is necessary, the hammer also provides a full range of self-acting blows, including light blows with long strokes. The tup can also be held up or held down.

Tire-fixing Rolls.—Railway engineers will be interested in the firm's tire-fixing rolls—Fig. 53—which have been designed to meet the demand for a machine for closing down the lip of the tire on the retaining ring of locomotive, carriage and wagon wheels. The machine consists of two main shafts, which are fitted at the large ends with rolls of the required form, the tire being gripped between the upper and lower roll. The lower shaft runs in phosphor-bronze bearings, and is driven by a steel worm running in an oil bath and a phosphor-bronze worm wheel fixed on a cast iron centre. The upper shaft is driven from the lower through cut steel spur gearing, and provision is made by means of a trunnion bearing at the back and a sliding bearing at the front for raising and lowering the roll to permit of the admission and removal of the work. The weight of the upper shaft and roll is counterbalanced, and the roll is lowered on to the tire by means of a hand wheel and screw. A further movement of the same hand wheel brings into operation a hydraulic press situated above the upper roll and actuated by a force pump which is operated from a crank on the end of the worm shaft and which is placed above an oil reservoir in the bed-plate. By this means the pressure, and thus the force with which the rolls are pressed together, can be readily varied over a wide range. During the rolling operation the tire is carried on the bottom roll and on two supporting rollers which can be adjusted along radial beds to suit the diameter of the wheel being dealt with. Adjustable thrust rollers on vertical spindles are also provided—one on each side of the rolls, and a third placed between the upper and lower shaft directly behind the point of maximum thrust.

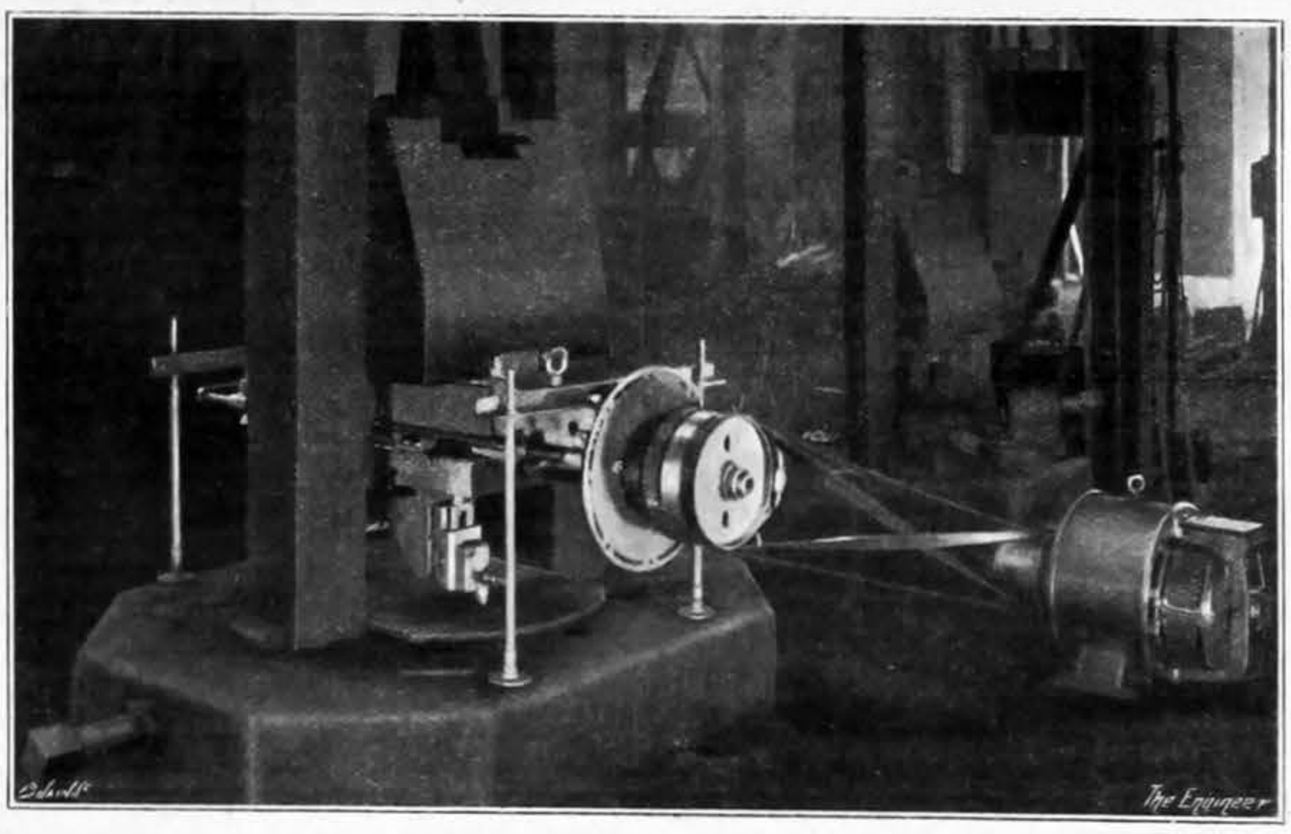


FIG. 52—PORTABLE PLANE MACHINING DROP STAMP BLOCK

Pneumatic Stamp.—The 10 cwt. pneumatic stamp

* No. III. appeared Sept. 19th.

—illustrated in Fig. 54—is of new design, and can be driven either electrically or by belt. This machine follows in general principle the firm's design of pneumatic hammers. In its framework the stamp resembles closely the double-acting steam stamp of the arch type. Cast steel standards and anvil block are used to withstand heavy working conditions. The stamp is very rigid in construction, and the standards are designed to give sufficient space round the dies and between the slides to permit the use of broad dies with multiple impressions or of a die-holder and gang of dies for preparing, stamping and cutting off. Two cylinders are provided in a single casting, the tops and bottoms being connected by passages which can be opened or closed at will by a control valve. A heavy fly-wheel driven by a belt actuates the crank shaft by spur gearing, and this crank shaft in turn causes the piston in the pump cylinder to reciprocate continuously. The air compressed on the down stroke of the piston is used to raise the tup and the air compressed on the up-stroke to force it down. When the control valve is in the full work position the passages mentioned above are left wide open and the maximum self-acting blows are obtained. By means of the valve, however, these passages can be closed and another passage opened connecting the top and bottom of the pump cylinder, thus allowing the pump to reciprocate without compressing any air. Intermediately between these positions are those in which the by-pass is partially closed, and the other passages, namely, to the top and bottom of the hammer piston, are also restricted in varying degrees, thus providing for a wide range in the length and force of the blow obtained. Means are also provided whereby the tup can be held up at the top of the stroke or hang idly in the upper part of the stroke. The stamp is controlled by means of a foot lever, but it can be arranged for hand operation if desired. By means of the foot lever the operator can complete all the processes in producing the finished stamping from a bar or a billet. Working in conjunction with the foot lever is a hand lever and quadrant, by means of which the upper position of the valve is determined. When the stamp is first started, this hand lever is set in the first position—"not working." By moving it to its second position "hold up," the tup is lifted to the top of the stroke and remains suspended there until the foot lever is brought into play, when automatic blows are delivered, the force of which is regulated by the movement of the foot lever. When the latter is released, the tup at once rises to the top of its stroke. An oil-timing device enables the foot lever to be pressed down at any moment irrespectively of the position of the pump piston, the device acting by delaying the action of the foot lever until the pump piston has reached the beginning of its stroke. This arrangement enables an even beginning to any series of blows or single blows to be obtained. Sideways adjustment of the dies is obtained by moving the whole framework of the stamp along the anvil block by means of wedges which are adjusted and locked by screws. The design of the slides in which the tup moves provides adjustment for wear. The taper in the slides is made in a reverse direction to that usually adopted, so that the thicker and stronger end is at the bottom, adjustment inwards being made by raising the slides. This arrangement prevents any possibility of the tup being jammed by reason of the slides accidentally slackening off and dropping. The slides are made wide enough to be secured to the face of the standards by means of bolts passing right through to the back of the standard, and small spigots are provided on the standards to fit in the recesses at the back of the slides, thus avoiding the weakening effect of the usual pocket arrangement. An air buffer is provided to prevent damage to the cylinder cover, and an air blast actuated from the pump cylinder is fitted to blow scale and dirt from the dies.

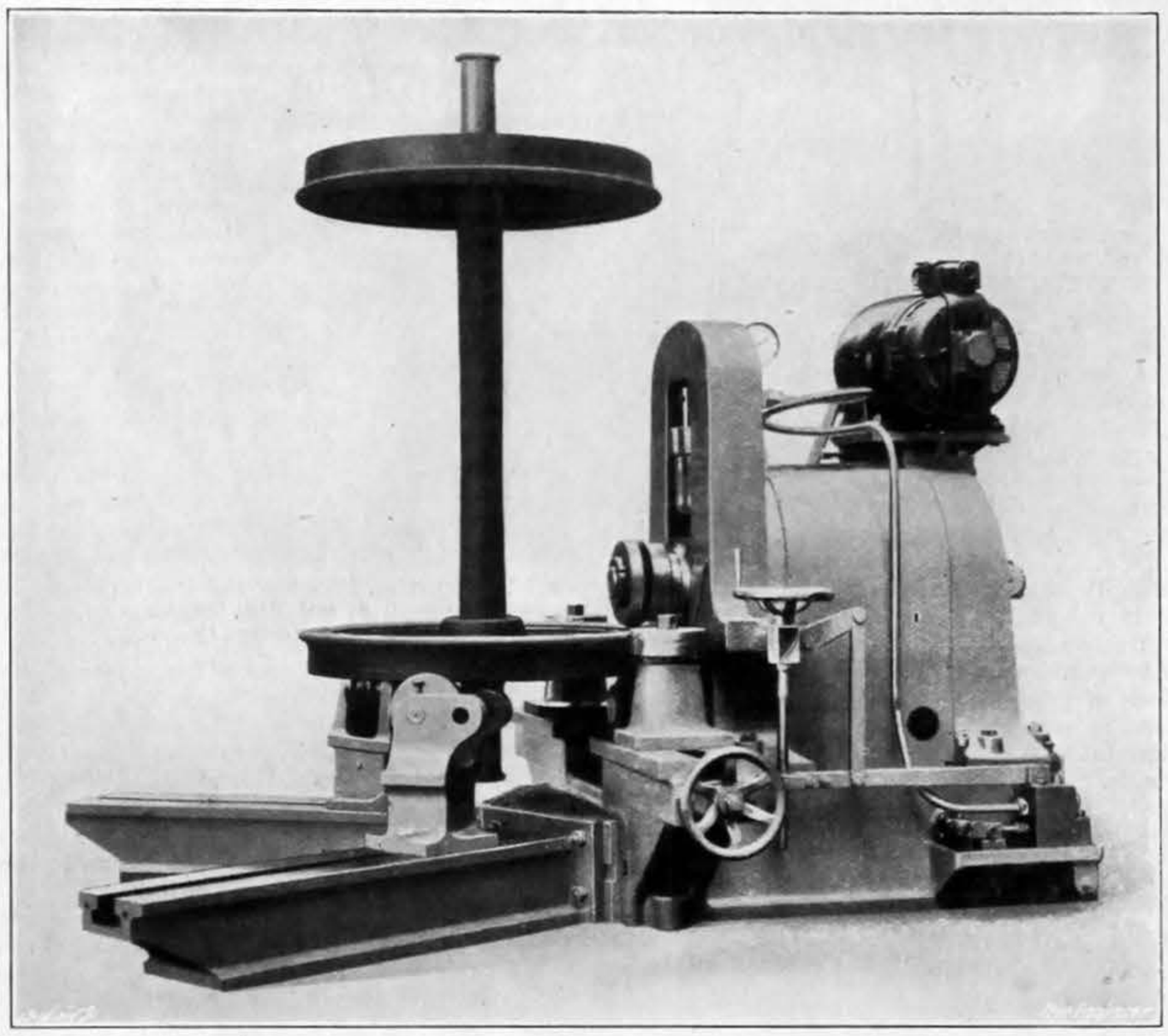


FIG. 53—TIRE-FIXING ROLLS—MASSEY

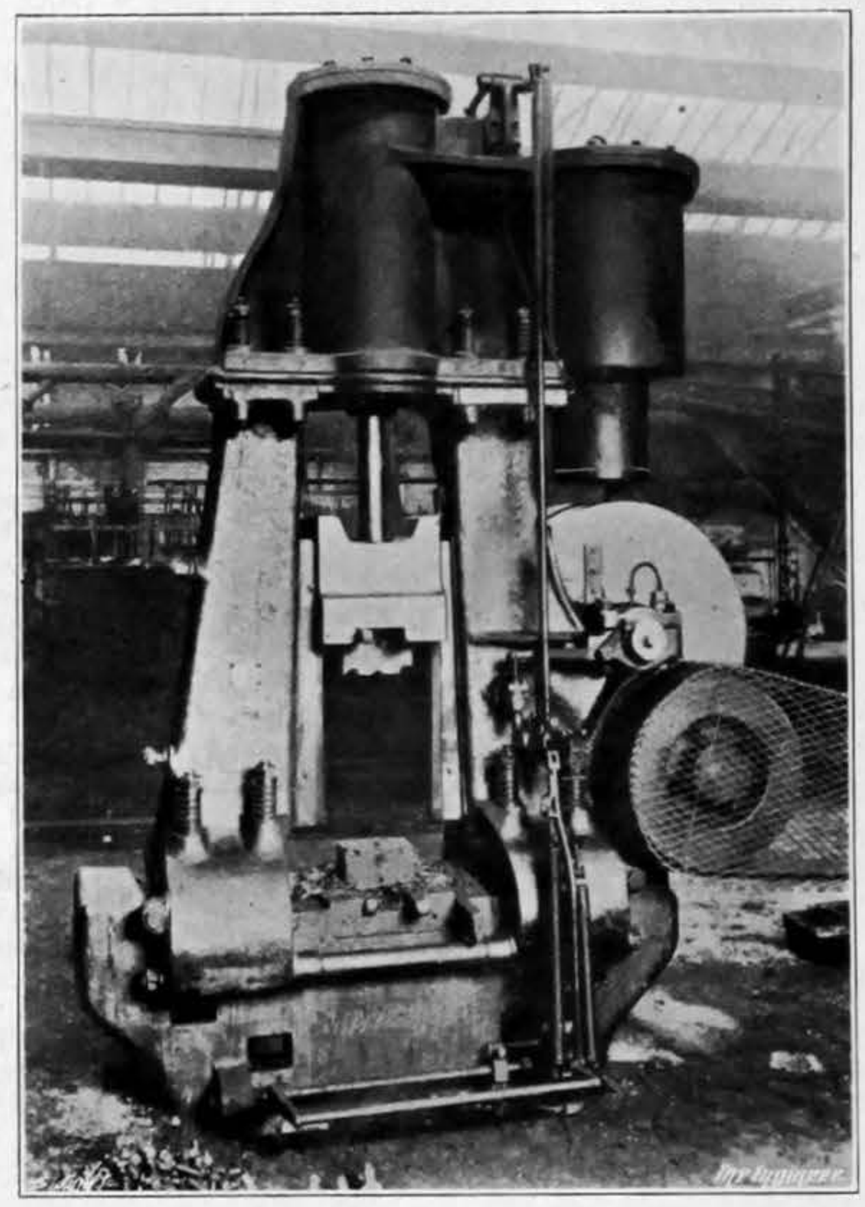


FIG. 54—PNEUMATIC STAMP—MASSEY

REAVELL AND CO., LIMITED.

Air Compressors.—The name Reavell, of Ipswich, is so intimately connected with air compressors in the minds of engineers that it is unnecessary to enlarge here upon the big compressors on the stand of this firm, which include typical examples of both the rotary and reciprocating types, which have already been described in THE ENGINEER. There are, however, two little compressors of comparatively novel design, which are illustrated in Figs. 55 and 56.

The first of these two machines is intended for such services as blowing out the dust from electrical machinery in sub-stations and small power-houses where a large equipment would not be justified. It comprises a rotary vane type air compressor bolted on to the end shield of an electric motor, by which it is driven directly at a speed of about 1440 revolutions per minute. At this speed the compressor will deliver 8 cubic feet of free air per minute at a pressure of 20 lb. per square inch. The delivery, it will be noticed, is fitted with a pressure gauge and there is 15ft. of flexible hose with a nozzle so proportioned as to give the required pressure. A steel drum is mounted on the top of the motor for coiling the hose round, while 30ft. of flexible cable is provided for connecting the motor with a wall socket. The machine as illustrated weighs 115 lb. and consequently can be carried by two men by means of two handles, one of which can be seen on the motor. An alternative arrangement is to mount it on a three-wheeled truck with rubber-tired wheels, when the total weight is 150 lb.

FIG. 55—SUB-STATION COMPRESSOR—REAVELL

FIG. 56—TIRE PUMP—REAVELL

The overall dimensions are 2ft. long by 1ft. 5in. wide by 1ft. 9in. high.

The great merit of this little machine is that, being of the rotary type, it can be run at a high speed without fear of vibration, and is consequently much smaller for its output than a reciprocating set. It is not, of course, intended for continuous running.

The garage tire pump shown in Fig. 56, unlike many machines of this class, is a real engineer's job and should give continuous service for very long periods without any attention beyond oiling. It has a cast iron cylinder 4in. in bore and a closely fitting piston, which has a stroke of 4in. The most noteworthy feature is, however, the working lever. The lever is approximately L-shaped with the short leg pivoted to the piston and a fulcrum in the angle of the L. This fulcrum is provided with rollers which work in horizontal guides on the top of the cylinder. The arrangement is such that at the beginning of the stroke the piston moves rapidly, but as the air pressure rises towards the end of the stroke the fulcrum rolls forward until it is nearly over the centre of the piston and the leverage is greatly increased. As a result an average man pressing on the end of the lever, which is some 28in. long, can easily pump up to a pressure of 100 lb. per square inch. If a higher pressure is required a piston 3in. in diameter is fitted. The piston displacement of the larger pump when worked at 70 strokes a minute is just over 2 cubic feet a minute, while that of the smaller set is 1.15 cubic feet.

THE IGRANIC ELECTRIC COMPANY.

The Igranic Electric Company, Limited, of 147, Queen Victoria-street, has two stands, one near the entrance to the Exhibition, and another in a more central part of the building. The company's exhibits include, among other things, a totally enclosed starting rheostat suitable for starting shunt motors, a "Varispede" pillar switch panel for variable speed direct-current motors, a "Urelite" circuit breaker, an automatic universal panel controlling a small variable-speed motor, a magnetic lock-out type starter as shown in Fig. 57, a drum reversing controller,

an automatic alternating-current motor starter, a hand operated polyphase starter, an auto-transformer starter, a start and stop push button suitable for use with all Igranic controllers, a magnetically-operated double-pole contacter switch, &c.

As regards the magnetic lock-out type starter—shown in Fig. 57—the series relays (one of which is provided to control each accelerating clapper switch) are so arranged that on closure of the motor circuit the initial current (which, of course, exceeds the normal running current) excites the first series relay and, by lifting its core, causes it to keep open the coil circuit of the first clapper switch, which consequently cannot close to short-circuit the first section of the starting resistance until the motor current has decreased to normal running value. When this occurs the relay releases its core, and the first accelerating clapper switch closes, and by short-circuiting a section of resistance permits the motor current again to rise to an abnormal value, thereby causing the second series relay to lift its core and keep open the second accelerating clapper switch until the motor current has again fallen to normal. This process is continued by successive series relays until all the starting resistance has been removed from the motor circuit by the closure of all the clapper switches. By this system, if the starting load be light, the starting resistance is quickly cut out, whereas, if the starting load be heavy, the starting resistance is removed slowly. In this system the clapper switches are of the shunt wound type, only the series relays that govern them having their coils in the motor circuit.

The company's "Varispede" pillar panel for vari-

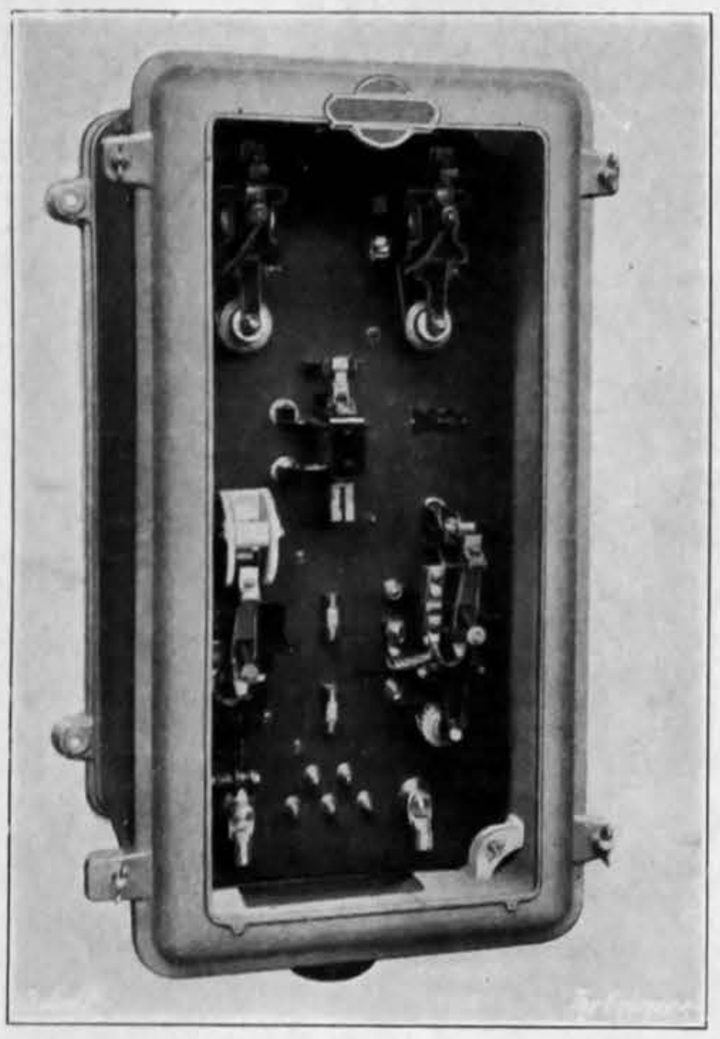


FIG. 57—MAGNETIC LOCK-OUT STARTER—IGRANIC

able-speed direct-current motors is well known. It is quite fool-proof and an important feature is that easy access can be gained to the interior of the panel. The panels are provided with a shunt regulator, which makes them suitable for the control of radial drills, shaping and slotting machines, &c.

The "Urelite" circuit breaker is designed for the protection of power and lighting circuits in workshops. The company's reversing drum controllers are supplied for all classes of alternating-current and direct-current service, and are particularly suitable for cranes and travelling gantries. Where squirrel-cage motors are in use, as on small machines, the company's automatic alternating-current motor starters can be employed with advantage. The starter is magnetically operated, and can be controlled from a distance. Overload protection is afforded by the use of mercury type thermal relays in place of fuses. The hand-operated polyphase starter, which is totally enclosed, is intended for similar purposes, but it is protected by fuses, and it may be provided with a single step of starting resistance for use when the motor to be started is too large to be connected directly across the line.

C. A. HUNTON AND SONS

Tube Bending Machines.—Among a large variety of tools and shop appliances on the stand of C. A. Hunton and Sons, 71, Southwark-street, London, S.E. 1, there are several new tube bending machines, one of which is illustrated in Fig. 58. These machines are intended for bending all kinds of tube to any radius, and when properly handled will even bend open joint electric conduit to curves much sharper than the standard radius without the conduit collapsing or puckering. The tube is, of course, bent round a grooved former, but there are two special precautions for preventing it from being deformed. The outside of the tube is prevented from being crushed in by a second former, which is a plain straight piece of steel grooved out on one side to fit the diameter of the tube and provided with a little wire handle. This former is slipped between the tube to be bent and a roller on the bending arm, so that the roller does not roll on the tube itself, but on the back of the former. When the roller has come to the end of the former, the former is pulled forward and so on until the bend is completed.

When very sharp bends have to be made a special precaution must be taken to prevent the tube being spoiled. The makers have found that if the angle between the two radii of the curve, which cut the fixed support for the end of the tube and the start of the curve, is 15 deg. the bend can be made satisfactorily regardless of the curvature. For this reason a

FIG. 58—TUBE BENDING MACHINE—HUNTON

gauge, which can be seen in Fig. 58, is fixed on a slide on the top of the bending arm, while the roller can be adjusted radially. The grooved former of the proper radius having been slipped in place, the tube is put in, bearing against the fixed stop. The gauge is then slid forward and the arm moved until the edge of the gauge is parallel with the centre of the tube. In this position the arm will be the required 15 deg. in advance of the stop, so that it is only necessary to arrange the straight former in place and adjust the roller to meet it to get a good fair bend. When bending very thin-walled tube round very small curves it is, however, best to use a filling of, say, equal proportions of pitch and resin, when bends as small as ½in. radius can be made. Two stops are provided on the table for dealing with right and left-handed bends. The machine shown in the illustration will, nevertheless, bend ½in. brass tube, No. 22 gauge thick, round a radius of 1⅞in. without loading. At the other end of the scale it will take No. 12 gauge 1¼in. steel pipe round a minimum curve of 4in. radius, or a maximum of 5in. For light work there is a similar machine with a simple lever instead of the ratchet and gear drive, while a worm-driven machine is used for pipes up to 2in. diameter.

JOHN STIRK AND SONS.

Planing Machines and Boring Mills.—John Stirk and Sons, of Ovenden-road, Halifax, have a large stand on which there are some very fine examples of the planing machines and vertical mills made by this company. The principal item is the "Hiloplane," illustrated in Fig. 59; there are also a smaller belt-driven planing machine and a couple of vertical mills, the larger of which is shown in Fig. 60.

The Hiloplane planing machine is very similar to that exhibited at Olympia in 1920, but is considerably larger, its weight being 90 tons, in comparison with 48 tons, while several refinements have been added to the control gear. The machine has a table 6ft. 11in. wide, but will admit between the uprights a job which is 100in. wide by 72in. high, and has a planing stroke of 22ft.

The chief characteristics of the Hiloplane are, of course, the electrical systems of driving and control, which enable the attendant to work the machines in a large variety of manners without any great physical effort and without having to move from one position. The machine is driven by an electric motor geared to a pinion, which meshes with a rack under the table, and this motor receives its current from a motor generator worked off the mains. The motor of the combined set is a normal shunt-wound machine, but the generator has two field windings arranged in opposition, so that the direction of the generated current can be reversed by using either one or the other of the two field windings. The current is taken directly to the armature of the planer motor, which has two field windings arranged in sympathy. During the cutting stroke, both these windings are energised, but for the return stroke one of them is cut out and the motor is correspondingly speeded up. It will thus be seen that the reversal and acceleration of the motor only involves the manipulation of the field current by means of two contactors. These contactors are, in turn, controlled by a throw-over switch, operated by the table. Instead of using stops bolted to the side of the table for moving the switch, a disc driven by the table is used to accommodate the stops. This disc makes nearly a complete revolution for the longest stroke of the machine, and by fixing the stops in a T slot in its face the length of stroke can be very quickly and conveniently fixed. In this way the necessity for walking from end to end of the table when changing the stroke is avoided. The contactors in the field circuits are, of course, provided with magnetic blow-outs, and no appreciable arcing takes place as the motor is reversed. It is really remarkable how quickly and precisely this heavy p'aner can be reversed and strokes down to about only 3in. long can be taken.

The various feed motions are all worked by a separate motor arranged alongside one of the standards, which is connected with the throw-over switch in such a manner that it does not reverse, but alternately goes forward and stops still. There is, however, an alternative use for this motor in traversing the tools at such a speed that a cut can be taken from side to side. In such circumstances the stop disc is disconnected from the table, and clutched on to the shaft used to drive the feed screw of the tool box. Then the throw-over switch is arranged to operate the feed motor in the same way as the main motor. It should be mentioned that the alterations to the electrical connections are made by a simple push button, while a single lever controls the clutches. It will be noticed that the machine is equipped with two tool-boxes on the main slide, and one on each of the main standards. All these boxes are connected with the gear just described, so that the top face can be planed transversely and the sides slotted vertically. For these movements the main drive to the table is naturally put out of action, and the table is fed forward to the cut by a slow gear. It is also possible to plane the vertical face of the end of a casting, in a transverse direction, when a slow vertical feed is given to the cross slide. It will be obvious that the fast movements can also be used to get the tools into place when starting on a new job. It will thus be seen that the Hiloplane possesses the great advantage that a large variety of work can be done without it being necessary to re-set the job.

Besides the controls already mentioned, there is another one, in which a double-ended push button takes the place of the throw-over switch. The push button is attached to the end of a length of flexible cable, which the attendant can carry about, and thus control the machine while he watches the progress of the work. The cutting speed of the machine can be varied between 23ft. and 90ft. per minute, while the return stroke ranges from 90ft. to 180ft. per minute. All the movements can be "inched" for setting up purposes. The feeds range from $^{1}/_{32}$in. to 1¼in., and when a broad feed is being used for a finishing cut, a solenoid can be brought into operation for positively relieving the tool on the back stroke, instead of letting it drag over the work.

In the design of the Stirk Hilomill—see Fig. 60—much the same ideals have been followed as in the planing machine, but the problem is naturally simplified as the continuous rotary movement of the table provides a convenient means for working the feeds. There are, however, three small motors over and above the main driving motor. One of these motors is mounted on the cross rail at the top of the housing, and is used for elevating the cross slide. The other two small motors are arranged one on either side of the machine, and give quick power traverses to the heads in all directions. All three motors are controlled by a single push button on the end of a long cable, and throw-over switches are used for connecting the machine with either motor.

Where direct current is available, a variable speed motor is used for the main drive in conjunction with a three-speed gear-box, but for alternating current a constant speed motor is generally adopted, with an extra six-speed gear, giving eighteen speeds in all. The machine exhibited will turn up to a maximum diameter of 100in., with 48in. height under the tool holders or 58in. under the cross slide.

THE CAMBRIDGE INSTRUMENT COMPANY.

A collection of instruments, manufactured by the Cambridge Instrument Company, is to be seen on the stand of Brayshaw Furnaces and Tools, Limited. There are industrial pyrometers working in connection with Brayshaw's gas-fired furnaces and three thermocouples—one in each of the three furnaces is connected up to a three-point metal-cased Cambridge recorder of the maker's latest design. The thermocouples are also connected to Cambridge indicators mounted near the furnaces. The fireman can thus see the temperature of each furnace at a glance, while the permanent records, which are traced on the recorder chart, are extremely valuable for reference purposes. A thermocouple in another furnace, and a Fery pyrometer sighted on a fifth furnace, used for high-speed steel treatment, are connected to a metal-cased indicator, which is mounted on the same panel as the recorder. The temperature of this high-speed steel furnace can also be measured by a Cambridge optical pyrometer and a Cambridge disappearing filament pyrometer.

A Cambridge apparatus for automatic temperature

MACHINE TOOLS AT THE OLYMPIA EXHIBITION

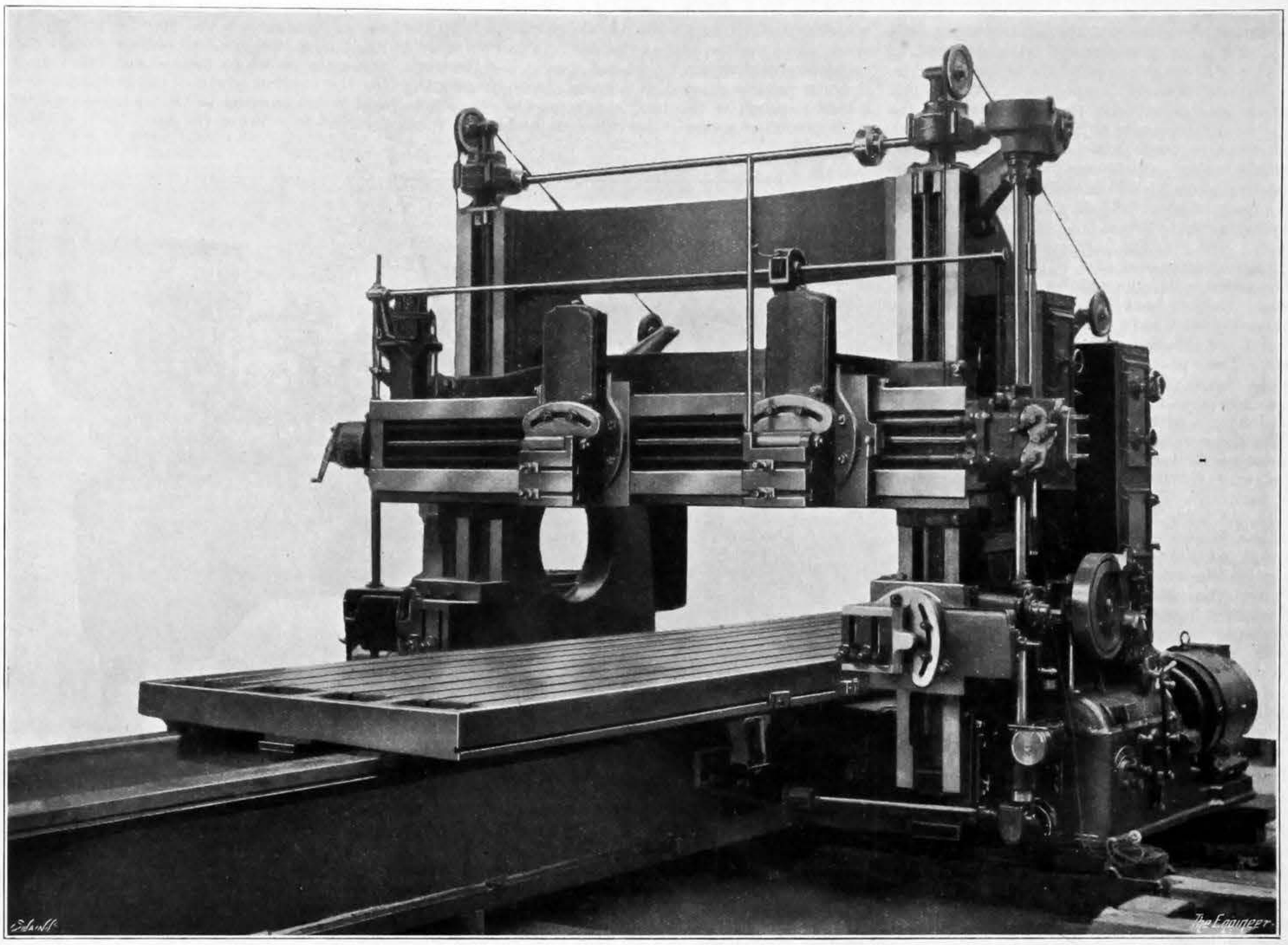


FIG. 59—THE HILOPLANE ELECTRICALLY-DRIVEN PLANING MACHINE—STIRK

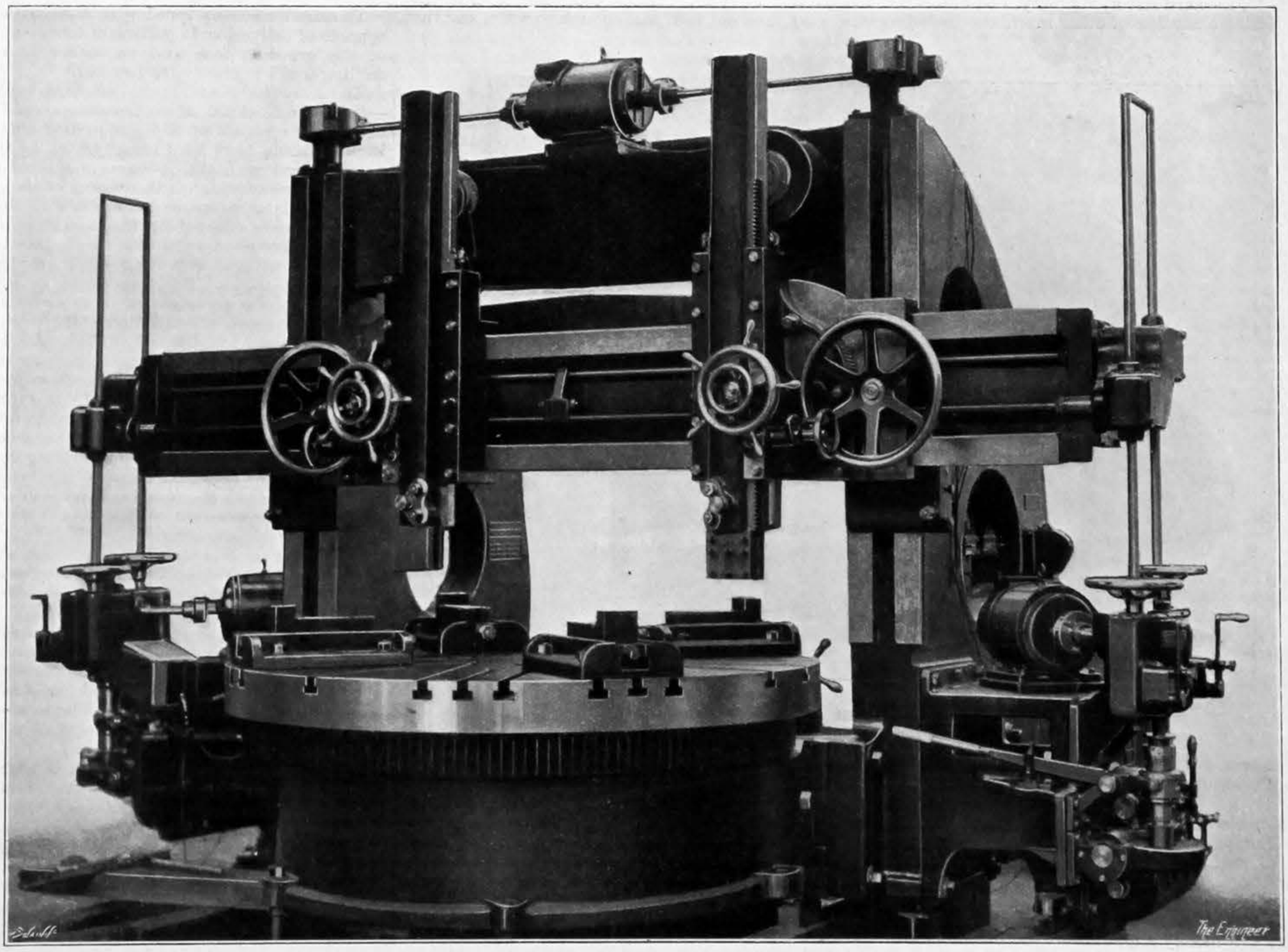


FIG. 60—THE HILOMILL ELECTRICALLY-DRIVEN BORING AND TURNING MILL—STIRK

control, comprising a wall type indicator and a 2in. balanced gas valve, is shown applied to a furnace. The indicator consists of a high resistance moving coil galvanometer, fitted with a scale calibrated in terms of temperature, and it is connected by leads to a thermocouple in the furnace. A light thermocouple is attached to the pointer, and is electrically connected to a moving coil relay. A small electrically heated coil is set at the point on the scale corresponding to the desired temperature. When this temperature is reached the thermocouple on the pointer is brought opposite to the coil and is heated. The electromotive force which is thus established energises the relay which completes an electrical circuit and operates the balanced valve which controls the supply of heat. As soon as the temperature falls the thermocouple leaves the coil and the process is reversed. The coil can, of course, be set to any point on the indicator scale.

In connection with the exhibit examples of the Cambridge "Easy to read" thermometers are shown. These thermometers have been introduced to meet the demand for efficient and easily read dial thermometers. Their cost does not exceed that of high-grade glass thermometers, and they are, of course, much more easily read. The dials are 4in. in diameter, the actual length of the scale being approximately 8¼in. The thermometers are made for various temperature ranges extending up to 550 deg. Fah.

The operation of the company's dial thermometers depends upon the expansion of a vapour from a volatile liquid with changes of temperature. The bulb of the instrument which is exposed to the temperature to be measured is connected either directly or by a length of flexible tubing to a Bourdon gauge tube, the whole arrangement being filled with a volatile liquid. Changes in the bulb temperature cause changes in the vapour pressure of the liquid, and the resultant movements of the Bourbon tube are communicated to a pointer moving over a calibrated scale. Changes in the temperature of the indicator or of the flexible tubing do not affect the accuracy of the readings. The instrument can consequently be placed some distance from the point where the temperature is being measured. In the case of low-temperature measurements, the indicator may be placed in a position which is at a considerably higher temperature than the bulb without any danger of the readings being too high.

Other Cambridge instruments shown include a pyrometer tester, a workshop potentiometer, a Whipple indicator, an extensiometer, a Rosenhain calorimeter, a microscopic lathe attachment, a pressure recorder, &c.

CHARLES CHURCHILL AND CO.

Centreless Grinding and Automatic Machines.—Besides the grinding machines already described in our Supplement of the 12th inst., Charles Churchill and Co., of 9–15, Leonard-street, Finsbury, London, E.C.2, are exhibiting a number of other machines, including

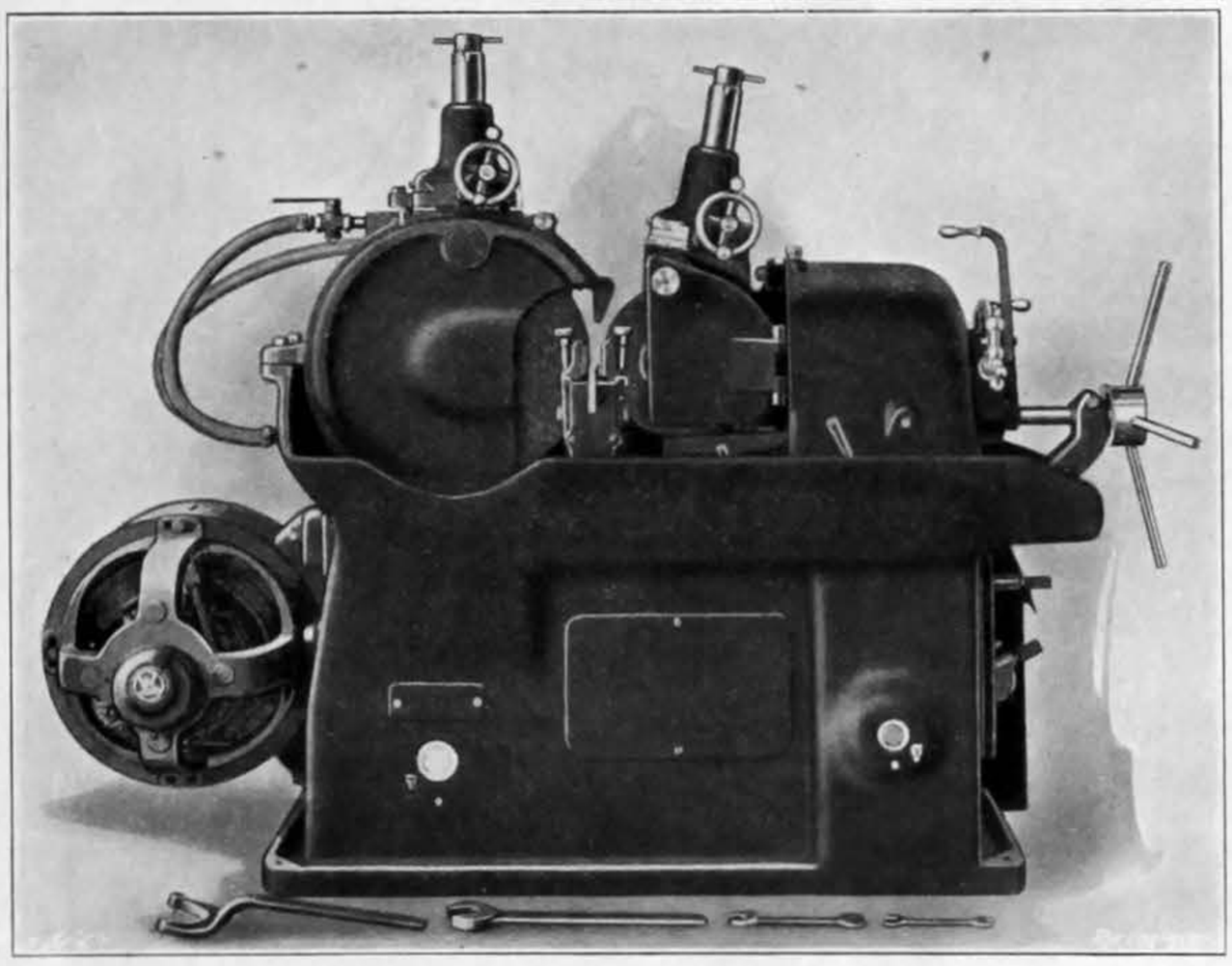


FIG. 61—CINCINNATI CENTRELESS GRINDER—CHURCHILL

the centreless grinder shown in Fig. 61, and the five-spindle automatic screw machine illustrated in Fig. 62.

The centreless grinder, by the Cincinnati Milling Machine Company, is, of course, intended for grinding cylindrical work which has no centres drilled in the ends, and possesses the advantage that the time required for setting up the work between the centres is eliminated. With plain work, having no shoulders, the pieces are merely slipped into the machine, and they drop out on the other side finished.

On referring to Fig. 61, it will be seen that there are two whee's. That on the left is the grinding wheel proper, and is 20in. in diameter. The wheel on the right is known as the feed, or control wheel, and is 12in. in diameter. In the gap between the two wheels there is a rest for supporting the work, which takes the form of a narrow strip of steel, with a stellite wearing surface, and a set of side guides to keep the work piece on the top of the rest. The two whee's are driven at different peripheral speeds, and the work is consequently rotated at a speed depending on the relative speeds of the two wheels, at the same time as it is being ground. In order to make the work travel across the face of the grinding wheel the control wheel is set at a slight angle out of the vertical p'ane, so that it drags the piece forward as it rotates.

Different classes of work naturally require different rates of feed, in both circumferential and longitudinal directions, and for this reason the control wheel is so mounted that its angle of inclination can be varied, while the drive is through a gear-box that gives sixteen changes of speed. When grinding very long pieces of work, for instance, the job is liable to whip, if it is rotated on its axis too fast. In such cases the speed of the control wheel is set so that the work does not turn fast enough to whip, and then the angle of inclination is adjusted to feed the piece through the machine fast enough to get the required output.

Work can also be ground up to a shoulder on this machine, but then, of course, it cannot be passed right across the wheels. A special form of rest is used for this class of work, and the control wheel is drawn back slightly while the work is put in place. The control wheel is then advanced against a stop, which determines the size of the ground piece. The control wheel is drawn back again and a hand-operated ejector used to push the piece out.

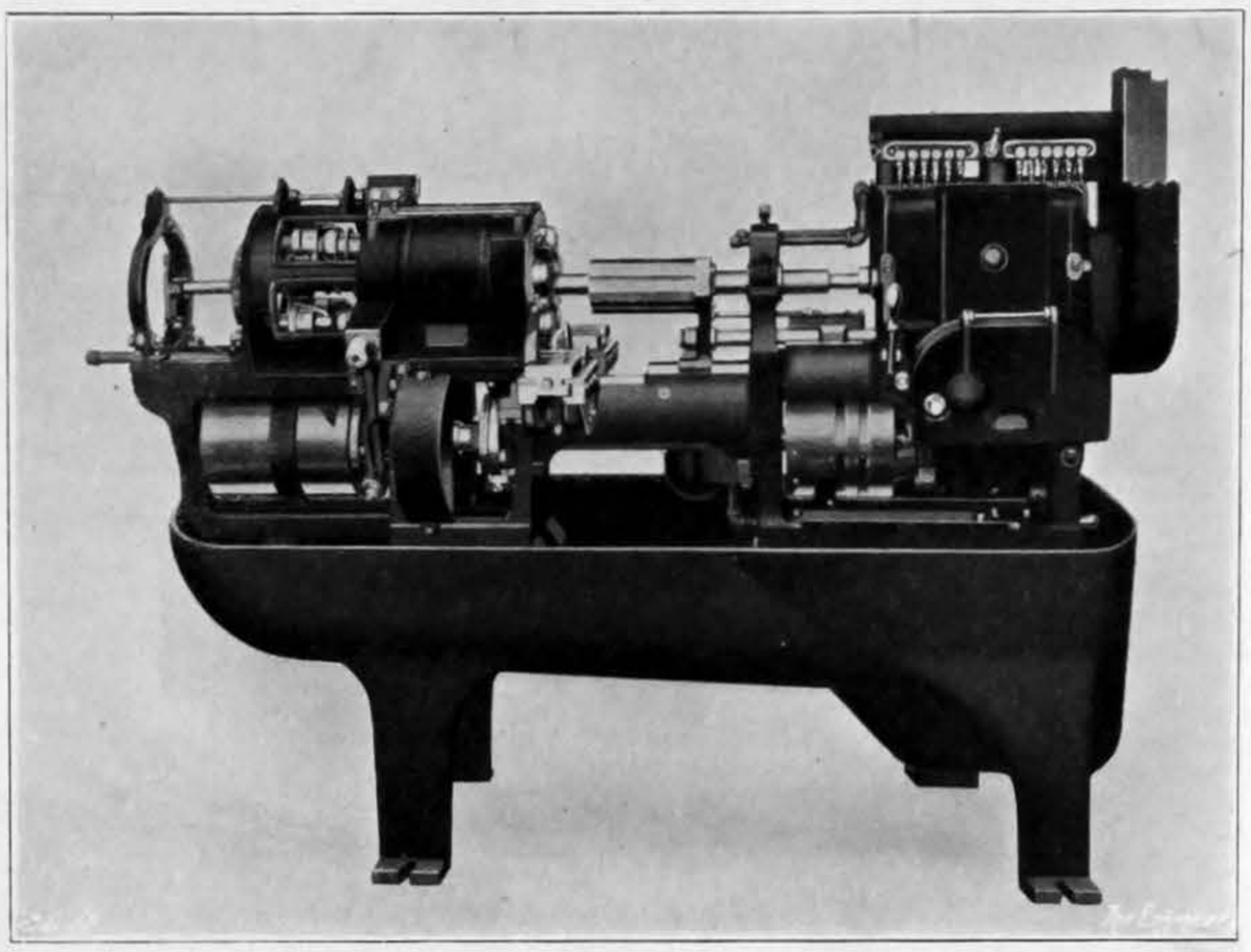


FIG. 62—NATIONAL ACME AUTOMATIC MACHINE—CHURCHILL

Both the wheels are driven by a 15 horse-power motor, bolted to the main frame, which drives a shaft beneath the grinding wheel spindle. A 5in. belt runs up from this shaft to the spindle, and a jockey pulley, which can be adjusted from the outside, is used to put the proper tension on the belt and to increase its arc of contact on the spindle pulley. The spindle itse'f is a heat-treated chrome nickel steel forging, and runs in white metal-lined bearings. The drive for the control wheel is taken from the same shaft, and is transmitted to the change-speed gear already referred to. From the last shaft in the gear-box a 3½in. belt runs up to the spindle of the control wheel, which is mounted in a tilting housing. A jockey pulley is used on this belt also to adjust the tension.

On the top of the wheel guards, it will be noticed, there are two fittings. They are the slides for carrying the diamonds used to true up the wheels. The slide for the grinding wheel runs truly across the face of the wheel in the normal manner, but that for the control wheel can be set at an angle, corresponding to the inclination of the wheel, so that the face can be trimmed up slightly hollow to give a fair bearing right across its face against the work piece.

The machine is equipped with a centrifugal pump capable of delivering 15 gallons of lubricant a minute at the grinding face and an elaborate system of settling tanks to clarify the lubricant.

The five-spindle automatic machine—see Fig. 62—is by the National Acme Company, and is capable of working on stock up to $^{9}/_{16}$in. in diameter. Several improvements have been incorporated in the design as compared with the previous model of the same capacity, one of which is the raising of the cam shaft so that it is close up to its work, and the various movements are effected by the direct application of rollers to the drums. In this way a positive action is obtained without any of the whip associated with intermediate levers. The drums, also, have been kept well clear of the tooling area in order to avoid any tendency to inaccuracies through chips lodging against the cam faces, while the bed is made of oval form to assist the swarf in dropping straight down.

In the new spindle carrier the bearings have a length amounting to half that of the cylinder, and the casing is counterbored at the front to take up end thrust. Arrangements are provided for accommodating wear in both directions. The driving gear for the spindles is now arranged between the bearings, and as a consequence it has been made possible to lengthen the distance between the bearings and at the same time reduce the rear overhang.

In view of the fact that these machines work at the rate of some 3000 operations an hour, great care has been taken in designing the spindle indexing and locking gear, which has to operate about once a second. In order to get the spindle carrier into its successive positions rapidly and without shock, the cam on the main shaft engages progressively with three rolls on the index gear, and this gear, in turn, meshes with the spindle head. The locking gear of the carrier is also new and comprises a latch bolt at the rear, with a lock bolt in front. The operation is as follows:—When the lock bolt is withdrawn by a positive cam from one of the five notches in the cylinder at the instant of indexing, the latch bolt rides up the slot on the opposing side of the head and springs into position at the next slot. Simultaneously, the lock bolt, which has a tapered face, is firmly settled into position by a positive cammed action without the use of springs. In this manner both members, the lock and latch bolts, have a tendency to pull the cylinder down towards the bed, firmly fixing the relative position of spindles to tools.

Rhodesian Water Power Scheme.

FOR years the harnessing of the water power of the South Central portion of Africa has been under consideration. It has, however, remained for the Rhodesia Broken Hill Company on the British side of the Congo–Zambesi watershed to make an actual start with the application of water power to the base metal industry.

The Mulungushi water power scheme aims at obtaining water power from the Mulungushi River at a point distant from Broken Hill about 34 miles to the East. In the first instance this hydro-electric plant is to be capable of generating 2500 horse-power, and will constitute the initial step in the provision for the recovery of the full metal contents of the various ores, as apart from lead only, as in the past. The power scheme entails the conservation of the flow of the river. The dam wall will be 117ft. high above the water level. It will dam the water for a distance of 15 miles, and the lake thus created will be 4½ miles wide at the widest point. The catchment area is 1500 square miles, and when full the dam will contain 4,000,000 cubic feet of water. It will store sufficient water to tide over the dry season, and provide such amount of horse-power during that period as will be required by a plant at the mine capable of producing 25 tons of zinc daily. The initial survey revealed a convenient gap in the mountain, capable of storing sufficient water, with a fall of 1000ft., to provide some 10,000 horse-power—the power required for a 25-ton a day zinc plant and other mine requirements—for 324 days.

On the basis of the supply of 6000 kilowatts for 24 hours for 30 days a month—that is an output of 3.3 million units per month, the expenditure is estimated at £800 per month, including repairs but exclusive of interest and depreciation. The net estimated cost of .06 per unit would be increased to .2d. by including the items mentioned. These figures represent the cost of current delivered at the mine. The capital cost is estimated at £150,000. The present cost of the steam-generated current used is about 1.4d. per unit. It is reckoned that 85 per cent. of the cost is represented by fuel, principally wood, which is about half the cost of coal. It is estimated that the hydro-electric plant will save £14,000 a year, as with an enlarged steam plant it is hardly likely that the working costs could be reduced below 1.1d. per unit.

EDUCATIONAL INTELLIGENCE.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—On Monday, September 29th, and Tuesday, September 30th (10 a.m. to 1 p.m.) students of the Faculty of Engineering will be received by the Provost, the Dean of the Faculty and the Sub-Dean. The new Engineering Laboratories, provided by the gifts of old students and friends of the College and with the help of the London County Council, are now available. The Ramsay Laboratory of Chemical Engineering will be opened by H.R.H. Prince Arthur of Connaught. The laboratory is under the direction of Professor E. C. Williams and is now ready for use.

LOCOMOTIVES FOR CHINA.—We learn with pleasure that Light Railways, Limited, a subsidiary company of John Birch and Co., Limited, secured in the face of keen German competition an order for three locomotives for a colliery in North China. The engines are of typical British design, with plate frames, side tanks, and rear bunkers, and are designed for burning coal fuel. They have copper fire-boxes and solid drawn brass tubes. They are six coupled with outside cylinders. The centre pair of wheels is flangeless. The cylinders are 12in. diameter, the driving wheels 2ft. 9½in. diameter. The engines have already been sent to their destination.

ELECTRIC BOILERS AS LOAD EQUALISERS.—Electric boilers are being used by the Poplar electricity undertaking for improving the load factor. The boilers are supplied with current after the peak load has gone off and supply is continued all night, so that a large supply of steam and water is accumulated for the following day's work. Mr. J. H. Bowden, in a recent statemen , said that hot water was supplied to the public baths during one half-year for 2.54d. per bath, there being 11,883 baths over that period. Thermal storage is being utilised in other directions, and bread baking is carried on during "off peak" hours. Some manufacturers have also installed electric drying plants, which may be profitably worked during such periods. The price of current in Poplar is 1.47d. per unit, and is said to be the lowest in London. At the present time a scheme is being considered for utilising pit waste as fuel.

THE ROYAL TECHNICAL COLLEGE, GLASGOW.—The electrical engineering laboratories of the Royal Technical College at Glasgow, are among the largest in the country. It has always been the practice of the College to keep the laboratory machinery and equipment right up to date with regard to the latest developments of the industry, but during the war years and the post-war period, it was not found possible to do this in any adequate manner. On the occasion of the recent retiral of Dr. Magnus Maclean and the appointment of Dr. S. Parker Smith to the Chair of Electrical Engineering, it was thought an opportune time to obtain new equipment representative of the latest advances in the industry. An appeal was accordingly made to the Council of the British Electrical and Allied Manufacturers' Association, which has resulted in a very generous response being made. Professor S. Parker Smith, in thanking the Association and its members for their immediate and sympathetic response, refers to the wide variety and generous gifts of modern machinery and instruments which have been made. Among other donors are the British Electric Transformer Company, Limited, the British Thomson-Houston Company, Limited, Electric Control, Limited, the English Electric Company, Limited, Electromotors, Limited, Ferranti, Limited, the General Electric Company, Limited, the Macfarlane Engineering Company, Limited, Mavor and Coulson, Limited, Metropolitan-Vickers Electrical Company, Limited, Bruce Peebles and Co., Limited, and Allen West and Co., Limited. At the beginning of last session valuable gifts of electrical mining apparatus were made by Reyrolle, Limited, Ferguson and Pailin, Limited, and Mr. George Ellison, in order that the mining students attending the College might obtain experience with the new types of switchgear. The new machinery and apparatus will enable the College to modernise its electrical laboratories and to relieve congestion by having fewer men in each group and by spreading a larger number of machines over increased floor area.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trade Situation.

THERE is as yet no sign of the autumn trade revival, and iron and steel masters in the Midlands and Staffordshire are carrying on from day to day unable to see further ahead. Severe curtailment of production has brought the output somewhat near the present restricted requirements, and there is little stocking of material. The future is so obscure that buyers are afraid to move. Consumption requirements tend to contract, and prices are weakening. Continental competition continues keen and business at home is, to a great extent, dominated by it. The effect of the new situation with regard to Germany is further to discourage enterprise. The unemployment returns for the Midlands area show a slight improvement, and this fact, together with one or two improvements in other directions, enables Midland producers of raw material to maintain their optimistic spirit.

Staffordshire Iron.

The Staffordshire finished iron mills are only partially employed, there being a very poor demand for medium class bars and nut and bolt qualities. Marked bars are a comparatively cheerful section, the works being fairly well employed on engineering and other material. Even at the high price of £15 per ton makers are well able to dispose of their products. There is more solidarity in the bar branch than has been usual in times of stress. In Crown bars alone is there any sign of yielding. Sellers in several instances accept £12 15s. to £12 17s. 6d. Many mills, however, adhere to the £13 standard. There is little business being done, however, in medium iron, and the small quantity of nut and bolt iron called for is largely bought from Belgium at £3 or more below the local product. But little is being bought, either at home or abroad, in the present state of the industry. With Belgian bars offered round about £7 at Antwerp, Staffordshire manufacturers have no alternative but to apply their mills to the working up of the foreign material. If they paid £12, the price quoted for the home production, they would doubtless gain something in quality, but not enough to counterbalance the price disparity. Black Country importers have never submitted willingly to the uncertainties of the franc exchange, by which Belgian shippers have been attempting to regulate transactions. The opposition has been so stubbornly maintained that quotations in sterling are now reinstated. The Belgian quotation for nut and bolt iron delivered now stands at £8 2s. 6d., but no great quantity is being sold, local works still having considerable tonnages of bars to work up.

Galvanised Sheets.

The galvanised sheet trade is still busy with very good order books. Though buying has not been quite so continuous of late, a good many inquiries are in the market, and prices are maintained, 24-gauge corrugateds being firmly quoted at £18 5s. per ton f.o.b. The sheet trade is secure of activity for some months to come, and the tin-plate works are well off for business, readily obtaining the small increase lately made to meet the higher cost of tin and other material.

Cheaper Pig Iron.

This week has witnessed a decided fall in Midland pig iron values, Northamptonshire makes having weakened to the extent of nearly 2s. per ton, and Derbyshire makes by about 1s. per ton, while North Staffordshire brands are cheaper by round about 2s. 6d. The quotations generally ruling on 'Change in Birmingham to-day—Thursday—were :—Northamptonshire forge, £3 15s. ; No. No. 3 foundry, £4 ; Derbyshire forge, £4 ; foundry, £4 4s. to £4 5s. ; and North Staffordshire forge, £4 2s. ; foundry, £4 7s. 6d. Despite these reductions business was not stimulated. A few firms which had run completely out of material bought just sufficient to carry them on, but generally consumers continued to hold off in the expectation that forced sales will result in a further lowering of what is already an unremunerative price. Smelters for their part are relying upon cheaper fuel at the end of the month.

Raw Iron Output.

The output of pig iron in August amount to 588,900 tons, compared with 615,600 tons in July and 599,800 tons in August, 1923. The number of furnaces in blast at the end of the month was 173, a decrease of 2 since the beginning of the month, and the lowest number in blast since December, 1922. The production includes 187,400 tons of hematite, 183,700 tons of basic, 155,800 tons of foundry, and 33,800 tons of forge pig iron.

Steel Business.

Steel prices are still irregular. Demand remains poor and a good deal of the available business is being taken by continental firms at very low figures. Native angles and joists continue to range in price from £9 10s. to £10, and tees from £10 10s. to £11. Ship bridge and tank plates command £10 5s., and boiler-plates £14. Mild strip can be bought down to £10 5s. Price cutting is reported by new comers in the cold rolled strip trade. English wire rods are quoted at £11, in contrast with which the imported article is £9. Rods are being produced in English mills from continental raw material, and in that case the price is £9 10s. Foreign competition is rather keener. The continental situation has so many elements of uncertainty for the buyer that a decided check has been given to the placing of orders with French and Belgian houses, which have, as usual, in such circumstances, turned to the British market with tempting offers to enable them to supplement their home orders. Germany is more frequently heard from. British makers of steel still quote £7 10s. for billets, not being disposed to make a reduction, although the Belgian figure ranges between £6 and £6 10s.

Steel Scrap.

Steel scrap values have weakened further, and this week it is reported that sales have been made at as low a figure as £3 10s. per ton delivered Birmingham. Sellers last week wanted £3 15s. and lower offers were then turned down.

Steel Production.

The falling off in steel production is reflected in the reduction in the output of steel ingots and castings for August to 527,500 tons from 689,300 in the previous month, a drop of 160,000 tons. This is the lowest total since the previous August, when the output was 567,000 tons, and the first time this year that the production has gone below the pre-war 1913 average of 638,600 tons. More mills have since gone out of action, and September gives little hope of a better result. Some of the largest mills are idle this week for lack of orders.

Iron and Steel.

Considerable attention has this week been manifested by Midland iron and steel circles in the recently published figures of imports and exports. It is noted that the volume of trade in iron and steel and their manufactures during August was smaller, both on the import and export sides. Non-ferrous metals and manufacturers thereof were imported to an increased extent, while the exports in the same group declined. The total value of imports classified under the head of iron and steel was £1,630,502, against £1,942,681 in July, the tonnage being 173,695, against 201,172. Shipments of forge and foundry pig increased, while those of basic decreased. After the heavy deliveries of the previous month, Belgium's consignments of steel blooms, billets, and slabs dropped 50 per cent., and France also sent less. Germany's contribution rose, however, from 3458 tons in July to 5600 tons in August. There was a falling off of imports in most of the other categories, steel girders, beams and pillars being an exception. The exports of iron and steel amounted to 301,057 tons, valued at £5,834,496, against 339,748, valued at £6,690,764 in July. Taking the tonnage, there were reductions in pig iron, ferro-alloys, iron bars, rods, angles, steel girders, thin plates and sheets, galvanised sheets, tinned and terne plates, tubes, pipes and fittings, wood screws, bolts and nuts, wire and hollow-ware. Increases were shown in the export of steel blooms, billets and slabs, hoops and strips—of which the tonnage was nearly doubled—railway material, wire manufactures, and bedsteads. It was commented upon that while we exported less iron and steel during the first eight months of the current year than in the corresponding period of 1923 our imports nearly doubled.

Cannock Chase Miners' Wages.

As the outcome of a conference of representatives of the Cannock Chase coalowners and the Miners' Association, the lower-paid workers in and about the mines of the Cannock Chase district are to receive advances on their wages basis. The application of the miners was for a variation in the wages basis of the lower-paid workers, particularly of those between eighteen and twenty-one years of age, and although they have not succeeded in obtaining all they asked for, they have secured fairly substantial advances for certain classes of men. The offer of the owners is to be submitted to the men and it is anticipated that it will be accepted.

New Industry for Wolverhampton.

Much satisfaction is expressed in Wolverhampton and the immediate neighbourhood over the news that Courtaulds, Limited, manufacturers of artificial silk, has decided to add to its long list of factories by erecting a works at Wolverhampton on land acquired several years ago in Hordern-road, adjoining the Dunstall Park racecourse. The plans indicate that the complete factory will cover something like 40 acres of land. Employment, it is said, will ultimately be found for several thousand workpeople. The coming of Courtaulds to Wolverhampton will introduce an entirely new industry, of a character hitherto unknown in the town, Wolverhampton's trade reputation having hitherto depended upon her metal products.

Unemployed.

It is in some measure satisfactory to find this week that the returns issued by the Ministry of Labour show that there is a slight decrease in the number of unemployed in the Midlands, the total for last week being 149,893, as against 150,344 for the previous return. There is, however, a slight increase in the number for the Birmingham area, but Coventry has improved, and so has Cradley Heath. The total is made up of :—Men, 106,527 ; boys, 3776 ; women, 35,227 ; girls, 4363. The returns for some of the principal towns in the area are Birmingham, 38,954 ; Bilston, 3229 ; Coventry, 5156 ; Cradley Heath, 4135 ; Dudley, 4153 ; Hanley, 3394 ; Northampton, 1467 ; Oldbury, 2068 ; Smethwick, 4978 ; Stourbridge and Brierley Hill, 3836 ; Tipton, 2217 ; Walsall, 5519 ; West Bromwich, 3562 ; Wolverhampton, 6501 ; and Worcester, 1448.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

General Conditions.

THERE has been no return of cheerfulness yet in the iron and metal markets of this district. Occasionally one meets with a maker or a merchant who has

done well and expresses a belief that things are better; but this is exceptional, and, as a rule, a gloomy feeling prevails. The expectation of any immediate result from the carrying out of the "Dawes" scheme of settlement with Germany seems now to be fading; but what was wrong in this expectation was the belief that conditions would alter for the better at once. In the end the settlement will bring benefit to European business, but the results will require time to disclose themselves. The general setback in the markets, and especially the more speculative markets, is probably attributable to the disappointment felt because business did not immediately respond to the better political conditions in Europe.

Metals.

The markets for copper have been rather on the weak side, but there is no very serious setback. Standard and ingot copper are, in fact, standing at prices which will not allow of any serious fall, although, of course, there is not the same limit that the rise which might take place. The hindrance to an advance in copper is the fact that the output is still believed to be well in advance of the consumption; and, more important still, is the fact that the output is capable of prompt expansion so soon as there is the least sign of profitable prices. The suppression of regular official reports as to statistics is doing no good to the "morale" of the market; for there is now a growing belief that accumulations are increasing. There have been some substantial orders for locomotives placed in the Manchester district lately, and these may result later on in orders for copper and brass; but the general demand for ingot copper here remains only small. It is not because there is any fear as to the course of the market, for that can scarcely be the case; and hence one is compelled to the conclusion that the demand for ingot copper is poor simply because there is not the work available for its consumption. The prices for sheet copper, copper bottoms, copper and brass tubes, &c., have been unaltered for some time, and they still show what, in pre-war days, could have been thought an extravagant margin for the costs of manufacturing. All kinds of scrap copper and gun-metal remain relatively cheap, but more especially gun-metal scrap. Some dealers here are offering only £45 per ton for this class of metal. The market for tin has been in a very uncertain condition. Of course, there was some reaction from the recent slump; that was only to be expected; but the difficulty is to decide how far it will go. It was expected that American consumers would begin to buy in large quantities on the big fuel, but they do not seem to have done so. Does this mean that the American tin-plate trade is worse than has been reported? In any case, tin prices are very tricky just now, and no one seems to have any idea which way they are going. Lead has remained quite a steady market, and but little change seems to be anticipated in the near future. We have had some heavy arrivals, but the market seems capable of absorbing them, and the Continent is rather a better buyer. Spelter has been inclined to weakness again, but there has not been any serious movement.

Pig Iron.

The market in Manchester for foundry iron shows very little change; but if there be any it is rather towards weakness than strength. We are now close upon October, and an autumn revival, if coming, ought to throw its shadow before to a certain extent. Nevertheless, we have known such a revival begin in November; but then there was a special reason for it. Consumers of foundry iron here seem confirmed in their opinion that 90s. per ton in Manchester will be reached in the course of a few weeks, if not by the middle of next month; but so far one does not find much disposition to quote for No. 3 at less than 92s. 6d. A moderate amount of business is being done at or near this figure; and in some cases sales have been made up to the end of the year; but this does not appear to be at all general Derbyshire foundry iron has been quoted at the furnaces down to 84s. per ton, and this would mean about 91s. 6d. in Manchester; but that quotation does not seem to be very general. At the end of the month coke prices are to be revised in the Midlands, and ironmasters claim that they must have a reduction if they are to sell their pig iron at anything less than the present prices. They want a reduction of 2s. 6d.; but possibly they may get 1s. In reckoning the profit on blast-furnace work it has always to be borne in mind that any No. 4 or forge quality of pig turned out by a furnace has to be sold now at about 7s. 6d. per ton less than the foundry quality, instead of 1s. less, which used to be the usual difference. Scotch pig iron is quiet and dull here, and the prices seem variable. The nominal price is 108s., but very much lower prices have been heard of. Hematite pig iron in Manchester is now cheaper than Scottish foundry iron.

Finished Material.

The malleable iron trade is much in the same condition. Consumers, as a rule, cannot pay the official prices of the Bar Iron Association, and are being driven more and more to the use of foreign iron. The demand for manufactured steel is almost at a standstill. Apparently no one wants to buy at any price, or otherwise the foreign agents would sell more; for no one can expect foreign prices to fall much lower, whatever may happen. Sellers of British steel will quote £9 7s. 6d. for joists and angles, £10 2s. 6d. for plates (or perhaps £10), and £10 for flat bar steel. Some concessions might be obtained on these prices if any good orders were on the market; but one does not hear of such orders.

Scrap.

The trade in scrap materials seems almost non-existent. There is, of course, a little buying of foundry scrap, but no sign of improvement in the prices. The best broken machinery iron can be had at 85s. per ton delivered; and one hears of good cast scrap at 82s. 6d. and even 80s. For steel scrap there is no demand at all, and very little now for heavy wrought scrap. The nominal prices are 62s. 6d. per ton on trucks here for melting steel scrap, and 87s. 6d. delivered at the works for heavy wrought scrap.

BARROW-IN-FURNESS.

Hematite.

If anything there is a slightly weaker tone in the hematite pig iron market, and the production of local makers is exceeding the demand by a fairly big margin. The two furnaces in Barrow which were to have closed last week end are being kept at work, but unless there is an immediate improvement in the demand for iron, they will have to be closed down. The requirements locally on steel account, are very low indeed, and as the foundries are not brisk very little is going in that direction. If the rail and merchant mills could get going again there would be some chance of the present number of furnaces being kept in blast, but the outlook in the steel market is blacker than in the iron market. Orders are being placed for iron in small quantities, and there seems no possible chance of customers ordering in bigger tonnage. The overseas trade is very dull, and but small parcels are being dispatched. Inquiries are scarce.

Iron Ore.

There is no change in the iron ore trade, which is largely confined to this district. None of the mines is active. Should there be a further restriction in the output of iron by the damping down of furnaces there will be an immediate reflection in the ore trade. Foreign ore is coming in in moderate quantities, and there are regular imports of Spanish sorts.

Steel.

The condition of the steel trade is bad, and as far as the rail trade is concerned little is being done. There is very little to pick up either in the home market or overseas, and the outlook is as bad as it could be. Costs of production operate against the booking of orders at present. The foundries are quiet. There is a better state of things as regards the hoop and small section mills which have orders sufficient to keep them going regularly.

Shipping.

The passenger steamers of the Isle of Man Steam Packet Company which in the summer season run between Douglas, Isle of Man, and British ports are beginning to return to Barrow, where most of them are usually laid up for the winter. During the winter months these vessels are thoroughly overhauled in readiness for next season. The company has its own staff here, but in the case of bigger jobs the vessels go to Vickers' yard. Many of the L.M.S. cross-channel passenger vessels are also laying up at Barrow, and one or more may be equipped with oil-burning installations. The Isle of Man vessels which have been so altered have given very good results.

SHEFFIELD.

(From our own Correspondent.)

Heavy Steel Slump.

THERE is no change to report in the condition of that important branch of the steel industry of this district which manufactures open-hearth steel in the form of billets for commercial use. The depressed conditions of which I have written in several previous letters continue unrelieved. Owing to the strike, the large melting plants of Steel, Peech and Tozer, Samuel Fox and Co., and the Park Gate Iron and Steel Company are still idle, and their stoppage has not thrown any much increased demand on the plants that remain at work. In this important branch of the steel industry Sheffield is suffering in common with other great centres of production. Buying seems to have fallen to a minimum. The Park Gate Company has issued a statement pointing out the seriousness of the position created by the strike. It is stated that, owing to heavy financial losses of the past few years, the company adopted a line of action a year ago, which, by the aid of the utmost economy and the development of new activities, tended to improve the position. The improvement depended upon its association with customers to whom the company's products were specially attractive. As is well known to its men, the company had got every department of the undertaking to work. Now, owing to the dispute, customers are obliged to find supplies elsewhere. The condition is arising, therefore, that when the men decide to resume work, there will be no orders to be executed. "The situation," the statement concludes, "calls for the very serious attention of the company, and as a consequence it may be necessary to decide to close the works for an indefinite period. This would be a very serious step to take, but the financial position may demand it, and the statement is not to be taken as a threat, but as the presentation of an economic fact."

The Finished Trades.

The daily Press has been devoting considerable attention to Sheffield during the past week or two, and the impression seems to have got abroad that the city's trade generally is in a very bad way. This, however, is not the case with a number of branches, including some of the most typical Sheffield manufactures. While the crude steel side is certainly very depressed, there is an improvement in crucible steel, and, although conditions in that trade are uneven, a few firms have quite a good amount of business in hand. The rolling mills are busy on sheets, but quiet in the rod departments. While the chairman of the Sheffield Forge and Rolling Mills Company has been speaking of decreased production, the head of another firm, the North British Steel Works, stated that the tonnage output for the firm in 1924 was more than double that of 1914, and that at present extensions are being made to relieve the pressure of business. Another firm which is extending is Craven's Railway Carriage and Wagon Company, Limited. A new smithy and stamp shop is to be built, and the contract for the structural steel work has been given to Thos. W. Ward, Limited, of Sheffield. In files, saws and almost every kind of tools, there is a good deal of activity; numerous orders are coming to hand, although the majority of them are only for small quantities. The electrical branch of engineering is enjoying improved times, and makers of textile machinery have on hand a good many orders from overseas countries. There is a good demand for all classes of builders' requirements.

An Order for Vickers.

Sheffield shares in the satisfaction felt in Barrow at the news that the hydro-electric department of Vickers Limited has received an order from the Government of New Zealand for two large water turbines. These will be installed at Lake Coleridge, in the South Island, and will provide power for Christchurch, Ashburton, Timaru and district. Each of the turbines will be of 12,650 horse-power. They are to be constructed at Barrow, and should provide an appreciable amount of employment there.

Developments at Sheepbridge.

The annual report of the Sheepbridge Coal and Iron Company, Limited, refers to a number of developments which are being carried out. The sinking to the lower measures at Glapwell Colliery has been completed, and the work on the surface plant and sidings is making satisfactory progress. The plant at Sheepbridge for the manufacture of centrifugal castings is now in successful operation. Ironstone of good quality is now being obtained from the company's mine at Roxby, in Lincolnshire. Rapid progress has also been made with sinkings and the erection of the permanent plant at Firbeck Main and Blidworth collieries. The report states that the iron trade has continued in a state of depression, and that both demand and prices have been poor during the year. With regard to the erection of houses, for which arrangements have been made with the Industrial Housing Association, the report mentions that so far forty-eight have been built and occupied at Sheepbridge, 216 at Langwith and 66 at Glapwell, while 154 more are in course of erection at Langwith and 84 at Glapwell.

Mansfield Schemes.

The Mansfield Town Council, Southwell and Mansfield Woodhouse District Councils are considering a joint sewerage scheme for the parishes of Clipstone and Edwinstowe, and portions of the borough of Mansfield and the urban district of Mansfield Woodhouse. The estimated cost of the works is £33,000, exclusive of engineers' fees and the salary of the clerk of works. The population provided for by the scheme is 17,500. Another matter of interest to Mansfield is the proposed technical college. This was referred to last week by Mr. A. J. Campbell, assistant director of education for the county of Notts. He spoke of the delay which has taken place in connection with the scheme, but expressed the hope that the plans would be submitted during the coming year. The cost will be between £30,000 and £40,000, towards which the substantial promise of £10,000 has been received from the Miners' Welfare Fund.

At Hull and Selby.

The Sheffield Society of Engineers and Metallurgists paid a visit last week-end to some large modern cement works near Hull, which have just been taken over by G. T. Earle, Limited, from the Humber Portland Cement Company. The works are laid out for the production of 2400 tons of cement per week, and are equipped with plant supplied by Edgar Allen and Co., Limited, of Sheffield. The chalk is taken from the hillside by means of large steam shovels, loaded into side-tipping wagons and conveyed to gyratory crushers, being afterwards converted into slurry and then pumped through a 6in. pipe for a distance of 1¼ mile to the factory proper. At Selby last week Cochrane and Sons, Limited, launched from their Ouse Shipbuilding Yard one of the largest steel screw tugs ever constructed by the firm. The boat is 125ft. long by 28ft. wide, and 14ft. 6in. moulded depth, and it was built to the order of the United Towing Company, Limited, of Hull.

NORTH OF ENGLAND.

(From our own Correspondent.)

Vexatious Transport Delay.

A STRIKING example of the vexatious delay experienced in the transportation of materials on the North-East Coast, which has been the subject of severe complaints from the commercial community for a long time past, is furnished this week. Smiths Dock Company, Limited, of South Bank, had an urgent ship repair job, and the necessary plates were ordered from Dorman, Long and Co.'s Warrenby Works, and were duly despatched by rail on Friday morning last. Up to Tuesday evening—five days later—the plates had not been delivered, and the repair contract may possibly be lost in consequence. The distance between the two works is only 7 miles.

Cleveland Iron Trade.

There is a complete absence of indication of any improvement in the Cleveland pig iron trade. Confidence is still lacking. Prices are not yet sufficiently stabilised for buyers to care to operate for forward business, and even for the satisfaction of prompt requirements there is usually a good deal of bargaining before a sale is effected. Certainly there is no steadiness about quotations. No. 3 Cleveland pig iron is generally quoted at 82s., and has been sold at that figure. But it has also been sold and offered at less, and the price is a matter of individual arrangement as between buyer and seller. The trouble is that the home demand is so limited. The slackness at the shipyards directly affects the foundries, and they, in turn, have so little work that they are using less iron.

Then, again, foreign competition is very keen. French and Belgian iron is offered f.o.b. from Antwerp as low as 73s. per ton, and it is only when consumers prefer to pay more for a pig iron which they know, rather than risk using iron which is variable in quality, that Cleveland iron can be sold for export to the Continent. Here and there, however, under these conditions small export orders are being secured, and a sale of special foundry iron from Cleveland to the United States is also reported. No 1 Cleveland iron, which is scarce, is 87s., No. 4 foundry 81s., and No. 4 forge 80s.

Hematite Pig Iron.

There have been rather better sales of East Coast hematite pig iron during the week. Of course, business has not been brisk by any means, but even a little better demand is welcome after the long stagnation, and makers are keeping the price of mixed numbers steady at 90s., with No. 1 at 6d. per ton premium. Here, again, however, the quoted price can be shaded for a good order.

Ironmaking Materials.

The foreign ore trade continues in a lifeless state, consumers having accumulated large stocks during the iron trade depression. Although quotations are based upon 22s. per ton for best Rubio ore c.i.f. Tees, current values are more nearly 21s. 6d. per ton. Sellers of good medium furnace coke still quote 26s. per ton delivered at the works, but there is little demand.

Manufactured Iron and Steel.

Conditions in the manufactured iron and steel trade, if no better, are certainly no worse. A few rail orders have been placed recently, and small contracts for other descriptions of material come irregularly to hand. But there is no general buying movement, and sales are within very restricted limits. There is, however, no indication of easier prices.

The Coal Trade.

The position in the Northern coal trade continues to give cause for considerable anxiety, and in many instances colliery owners are in a quandary as to the best course to take in view of the fact that considerable quantities of coal are being dumped at the pitheads because of the lack of demand. There is a continued and marked lack of orders, and the suspension of operations at another colliery in Northumberland is announced to take place at the end of next week. This is the Redheugh Colliery, at which part of the men were paid off in July. Now the remaining 600 to 700 men are to be dispensed with. The outlook ahead is certainly not very cheerful, and unless there is an early improvement in trade there appears no other alternative but to close down further pits. Whilst colliery owners adhere to recent quotations for early delivery and are disinclined to negotiate ahead to any extent, second hands are prepared to make concessions. Comparatively cheap German coal is capturing foreign markets. This week a firm of coal exporters in Newcastle received a letter from Sweden stating that the works which had recently bought German coal were satisfied with it, and preferred it to the English coal, taking into consideration the difference in price, for in Sweden German coal can be bought much cheaper than English coal. The coke trade is quiet, but production is well taken up, and in some instances makers are drawing from stocks to meet heavy shipments. Gas coke is quiet for forward business, but steady at 36s. to 37s. 6d. Patent oven coke is offered at 25s. to 26s. Beehive coke is scarce and firmly held at 32s. 6d. to 37s. 6d.

SCOTLAND.

(From our own Correspondent.)

Continued Depression.

THE Scotch steel and iron trade, and, to a lesser degree, the coal trade, remain in a state of depression. Business on all sides is very difficult to conduct, and the outlook holds little, if any, degree of encouragement. Buyers generally adhere to the principle of purchasing only for immediate requirements, and these daily or weekly necessities are at present reduced to a minimum. Keen competition is being met with, and there appears every likelihood of still sterner opposition from continental sources. Even the smallest orders are difficult to secure, even when home makers go to the limit in the matter of price reduction. Reports of work going abroad still come to hand, and there seems to be no immediate prospect of checking such movements. With conditions so unsettled producing for stock is almost impracticable, and consequently many establishments are working at a rate of production far below normal capacity. Immediate opinion is all against any improvement this autumn, whatever the turn of the year may bring.

No Demand for Pig Iron.

The state of trade is to some extent reflected in the poor situation in the pig iron trade. Neither the steel works nor the ironworks are taking anything of importance, while the export demand is exceptionally weak. Prices have suffered various reductions without bringing any reward in the way of increased business, and the weakening tendency continues. Very few furnaces are in operation, and the number is almost certain to be cut down further with conditions as at present.

Steel Plates and Sections Inactive.

Specifications for plates and sections are far below expectations, even allowing for the quieter situation at the shipyards. It is evident that local makers are securing a very low percentage of the work on hand. Home prices are unchanged, but for export plates prices are being quoted round about or as low as £9 5s. per ton. Sections are little, if any, better off, the export price in this material ranging from £8 10s. to £8 5s. per ton. The nature of the specification practically decides the price at present.

Steel Sheets.

Steel sheets continue to book a fair number of orders, but the bulk of the new business is still concerned with thin sheets, and a larger proportion of heavy gauges would be welcome. Plants, however, are fairly well occupied, and will be so for some time yet. Prices are firm.

Finished Iron.

Dull conditions characterise all sections of the finished iron trade. Bar iron makers have occasional orders for small sizes, but orders of considerable bulk are almost entirely absent. Re-rolled steel is similarly placed. Home prices are unchanged, re-rolled steel being about £9 5s. to £9 10s. per ton, but export is purely a matter of arrangement.

Coal.

The coal market is unsettled, and what business there is is of a fluctuating nature. Collieries are largely engaged running off old contracts, and they are not booking much in the way of fresh orders. Owners profess considerable apprehension regarding German competition, and the probability of low prices from producers in that country having a further detrimental effect on the already restricted foreign trade, seems very real. At any rate, new business is at a low ebb so far as owners are concerned, the bulk of the restricted turnover going through second hands. Forward transactions are of little account, the prices quoted being outside the ideas of buyers. Lanarkshire splints have been fairly well booked ahead, and maintain a degree of firmness, and third-class Fifeshire steams are similarly placed. Other descriptions of round coal, with the probable exception of screened navigation, show further weakness. Treble and double nuts are active, but single nuts and smaller sizes are poorly bought. Aggregate shipments amounted to 274,194 tons, against 250,724 tons in the preceding week and 335,502 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

IT is again quite impossible to strike a more cheerful note regarding the position or prospects of the steam coal trade. Neither the events of the past week nor indications respecting the future give ground for optimism, and unless the governing conditions undergo a radical alteration. It is difficult to see how there can be any improvement upon the existing depressing state of affairs. There has been no expansion in the demand, and inquiries are not coming forward as might have been expected in view of the low prices. The foreigner apparently thinks there is no bottom to the market and that the paucity in the demand from abroad must be followed by further reductions in price. As a matter of fact, there is very little real market as prices are controlled entirely by individual circumstances. There have been reductions in quotations, especially to those who have been able to take quick shipment, this course being preferable to collieries being brought to a standstill. On the other hand, there has been an advance in outward rates of freight, both for the westward and for the Mediterranean trade, so that while an exporter might have been able to get a concession on the coals, he has had to pay a higher rate of freight to obtain ready tonnage. Tonnage has become very scarce owing to so many steamers having been sent out westward—numbers of them in ballast—and bad weather has retarded the arrival of vessels, with the result that the position of numerous collieries has been a most unenviable one for prompt loading. The stocks of standing coals have increased and there have been innumable temporary stoppages of work at pits, which, of course, are costly items to the owners.

The Coalfield.

There is no doubt that the position in the coalfield is more serious than ever, and while the owners are experiencing their troubles in the financial sense, the workmen are having a very bad time from the employment point of view. This does not apply to the anthracite section but to the steam coal area. There is scarcely a colliery that is maintaining regularity of work, and the number of pits which have been closed or are on the verge of being stopped is increasing. There appear to have been hopes that the stoppage of work at the Bedlinog pits Nos. 1 and 2 would have been averted, and at the end of last week deputations on behalf of the miners and the Chambers of Trade of Merthyr and Dowlais waited upon the directors of Messrs. Guest, Keen and Nettlefolds, but the appeal was of no avail. The reply of the directors was that owing to the very heavy losses sustained it was impossible to carry on work any longer. It was ascertained that £100,000 spent by Messrs. Guest, Keen and Nettlefolds on new drifts in the Dowlais area had been lost by the company through these undertakings proving unremunerative. The deputations were further informed that fears were entertained that further suspension of work at other local collieries might be compulsory. Unfortunately this warning has come true, as on Monday last over 2000 miners employed at Castle Pit and Level (Troedyrhiw) and Gethin Colliery (Abercanaid) received notices to terminate their contracts in a fortnight's time. These pits are owned by Messrs. Crawshay Brothers (Cyfarthfa), which firm are embraced by Messrs. Guest, Keen and Nettlefolds. The position for the Merthyr and Dowlais district is an extremely serious one. Altogether it is understood that the number of unemployed miners in the steam coal section of South Wales runs to over 30,000. The Ocean Coal Company has been compelled to close down one of its pits at Abergwynfi for the reason that it cannot obtain on the market a price within some shillings per ton of the actual cost of producing coal. Fourteen days' notices have been served upon its miners, to the number of between 700 and 800. Numerous workmen in other areas are sharing the same fate.

Newport Docks Facilities.

The Newport Chamber of Commerce has decided to approach all the bodies interested in the port with a view of making a joint deputation to Sir Felix Pole, the general manager of the Great Western Railway, regarding the facilities for coal shipments. The Chamber views with considerable concern the contemplated postponement of the making of the proposed dock siding accommodation at the Newport Docks, and the possible postponement of the widening of the main bridge and the provision of a new bridge. It was stated at a meeting of the Chamber that with the exception of a short relief road the accommodation was the same as fifty years ago.

Cape Copper Works.

It is reported that negotiations for the purchase of the Cape Copper Works, Briton Ferry, by an East London firm, have been in progress for about six months, but have now been concluded. These works are the oldest copper smelting works in the country, and have been closed down since 1920, but they are well equipped.

New Coal Seam.

The Ystalfera Colliery Company, which has been developing on an extensive scale at Ystalfera, is reported to have struck a 9ft. seam of coal.

Current Business.

Business has been quiet all round and the supplies of coal on offer have been heavy. The depression has not been confined to any particular class, as even the superior grades of large have suffered weakness, and prices are not better than 27s. 6d. to 28s. The inferior qualities have been plentiful and easy, and in the case of small coals stocks have been so heavy that collieries have been banking supplies owing to there being no satisfactory market. In the anthracite section the position is very different, and the market for practically all descriptions is quite firm and collieries are well booked up for the next month or two.

LAUNCHES AND TRIAL TRIPS.

DON, cargo and passenger steamer; built by Vickers, Limited; to the order of the London, Midland and Scottish Railway Company; dimensions, 240ft. by 34ft. by 16ft. 4in. Engines, one set of three-crank inverted vertical, direct-acting triple-expansion, 22in., 36in., 61in. by 39in. stroke; pressure, 180 lb.; constructed by the builders; launch, September 18th.

CONTRACTS.

WE are informed that Thos. W. Ward, Limited, Albion Works, Sheffield, have secured a large contract for structural steel work for new smithy and stamp shop for Craven's Railway Carriage and Wagon Company, Limited, Sheffield.

THE Thurnscoe (Yorks.) Urban District Council has placed a contract for new sewage disposal works with the Provincial Construction Company, Limited, of Sunderland, at approximately £25,000. The plans and specifications were prepared by Messrs. W. H. Radford and Son, of Nottingham.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

AN interesting event occurred at the works of R. Broadbent and Son, Limited, Stalybridge, on Friday, September 19th when the directors presented to Mr. Joseph Broadbent, a member of the board and manager, with a silver tea service and a gold watch, to mark the completion by him of fifty years' service with the company. The opportunity was also taken of presenting a gold watch to each of four men who have served over forty years with the firm. Every employee also was given an additional full week's wage.

BRADFORD ENGINEERING SOCIETY.—The Bradford Engineering Society has arranged an attractive programme of lectures for the coming twenty-sixth session, 1924–25. The opening meeting will be held on October 6th, when the President, Mr. I. Baldwin, will give a short address on a visit to the Redcar Steel Works of Dorman, Long and Co., Limited, which will be followed by the exhibition of a cinematograph film showing the operation of the new electrically driven plant at the works of that well-known firm. Mr. R. B. Pullin, of Rockferry, will also requisition the cinematograph to illustrate his lecture on "The Gyro Compass." As might be expected in an industrial community such as Bradford, the outstanding feature of the session's work is the prominence which will be given to power production. In this connection, Mr. B. C. Johnson, of Manchester, will speak on "The Geared Steam Turbine Drive for Textile Mills," and at a joint meeting with the Yorkshire branch of the Institution of Mechanical Engineers Mr. W. S. Burge will deal with "The 'Pass-out' Steam Turbine," subjects which are both of the greatest importance to millowners at the present time. "Water Purification, with special reference to Boiler Feed," by Mr. H. W. Coulson, of London; and "The Application of Colloid Chemistry to the Elimination of Grease from Boiler Feed Water," by Mr. H. W. Bannister, of Liverpool, bear upon a subject which must be regarded as of great value to steam users generally. "The Gas Turbine," by Mr. Hugh Campbell, of Halifax, is in very competent hands; and the latest developments in electric power distribution have been entrusted to Mr. J. W. Townley, the deputy city electrical engineer, and Mr. W. A. Benger. "Problems in Engine Governing" will be discussed by Mr. M. Carter, and Professor Charnock will explain "The Steam Ejector Air Pump." Workshop operations and the practical side of engineering have not been overlooked. Mr. F. Somers, of Halesowen, will speak on "The Manufacture of Forgings," and Mr. G. Bull, of Leeds, will give an account of "Hydraulic Machine Tools and Power-saving Appliances." A notable event, which it is hoped may become an annual fixture, is the conversazione of local technical societies, which will be held in February next, and in which the Bradford Textile Society, the Textile Institute, the Society of Dyers and Colourists, and the Bradford Engineering Society will take part. The meetings of the Society are held at the Bradford Technical College, and Professor G. F. Charnock, of that institution, is the hon. secretary.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	17/6 to 24/-
(1) Spanish	23/-
(1) N. African	23/-
N.E. COAST—	
Native	—
Foreign (c. ...)	22/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 15 0	—
No. 1 Foundry	4 16 3	—
No. 3 Foundry	4 11 3	—
N.E. COAST—		
Hematite Mixed Nos.	4 10 0	4 10 0
No. 1	4 10 6	4 10 6
Cleveland—		
No. 1	4 7 0	4 7 0
Silicious Iron	4 7 0	4 7 0
No. 3 G.M.B.	4 1 6	4 1 6
No. 4 Foundry	4 1 0	4 1 0
No. 4 Forge	4 0 0	4 0 0
Mottled	—	—
White	—	—
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	9 2 6	—
North Staffs. Forge	4 2 0	—
„ „ Foundry	4 7 6	—
(3) Northampton—		
Foundry No. 3	4 0 0	
„ Forge	3 15 0	—
(3) Derbyshire—		
No. 3 Foundry	4 4 0 to 4 5 0	
Forge	3 17 6	—
(3) Lincolnshire—		
No. 3 Foundry	4 10 0 to 4 12 0	
No. 4 Forge	4 12 6 to 4 15 0	
Basic	4 5 0 to 4 10 0	
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	5 5 0 (a) / 5 10 0 (b)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	12 10 0	—
Best „	—	—
N.E COAST—		
Common Bars	12 10 0	—
LANCS—		
Crown Bars	13 0 0	—
Second Quality Bars	12 0 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	13 10 0	—
Best „	14 0 0	—
Hoops	15 0 0	—
MIDLANDS—		
Crown Bars	12 15 0 to 13 0 0	
Marked Bars (Staffs.)	15 0 0	—
Nut and Bolt Bars	12 0 0	—
Gas Tube Strip	13 5 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 10 0	—
Ship Plates, ½in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ½in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	9 15 0	—
Angles	10 0 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	13 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	9 10 0	—
Soft Billets	8 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 5 0†	—
Light „	9 10 0 to 10 0 0†	
Billets	8 10 0 to 12 0 0†	
MANCHESTER—		
Bars (Round)	10 5 0 to 10 15 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 0 0 to 10 5 0	—
„ (Lancs. Boiler)	13 10 0	—
SHEFFIELD—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	9 10 0	
Intermediate Basic	9 0 0	
Soft Basic	8 5 0 to 8 10 0	
Hoops	12 10 0 to 13 0 0	
Soft Wire Rods	11 0 0 to 11 10 0	
MIDLANDS—		
Small Rolled Bars	9 7 6 to 10 0 0	
Billets and Sheet-bars	7 10 0 to 7 15 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	18 5 0	—
Angles	9 10 0 to 10 0 0	
Joists	9 10 0 to 10 0 0	
Tees	10 10 0 to 11 0 0	
Bridge and Tank Plates	10 10 0	—
Boiler Plates	14 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	23/6 to 23/7½
Block Tin (cash)	227 15 0
„ (three months)	229 10 0
Copper (cash)	62 0 0
„ (three months)	63 0 0
Spanish Lead (cash)	32 15 0
„ (three months)	32 8 3
Spelter (cash)	32 7 6
„ (three months)	32 7 6
MANCHESTER—	
Copper, Best Selected Ingots	67 10 0
„ Electrolytic	68 10 0
„ Strong Sheets	92 0 0
„ Tubes (Basis price)	0 1 1¼
Brass Tubes (Basis price)	0 1 0
„ Condenser	0 1 2¼
Lead, English	35 0 0
„ Foreign	33 10 0

FERRO ALLOYS.

(*All prices now nominal.*)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8½ per lb.	
Ferro Tungsten	1/4½d. per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	8/-
„ 6 p.c. to 8 p.c. „	£23 10 0	7/9
„ 8 p.c. to 10 p.c. „	£23 0 0	7/6
„ Specially Refined		
„ Max. 2 p.c. carbon	£43 0 0	16/-
„ „ 1 p.c. „	£52 0 0	17/6
„ „ 0.75 p.c. carbon	£60 0 0	20/-
„ „ carbon free	1/5 per lb.	
Metallic Chromium	4/2 per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
„ Silicon, 45 p.c. to 50 p.c.	£12 0 0	scale 5/- per unit
„ „ 75 p.c.	£17 17 6	scale 6/- per unit
„ Vanadium	18/3 per lb.	
„ Molybdenum	7/9 per lb.	
„ Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£155	
Cobalt	10/6 per lb.	
Aluminium (per ton)	£130	

FUELS.

	Export.
SCOTLAND.	
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	18/-
„ „ Ell	19/6
„ „ Splint	22/- to 24/6
„ „ Trebles	21/9
„ „ Doubles	18/-
„ „ Singles	14/9
AYRSHIRE—	
(f.o.b. Ports)—Steam	18/-
„ „ Splint	22/-
„ „ Trebles	21/9
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	16/- to 19/3
Screened Navigation	26/-
Trebles	24/-
Doubles	19/-
Singles	15/3
LOTHIANS—	
(f.o.b. Leith)—Best Steam	17/9
Secondary Steam	17/-
Trebles	23/3
Doubles	19/9
Singles	15/-
ENGLAND.	
(8) N.W. COAST—	
Steams	28/6
Household	45/- to 58/4
Coke	33/6
NORTHUMBERLAND—	
Best Steams	19/- to 19/6
Second Steams	17/6 to 18/-
Steam Smalls	10/9 to 11/-
Unscreened	15/6 to 17/-
Household	23/6 to 25/-
DURHAM—	
Best Gas	22/- to 22/6
Second	17/- to 18/-
Household	23/6 to 25/-
Foundry Coke	26/ to 26/6

	Inland.	Export.
SHEFFIELD—		
Best Hand-picked Branch	32/- to 35/-	—
Barnsley Best Silkstone	26/- to 28/-	—
Derbyshire Best Brights	26/- to 28/-	—
„ „ House	23/- to 25/-	—
„ „ Large Nuts	21/- to 25/-	—
„ „ Small „	15/- to 17/6	—
Yorkshire Hards	21/6 to 22/6	—
Derbyshire „	21/- to 22/-	—
Rough Slacks	12/6 to 15/6	—
Nutty „	12/- to 14/-	—
Smalls	6/- to 8/6	—
Blast-furnace Coke (Inland)*	—	—
„ „ (Export)	f.o.b.	26/- to 27/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	27/6 to 28/-
Second „ „	26/- to 27/-
Best Dry Large	26/- to 26/6
Ordinary Dry Large	25/- to 26/-
Best Black Vein Large	25/6 to 26/-
Western Valley „	24/6 to 25/-
Best Eastern Valley Large	24/6 to 25/-
Ordinary „ „	23/6 to 24/-
Best Steam Smalls	15/6 to 16/-
Ordinary „	13/- to 15/-
Washed Nuts	25/- to 27/-
No. 3 Rhondda Large	27/- to 27/6
„ „ Smalls	19/6 to 20/-
No. 2 „ Large	23/- to 24/-
„ „ Through	18/- to 20/-
„ „ Smalls	12/- to 14/-
Foundry Coke (export)	45/- to 52/6
Furnace Coke (export)	27/6 to 32/6
Patent Fuel	26/- to 28/6
Pitwood (ex ship)	29/- to 30/-
SWANSEA—	
Anthracite Coals	
Best Big Vein Large	52/6 to 55/-
Seconds	45/- to 47/6
Red Vein	33/- to 35/-
Machine-made Cobbles	57/6 to 62/6
Nuts	55/- to 62/6
Beans	40/- to 42/6
Peas	24/- to 26/-
Breaker Duff	11/- to 11/6
Rubbly Culm	12/6 to 13/-
Steam Coals:	
Large	22/6 to 23/6
Seconds	22/- to 22/6
Smalls	14/- to 16/-
Cargo Through	17/- to 19/-

(1) Delivered (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* For blast furnaces only, 21/- to 25/-; open market, round about 24/- at ovens. † Latest quotations available. (a) Delivered Sheffield or Glasgow. (b) Delivered Birmingham

French Engineering Notes.

(From our Correspondent in Paris.)

German Reparations.

THE conditions that have been imposed upon Germany to supply goods on account of reparations are being discussed in a critical spirit by manufacturers. They were quite favourable to payments being made in kind so long as they were restricted to raw material or to goods that did not compete directly with home industries; but now that payments are being made largely in manufactured goods they hold that the situation has become much more serious. The immediate result will be to favour the development of German industries at the expense of French. Nothing has yet been done to appease the feelings of locomotive and wagon builders over the placing by the Government of a large order in Germany on account of reparations, and the report that further orders are to be distributed for requirements during the next five years has not yet been denied. The only element of consolation is that the Government has promised to give out no new orders to Germany without consulting the industries concerned. It is certain that those firms which laid themselves out extensively after the Armistice for the construction of locomotives and rolling stock generally, and which have since had very little work allotted to them, will have to abandon this branch of industry if the future requirements are to be supplied by Germany. Again, German makers of machine tools are beginning to advertise in this country the goods they are prepared to supply on account of reparations. The opportunities now offered to German firms to develop their business are unprecedented. They will be paid for their goods at the expense of the German taxpayers, who will indirectly benefit themselves, and the money for reparations is to be used to give employment to German manufacturers who will be in a position practically to control the world's markets. Before the matter goes too far there is bound to be a strong reaction in favour of limiting reparations to raw material and to goods that do not come into competition with home industries.

Protection.

On the occasion of the visit of the Minister of Commerce to Alsace some rather strong representations were made on behalf of the Strasburg Chamber of Commerce concerning the evil effects upon the commerce of Alsace produced by the protectionist policy carried out in France. In this respect Strasburg is following the example of Lyons, Marseilles and other great commercial centres, which hold that business can only be developed by providing facilities for the interchange of goods with other countries. There is a good deal of indecision regarding the fiscal policy to be adopted in the future, on account of the conflicting interests of the manufacturing industries and of the commercial communities, who hope to see France become one of the great centres of traffic in Europe. The waterway schemes and the port improvements are intended to create lines of traffic between Central Europe and the Channel, Atlantic and Mediterranean coasts. It is argued that if this traffic is to be developed the present Customs methods must be modified in the direction of helping trade instead of impeding it, and the Customs duties must be adapted more intelligently to the national interests instead of to the interests of certain classes. The Alsatian representatives were very insistent in their demands for a more liberal commercial policy which would enable Strasburg to develop its traffic and permit of the restored provinces carrying on business with neighbouring countries. Meanwhile, the present Government finds itself in something of a dilemma, for while it is believed to be favourable to a more liberal trade policy, it is, nevertheless, harassed by the complaints of some of the manufacturing industries which affirm that their future is imperilled unless they are adequately protected by higher import duties.

Electric Traction.

In view of the manifestations in favour of electric traction which will be carried out next year in connection with the exhibition at Grenoble, more than usual importance is being given to the trials of electric vehicles being organised to take place in the neighbourhood of Paris early in October. Nevertheless, the interest does not appear to be so pronounced as would seem to be warranted by the propaganda work accomplished by the Union des Syndicats de l'Electricité, which is organising the trials. Car builders are evidently waiting until the promises of cheap electrical energy are realised before embarking upon the construction of electric vehicles. Despite the extraordinary progress that has been made in electrical distribution all over the country, there has been no reduction in the cost of current, nor has anything yet been done in the way of creating preferential rates, whereby specially favourable terms will be offered to certain classes of consumers, including owners of road vehicles. For the forthcoming trials there are only seven entries, amongst which are those of three motor car firms, an electrical engineering concern, an electric traction company, and M. Krieger, who is the only builder of electric cars to have continued their construction since the early days of the motor industry.

Foreign Trade.

While the values of goods exported have fluctuated in a downward direction since the record total for last March, the returns for the first eight months of the year nevertheless continue to show an excess of exports over imports, a particularly interesting feature being the progress in the sales of manufactured goods, the value of which, including the consignments by post, were in excess of the value of raw material imports. The total imports were valued at 26,044 million francs, an increase of 6127 million francs on the corresponding period of last year, and the total value of exports was estimated at 27,363 million francs, an increase of 8215 million francs.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

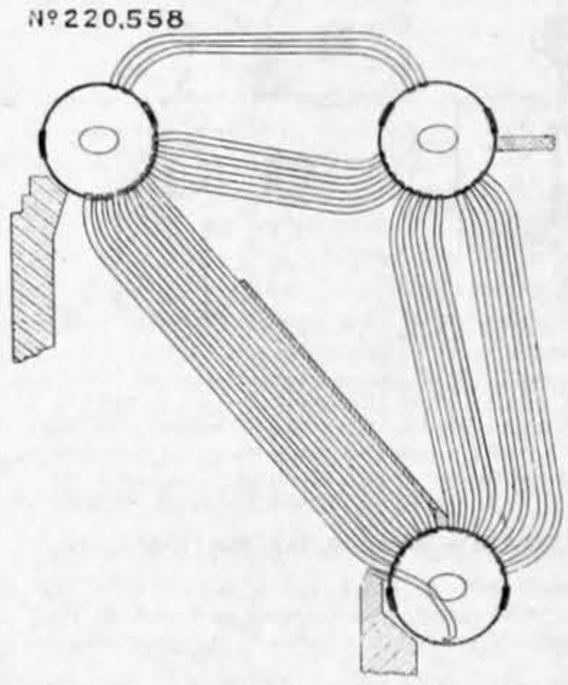
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

220,558. February 7th, 1924.—WATER-TUBE BOILERS, The Stirling Boiler Company, Limited, 54, Victoria-street, Westmins er, and H. J. S. Mackay, 6, Charles-street, St. James-square, Haymarket, London, S.W. 1.

In some forms of water-tube boiler there may exist during banking or low evaporating periods a limited circulation which may cause some difference between the temperature of the top and bottom of the mud drum; the consequence is that the drum may tend to camber, thus inducing strains on the butt straps,

Nº 220,558



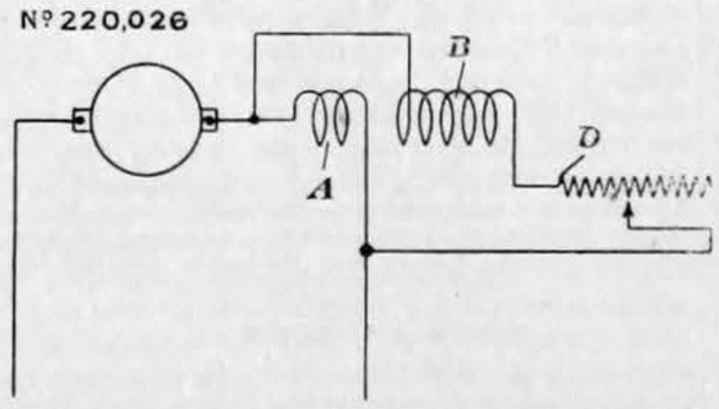
joints or rivets. In order to avoid such strain and to equalise the temperature throughout the mud drum, there are fitted to a number of the main tubes entering this drum, and extending over the fire, extension pieces projecting nearly to the bottom of the drum. In each of these extension pieces is fitted a steam jet device serving to induce an upward circulation in the tubes. The consequence is that the water in the mud drum is agitated and a circulation of warm water is induced throughout the drum, thus equalising the temperature and reducing the tendency to camber.—*August 21st*, 1924.

DYNAMOS AND MOTORS.

220,026. April 28th, 1923.—IMPROVEMENTS RELATING TO WINDINGS ON COMMUTATING POLES OF DYNAMO-ELECTRIC MACHINES, Adolph Harry Railing and Max Ludwig Kahn, both of Magnet House, Kingsway, W.C. 2.

The object of this invention is to provide an improved method of regulating the magneto-motive force of commutating pole windings and to make the necessary adjustments without appreciably altering the time constant of the electric circuit through the windings and the regulating medium. In addition

Nº 220,026

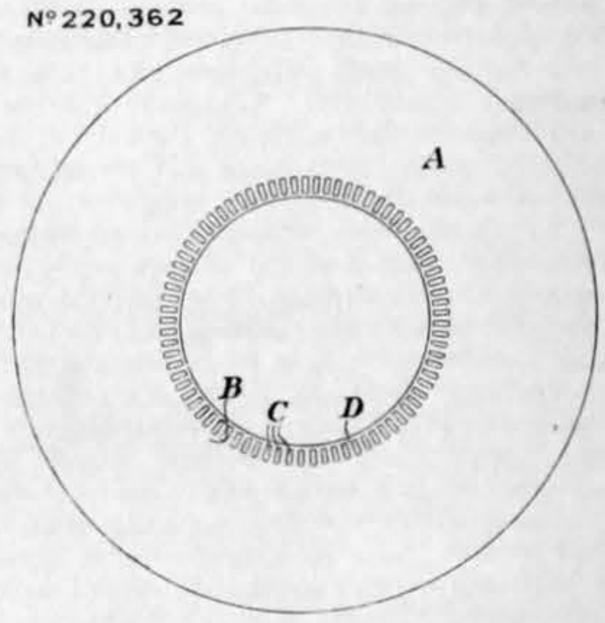


to the usual windings A which carry the main current, each commutating pole is also provided with a winding B. This coil has a resistance substantially greater than that of the main coil. The number of turns on this coil is also substantially greater than the number on the main coils. The additional coils B are connected in parallel with the main coils as shown. The main coils carry the bulk of the current and the auxiliary coils B only a fraction of the current. By introducing a resistance D in series with the auxiliary coils the current in these coils can be altered. —*June 28th*, 1924.

220,362. May 16th, 1923.—IMPROVEMENTS RELATING TO DYNAMO ELECTRIC GENERATORS, Jan Arthur Kuyser, of Knowle Lodge, Sibson-road, Sale, Chester, and the Metropolitan Vickers Electrical Company, of 4, Central-buildings, Westminster.

In dynamo electric machines the stator cores have usually been provided with end plates of iron, between which and the cores in the neighbourhood of the teeth, finger plates of iron or bronze have been inserted. According to this invention the end plates and fingers are constructed of a non-magnetic material which has a conductivity higher than 40 per cent. of Mathieson's standard conductivity of copper. When the fingers are bridged across at their inner ends by a continuous ring integral with the fingers, the ring is also constructed of similar material having an electrical conductivity higher than 40 per cent. of Mathieson's standard conductivity for copper. By this means the stator currents readily induce currents, corresponding to their own value in the material of the end plates and fingers, and energy loss is to a large extent neutralised. When a continuous ring is employed to bridge over the ends of the fingers a large neutralising current may flow in the ring. In the form illustrated the end plate A is of non-magnetic material having high electrical conductivity, such, for instance, as rolled copper, and the fingers B are formed integral. The winding slots C between the fingers do not extend to the inner periphery of the plate, whereby a continuous ring D is formed between the winding slots and the stator bore. The ring D provides an electrical conducting path capable of carrying heavy currents and, owing to the fact that the fingers are integral with the end plate, the heat generated in the ring D and the fingers is readily conducted outwardly and dissipated from the surface of the large

Nº 220,362



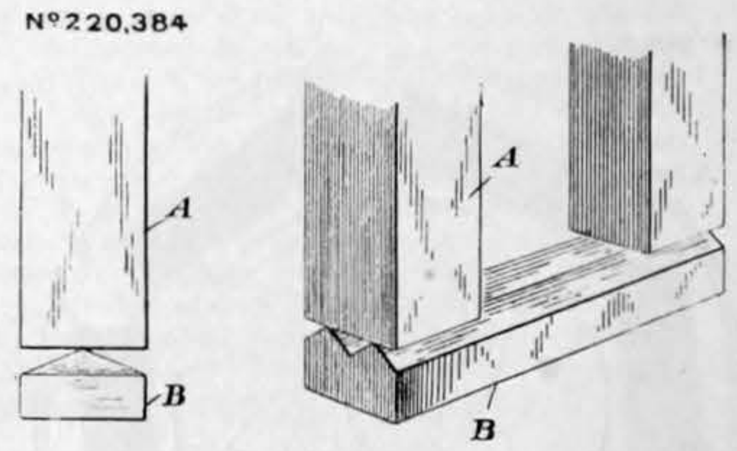
mass of metal of the plate A. In a modification of the form illustrated the slots C are continued into the inner periphery of the fingers B, the latter being of material having high thermal conductivity so that the heat generated in the fingers and in the plate is readily conducted outwardly and dissipated.—*August 11th*, 1924.

SWITCHGEAR.

220,384. May 17th, 1923.—IMPROVEMENTS IN OR RELATING TO ALTERNATING-CURRENT ELECTRO-MAGNETS, A. Reyrolle and Co., Limited, of Hebburn-on-Tyne, Durham, and Percival Frank Harris, of 223, St. Vincent-street, South Shields, Durham.

This invention relates mainly to alternating-current electromagnets, as used in alternating-current relays or contactors,

Nº 220,384



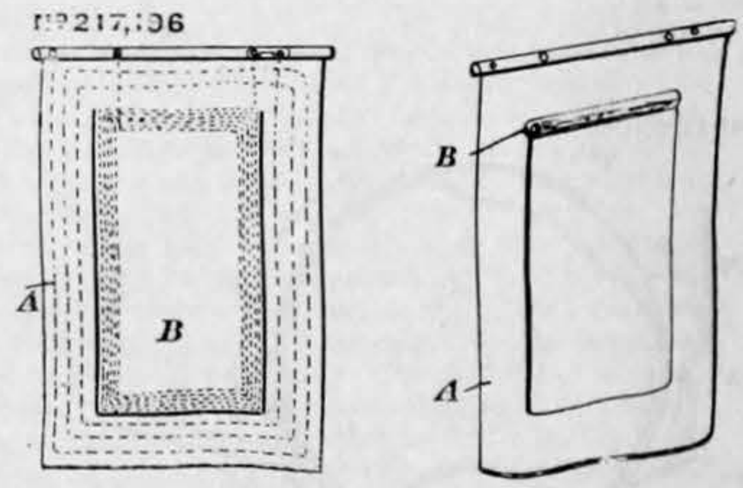
and the object is to avoid chattering and sticking between the members between which mutual attraction exists. Both of the surfaces A and B of the co-operating laminated magnetic members are formed with one or more points or ridges of small surface areas, which prevent the two main surfaces touching over their main areas, and prevent chattering or sticking without the use of a shaded pole.—*August 18th*, 1924.

TELEGRAPHS AND TELEPHONES.

217,196. May 16th, 1924.—IMPROVEMENTS IN FRAME AERIALS, Société Francaise Radio-Electrique, of 79, Boulevard Haussmann, Paris.

This specification describes a frame aerial which can be used efficiently for receiving long and short waves. The portion of the winding which is not used when receiving short waves is mounted on a movable support which allows this portion to be placed in

Nº 217,196



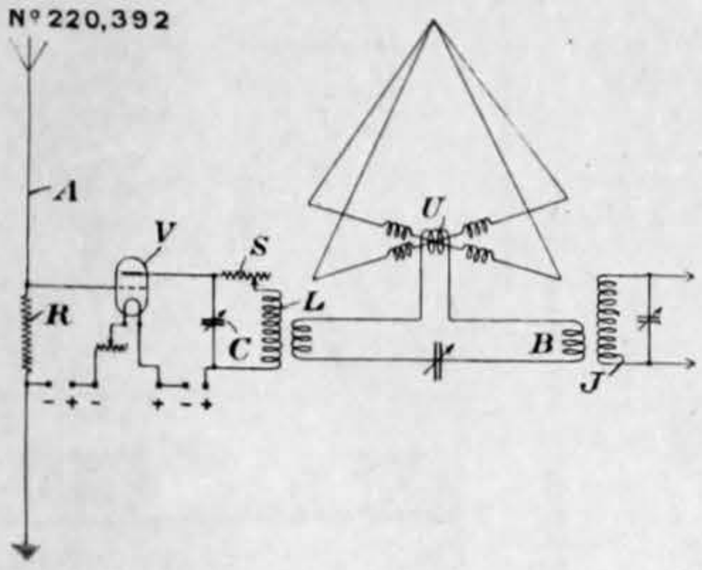
a position in relation to the active portion, where there is little or no reaction between the two portions. A spiral conductor is supported on the surface of a fabric. The portion of the winding with widely spaced turns is on the outer part A of the fabric, whilst the middle part B carries the other portion of the winding. This portion of the fabric may be rolled up as shown in the right-hand illustration.—*August 14th*, 1924.

220,392. May 18th, 1923.—IMPROVEMENTS IN WIRELESS RECEIVING SYSTEMS, George Maurice Wright, of Lyngrove, Cromwell-road, Chesterfield, and Laurence Davenport Hill, of Engineers' Club, Coventry-street.

This invention relates to wireless receivers with a directional and non-directional aerial. The inventors combine with one of the aerials a thermionic valve, so that the currents produced by the incidence of the waves to be received on the two aerials may be made to balance, and thus a cardioid polar diagram may be obtained for various wave lengths. A is the vertical aerial which is damped by a series resistance R of a valve that will give the aerial its critical damping. The filament and grid of a valve V are connected to either end of this resistance. In the plate circuit of the valve there is an inductance L with a small impedance as compared with the resistance of the valve, which may be varied by a variable resistance S in series with it and by the condenser C. The inductance is coupled magnetically to the search coil circuit of a radiogoniometer U. A coupling coil B included in the same circuit induces current in the inductance

J which is connected to any suitable receiver. The arriving wave induces in the aerial A an E.M.F. which is in phase with the electrical field in the wave, and since the aerial A is damped by means of the resistance R, the current which flows in this aerial is also in phase with the electrical field, and hence the potential difference across R is in phase. Moreover, since the impedance of the anode coil is small compared with the resistance of the valve, the current in this coil is in phase with the potential difference across R, so that the induced E.M.F. is 90 deg. out of phase with the electric force in the arriving

Nº 220,392



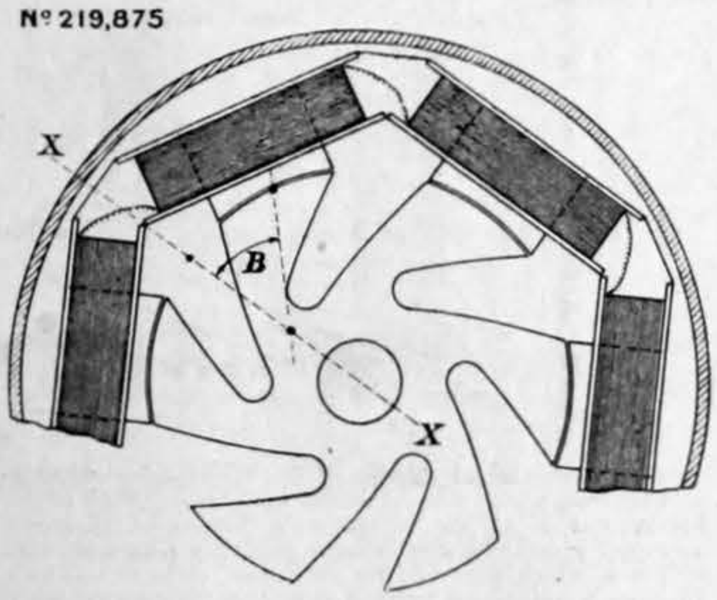
wave. In the case of the loop aerials, the E.M.F. induced is 90 deg. out of phase with the electric force in the arriving wave, and since the impedance of the aerial is mainly inductive, the current which flows is 180 deg. out of phase with the electric force, and it follows that the phase difference between the E.M.F. in the search coil circuit and the electric force in the arriving wave is 90 deg. Under these conditions it is clear that a balance can be obtained between the open and the loop aerial, resulting in the usual cardioid diagram.—*August 18th*, 1924.

MOTOR CARS AND ROAD TRAFFIC.

219,875. January 9th, 1924.—IMPROVEMENTS IN AND RELATING TO MAGNETO-ELECTRIC MACHINES, Fritz Eichert, of Cottastrasse 1, Niederschonhausen, Germany.

The inventor's object is to save material and reduce the weight

Nº 219,875



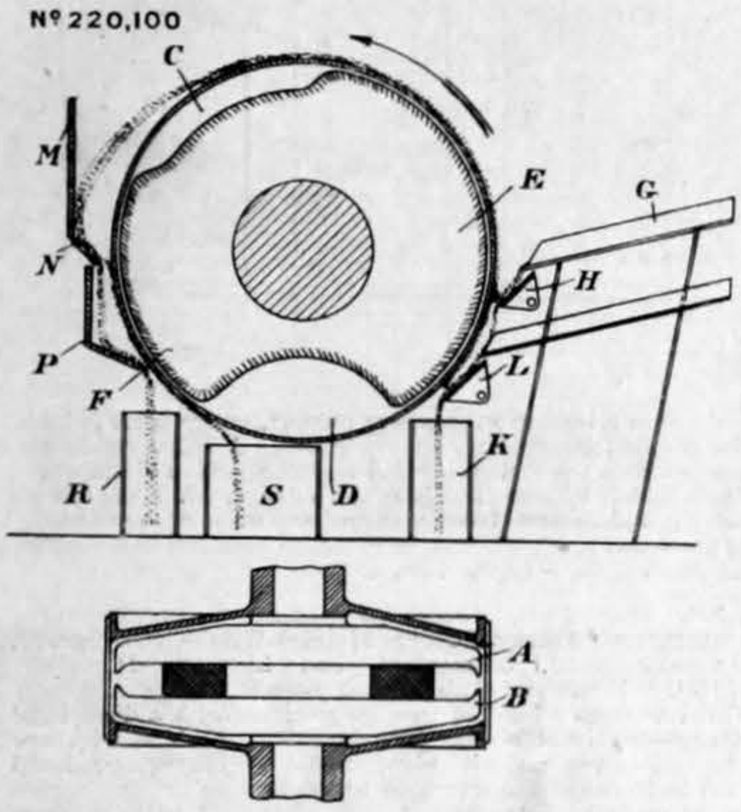
and size of magneto machines. The rotating permanent magnets are shaped as shown. The consecutive limbs form approximately V-shaped magnets, but the limbs are set askew so that the axis of each limb is at an angle B with respect to the radial line X X.—*August 7th*, 1924.

MACHINE TOOLS AND SHOP APPLIANCES.

220,100. May 29th, 1923.—METHOD OF AND APPARATUS FOR THE MAGNETIC SEPARATION OF MATERIALS, *Percy Charles Rushen, of Haseltine, Lake and Co.*, 28, *Southampton-buildings, W.C.* 2.

According to this invention two or more kinds of raw material can be treated on a single drum separator, or in cases where only one kind of raw material is being separated the output of the

Nº 220,100

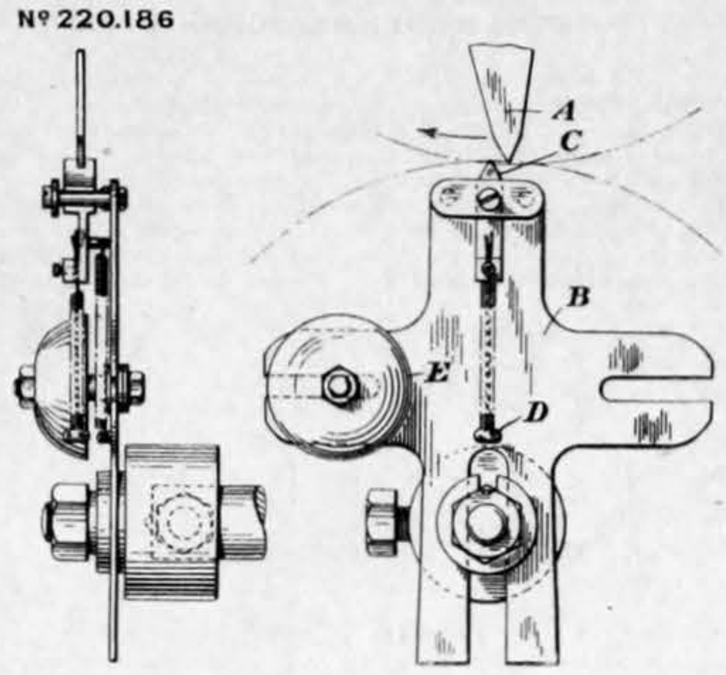


separator may be increased. The magnetic material won at the first separating point or points is thrown or guided from the drum and is then again conducted to another part of the drum for the purpose of subsequent separation in the manner shown. The disc poles A and B have two notches C and D, which produce two separating zones E and F with a weak zone between each. The material is delivered to the separator at G and it passes over the deflector H into the main separating zone E. The non-magnetic material can either be conducted into the receptacle K as shown or for the purpose of subsequent separation to a second delivery apparatus L, which brings it into the field again. The magnetic material travels with the rotating drum and passes to the weak magnetic zone C, where it is thrown off the drum against a baffle M. By means of the delivery apparatus N both kinds of material are again delivered to the zone F. The non-magnetic material falling away may again be conducted for the purpose of subsequent separation by a second delivery apparatus P to the zone F again. It thus falls into the receptacle R. The magnetic material attached to the zone F finally drops from the drum at the non-magnetic zone D and is received in the receptacle S.—*August 14th*, 1924.

220,186. September 27th, 1923.—SCREW CUTTING GEAR, W. Spurrell, 37, King-street, Carmarthen, South Wales.

This is a simple device for assisting a turner to close the lead screw nut of a screw-cutting lathe at the moment when the mandrel and the lead screw are in the proper relative positions for

Nº 220,186



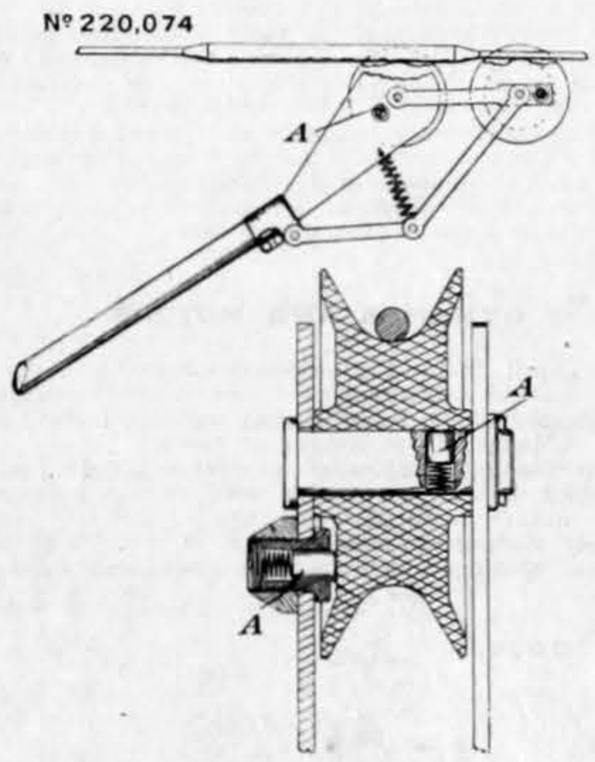
starting the cut. On to the end of the mandrel there is clamped a pointer A, while a plate B is fixed on the end of the lead screw. The plate B is provided with a trigger C which operates a clapper D to strike a bell E when the pointer and trigger meet and thus marks the time for cutting in the tool.—*August 14th*, 1924.

TRAMWAYS AND RAILWAYS.

220,074. May 10th, 1923.—IMPROVEMENTS IN OR RELATING TO TROLLEY ARMS AND LIKE DEVICES FOR USE IN ELECTRIC TRACTION, Gian Battista Ganale, of Pieve Lingure, Genoa, Italy.

According to this invention the current is collected at two or

Nº 220,074



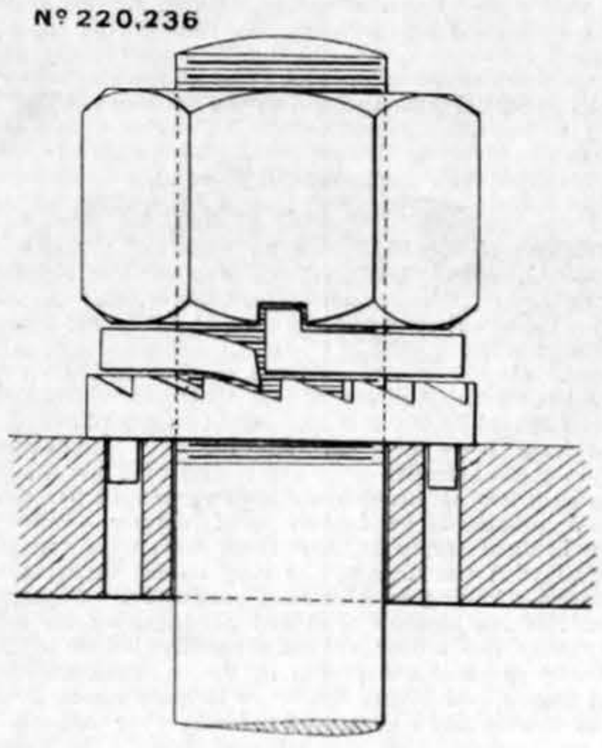
more points. The trolley head carries an additional current-collecting wheel or wheels which can be added to an existing trolley head. Brushes A are also provided to take up wear on the wheels and to make contact with the wheels.—*August 11th*, 1924.

MISCELLANEOUS.

220,236. February 5th, 1924.—LOCK NUTS, J. Le G. Thelland, Marine Chambers, 25, Gardiner-street, Durban, South Africa.

This lock nut is provided with a groove in its lower face to

Nº 220,236

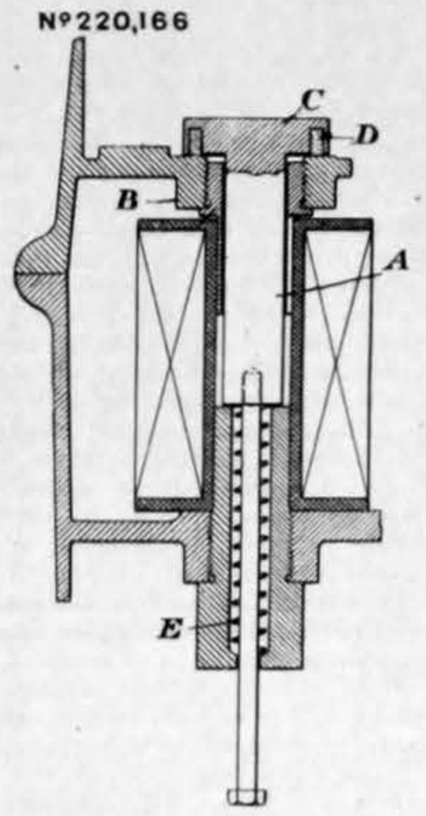


engage a lug on a spring washer. The other end of the washer is turned down to form a spur to work in conjunction with a ratchet toothed washer. The ratchet washer is prevented from turning by two lugs of soft metal which project into small holes in the object to be bolted. When it is desired to unscrew the nut sufficient force is used to shear off the lugs.—*August 14th*, 1924.

220,166. August 15th, 1923.—IMPROVEMENTS RELATING TO ELECTROMAGNETS, George Ellison and James Anderson, both of Wellhead-lane, Perry Bar, Birmingham.

A well-known difficulty associated with electromagnets of the solenoid type designed for use on alternating-current systems and particularly no-volt magnets, is that of preventing chattering of the plunger or core. According to this invention the core or plunger A is arranged to pass freely through an iron plate B forming part of the flux circuit of the magnet. The plunger is

Nº 220,166



provided with an iron or steel head or enlargement C having a flat surface adapted to co-operate with one side of the plate. Within the face of the head there is a copper or brass ring D. Current induced in this ring produces a phase difference between the fluxes passing through the plunger on opposite sides of the ring, and owing to the phase difference between the fluxes chattering or vibration of the plunger is prevented. The usual spiral spring E is provided for imparting an outward movement to the plunger when the current in the exciting coil ceases to flow or falls below a predetermined value.—*August 14th*, 1924.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

FRIDAY TO SATURDAY, SEPTEMBER 5TH TO 27TH.

MACHINE TOOL AND ENGINEERING EXHIBITION.—At Olympia. 10.30 a.m. (10 a.m. Saturdays).

SATURDAY, SEPTEMBER 27TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Council Chamber, Town Hall, Gosport. Southern District meeting. 11 a.m.

TUESDAY, SEPTEMBER 30TH.

INSTITUTE OF MARINE ENGINEERS.—85-88, The Minories, Tower Hill, London, E. 1. "Marine Oil Engines, Practical Notes on Bearing Adjustment," by Mr. John Lamb. 6.30 p.m.

THURSDAY AND FRIDAY, OCTOBER 2ND AND 3RD.

INSTITUTION OF MINING ENGINEERS.—British Empire Exhibition, Wembley. Thirty-fifth annual general meeting.

FRIDAY, OCTOBER 3RD.

DIESEL ENGINE USERS' ASSOCIATION.—The Engineers' Club, Coventry-street, London, W. 1. Paper, "The Significance of Exhaust Temperature," by Mr. P. H. Smith. 3.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W 1. Lecture, "Explosions, Terrestrial and Celestial," by Professor A. W. Bickerton. 7.30 p.m.

SATURDAY, OCTOBER 4TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—College of Technology, Sackville-street, Manchester. Presidential address by Mr. R. A. Miles. Paper, "John Wilkinson," by Mr. J. P. Bedson. 4 p.m.

MONDAY, OCTOBER 6TH.

BRADFORD ENGINEERING SOCIETY.—Technical College, Great Horton-road, Bradford. "A Visit to the Redcar Steel Works," by the President, Mr. L. Baldwin. A film showing the electrically-driven plant at the Middlesbrough and Redcar Works of Dorman, Long and Co. will be shown. 7.30 p.m.

INSTITUTE OF TRANSPORT.—Institution of Electrical Engineers, Savoy-place, London, W.C. 2. Presidential address by Sir Lynden Macassey. 5.30 p.m.

SATURDAY, OCTOBER 11TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South Western District Meeting at Truro. 1.45 p.m.

MONDAY, OCTOBER 13TH.

INSTITUTE OF TRANSPORT: MIDLAND LOCAL SECTION.—Chamber of Commerce, New-street, Birmingham. Address by Sir Herbert Austin, Chairman of the Midland Local Section. 6 p.m.

TUESDAY, OCTOBER 14TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, BURNLEY SECTION.—Municipal College, Burnley. Open discussion on "Some Foundry Problems," to be opened by Mr. J. Hogg. 7.15 p.m.