

A Seven-Day Journal

The Future of the Roads.

IN the course of an address to the National Safety Congress, which was held in London on Friday, May 22nd, under the chairmanship of Captain Hudson, Parliamentary Secretary to the Ministry of Transport, Sir Charles Bressy, the Engineer of the Greater London Highway Development Survey, discussed the future of the roads. He urged that ambiguity, hesitation, and indecision lay at the root of many road accidents. The ambiguity apt to arise in the centre of a busy 30ft. carriageway could not, he said, occur on dual carriageways separated by a central reserve. The Restriction of Ribbon Development Act would, he thought, lead to co-operation between neighbouring councils, enabling them to provide standard lay-outs for routes traversing several administrative areas, which would conduce to public safety. There was need for street widenings in built-up areas, and the construction of new routes of modern design which would link up the new arterial roads discharging into London. Slow progress was being made in allotting varying levels to different streams of traffic. Vertical segregation was still unfamiliar. There were localities where the lie of the ground would lend itself admirably to tunnels and vehicular subways. One of the tunnels proposed on the outskirts of Paris was designed to have five traffic lanes. Similarly, the advantages of long viaducts needed careful and unbiased study. New York furnished us with worthy examples. The "fly-over" junction, which had become almost standard practice on the Imperial German Motorways, was less familiar in this country. The "clover-leaf" device for road junctions was shown at the Congress, and it might well be given an early trial, enabling as it did several converging streams of vehicles to flow uninterruptedly without traffic cuts.

The Late Mr. Charles James Hobbs.

MANY of our readers connected with hydraulic and general engineering work will learn with deep regret of the death of Mr. Charles James Hobbs, which took place suddenly on Friday, May 29th, at Lexden Rise, Colchester. Mr. Hobbs will be recalled as a former director of the Hydraulic Engineering Company, Ltd., of Chester, which he joined in 1898 and from which he retired in March, 1932. Before joining the Chester firm he worked as an outside engineer with Mr. Mair Romley, of Simpson's, Grosvenor-road, London. His first work with the Hydraulic Engineering Company was to manage the firm's outside department, in which capacity he worked at the London office of the firm until early in 1906, when he went to Chester as general manager of the company's works. He continued in that capacity until he retired, and he was made a director of the company in July, 1913. While in London Mr. Hobbs supervised a great deal of the work done by his firm in connection with the London Hydraulic Power Company's pumping stations, and he conducted trials at the Millbank station, which formed the basis of a paper presented by him to the Institution of Mechanical Engineers. At Chester Mr. Hobbs carried out many large contracts for the railway companies, which included the cranes at Garston Docks, for the London and North-Western Railway Company; dock gate and other machinery for the Hull Joint Dock; and the machinery for the Gladstone Dock at Liverpool. His work also included Admiralty and foreign government contracts. Mr. Hobbs was a valued member of the Institution of Civil Engineers and the Institution of Mechanical Engineers.

The Mining Association of Great Britain.

THE eighty-second annual meeting of the Mining Association of Great Britain took place at the Victoria Hotel, London, on Thursday, May 28th, when Sir Evan Williams was re-elected President for the eighteenth year in succession. Referring to the Coal Mines Bill, Sir Evan said emphatically that two of the three amendments announced by the President of the Board of Trade must be regarded as wholly unsatisfactory. One of those amendments proposed to appoint an independent authority to hear objections, but to give it no powers. As for the amendment deferring the operation of the Bill for two years, that would merely leave the collieries in a state of uncertainty which would tend to bring all development to a standstill. He expressed surprise at the violence of the agitation which had been worked up to set aside the selling schemes now before Parliament. Those schemes, he said, had been prepared by the colliery owners in fulfilment of their pledge to the Government and the Government's undertaking to the mineworkers, and had been approved by the Board of Trade. Their primary object was to secure an economic price for the output of the collieries, thereby enabling the owners adequately to meet the wages situation. The whole question of safeguards for the consumer was one which the colliery owners had indicated their willingness to discuss. In the matter of amalgamation, the colliery owner in the last ten

years had carried through on a voluntary basis schemes involving 154 undertakings, 379 pits, and 239,000 workpeople, or about one-third of the number at present employed in the industry. To-day more than 75 per cent. of the total output of the country was produced by less than 150 undertakings. The process of voluntary amalgamation had been continuous and would continue. On the technical side enormous progress had been made. Tens of millions of pounds of new capital had been put into the industry. New pits had been sunk, and older mines had been completely reorganised and re-equipped. Since 1920 the proportion of the total output of coal cut by machinery had been multiplied three and a half-times, while in the last six years the proportion carried by mechanical conveyors had been trebled, and since 1927 the amount of coal treated at the pithead had been doubled.

The British Oxygen Company.

IN celebration of the fiftieth anniversary of the foundation of the British Oxygen Company a luncheon was held at Grosvenor House, Park-lane, on Thursday, May 28th. The luncheon was preceded by a visit of inspection to the new head offices of the company at Thames House, Millbank, S.W.1, where they occupy the entire first floor of the southern section of the building, an area of 37,000 square feet. The chairman of the company, Dr. J. Donald Pollock, presided at the luncheon and was supported by Mr. S. J. L. Hardie, the vice-chairman. The toast of "The Visitors" was proposed by Mr. P. B. Liversidge, and in response Lord Melchett pointed out the progress that the British Oxygen Company had made in its fifty years of life. Starting with a capital of £75,000, it now represented an invested capital of three and a half millions. It was one of the most advanced scientific companies of the present time and had done great work in advancing knowledge in its own particular industry. Referring to the recent developments of the company's interests in Australia, Lord Melchett said that it was an example in the matter of bringing together the industrial power of the different parts of the British Empire. He expressed the hope that the example would be followed by the present Government and by future Governments of the Empire, which, by the application of scientific knowledge and common sense, was capable of tremendous industrial development. The toast of "The Chairman" was proposed by Lord Alness, and in response Dr. Donald Pollock drew attention to the large numbers attending the luncheon, amounting to more than 400, as being the best evidence of the success of the company.

The French Liner Normandie.

IN a Journal note of May 8th we recorded the official trials of the French liner "Normandie," and her return to Atlantic service. On Monday morning, June 1st, we were invited by the French Line to board the liner in the Cowes Roads and to proceed to Le Havre to confirm for ourselves the beneficial effect of the alterations made to the ship, the principal of which is the substitution of four-bladed propellers for the original three-bladed design. During the voyage a speed of between 29½ and 30 knots was attained, and in the comparatively shallow water of the English Channel we were pleased to note that there is no undue vibration in any part of the ship. The claim that the somewhat abnormal vibrations experienced during the first year's service of the ship have been practically eliminated we found fully substantiated. Other improvements comprise a new café grille and tourist lounge towards the stern of the ship, which has given increased tourist accommodation. On the sun deck between the second and third funnels, a full-sized tennis court has been built, and several shelters have been added in order to allow games to be played under more wind-free conditions.

Forty Years of Wireless.

FORTY years ago on Tuesday, June 2nd, Marconi filed the application for his first wireless patent, No. 12,039 of 1896, relating to the sensitive tube receiver or coherer connected to earth and an aerial, and to the tuning of the transmitting and receiving circuits. Since then hundreds of patents have been granted to Marconi and the companies bearing his name for inventions and developments which year by year have contributed to the building up of the world-wide system of wireless telegraphy and telephony and to the development of broadcasting. In the year in which the application for the patent was made Marconi introduced his invention to Sir William Preece, then Chief Engineer of the Post Office, and by the end of that year wireless signals had been sent over a distance of 1½ miles. During the following twelve months the distance covered was gradually increased, first to 4, 8, 10, and eventually to 34 miles, between Bath and Salisbury. In 1898 wireless installations were placed on Trinity House lightships, a demonstration was given at the House of Commons, and communication was established for Queen Victoria between the Isle of Wight and the Prince of Wales on the Royal Yacht in the Solent. The English Channel was bridged in 1899 and the Atlantic Ocean in 1901. Wireless messages were exchanged between England and Canada in 1902, and a public service was opened in 1907. This linking of

Canada with the Mother Country naturally led to schemes for connecting all the Dominions with England by wireless telegraphy, and finally 6000 miles were covered by direct transmission instead of in hops of one or two thousand miles. Experiments with the Marconi beam system in 1923 and 1924 led to communication with the Dominions at greatly reduced cost, and at speeds of 400 words a minute.

New R.A.F. Rescue Boat.

A NEW launch, designed as a rescue boat for use when land aircraft are forced down in the course of flights over the sea, has recently completed a long-distance high-speed trial. The passage from Grimsby to Hythe, in Southampton Water, a distance of 373 miles, was made in 10 hours 29 minutes at an average of 36.2 m.p.h. The boat has a length of 64ft. and is fitted with three 500 H.P. "Sea Lion" engines, which are marine adaptations of the Napier "Lion" aero-engine. The R.A.F. specification requires a maximum speed of 33 knots and a cruising range of 800 miles. The voyage was begun in a heavy swell broken by short seas, a condition which persisted until Cromer was sighted. Here the swell eased, but the seas persisted. The average speed put up was then just over 30 knots, or 34.5 m.p.h. Tests of fuel consumption were carried out. The following two hours were occupied in reaching Orfordness at a higher speed, and after another hour's run the average speed was found to be 34 knots for the second three-hour period. After passing Beachy Head the sea began to diminish and by the time Portsmouth was reached weather conditions were excellent. The maximum speed attained in the last part of the trip reached 35 knots. Throughout the trial the boat was handled by the designer, Mr. Scott-Paine, of the British Power Boat Company, who expressed himself as quite satisfied with the ease of control. No water was shipped at any time, in spite of the weather conditions and speed, although some spray was blown aboard by a beam wind.

The Maiden Voyage of the Queen Mary.

FOLLOWING a Royal inspection on Monday, May 25th, the new Cunard White Star liner "Queen Mary" started on her maiden voyage from Southampton to New York on Wednesday, May 27th, a few seconds after her scheduled time of 4.30 p.m. She had over 2000 passengers on board, and was given an enthusiastic send off. The port of Cherbourg was reached 4 h. 20 min. after leaving Southampton. Good progress was made in the four following days, but unfortunately a fog which was encountered on the fourth day prevented a record passage being made. The ship and her propelling machinery more than fulfilled the expectations of her owners and builders, and on arrival at New York on Monday, June 1st, Sir Percy Bates, the chairman of the Cunard White Star Line, said that he was of opinion that the "Queen Mary" would prove the most profitable ship in the Atlantic service. Her magnificent performance would, Sir Percy stated, justify the construction of a sister ship, but he was not prepared to say how soon that would be done. The run from Bishop's Rock to the Ambrose Lightship was made in 4 days 5 h. 46 min., which compares with the "Normandie's" maiden voyage of 4 days 3 h. 14 min. The official time for the whole trip from Cherbourg is given as 4 days 12 h. 24 min., compared with 4 days 11 h. 33 min. for the "Normandie." The average speed of the "Queen Mary" from Cherbourg to the Ambrose Lightship, which included speeds of over 30 knots, worked out at 29.133 knots for the 3158 miles, while that of the "Normandie" on her maiden voyage was 29.94 knots. The result of the return voyage will be awaited with great interest.

Retirement of Mr. J. B. Wilkie.

THE retirement is announced of Mr. James Bowyer Wilkie, the superintendent engineer of Elder Dempster Lines, Ltd. Mr. Wilkie was appointed to his present position by the late Sir Alfred Jones, at the time of the amalgamation of the Elder Dempster Line with the British and African Steam Navigation Company and the African Steamship Company, in succession to his father, Mr. James J. Wilkie, who had held the position for thirty-one years. Mr. J. B. Wilkie was at the time only thirty years of age, and was considered to be one of the youngest superintendent engineers at the port of Liverpool. He had served his apprenticeship with Fawcett, Preston and Co., of Liverpool, and at the same time had attended Liverpool University under Professor Hele-Shaw. On completion of his apprenticeship he served for three years as a draughtsman with Vickers, Sons and Maxim, of Barrow-in-Furness. He then spent 2½ years at sea, securing his extra-chief engineer's certificate. After returning to Vickers, Sons and Maxim he was invited to take up the duties of assistant superintendent engineer to the Elder Dempster Line under his father. During his period of office he has been responsible for the design and operation of many outstanding motor vessels in the company's West African service. Mr. Wilkie is a member of the Institution of Naval Architects and of the Institution of Mechanical Engineers, and was President of the Liverpool Marine Engineers and Naval Architects' Guild in 1912.

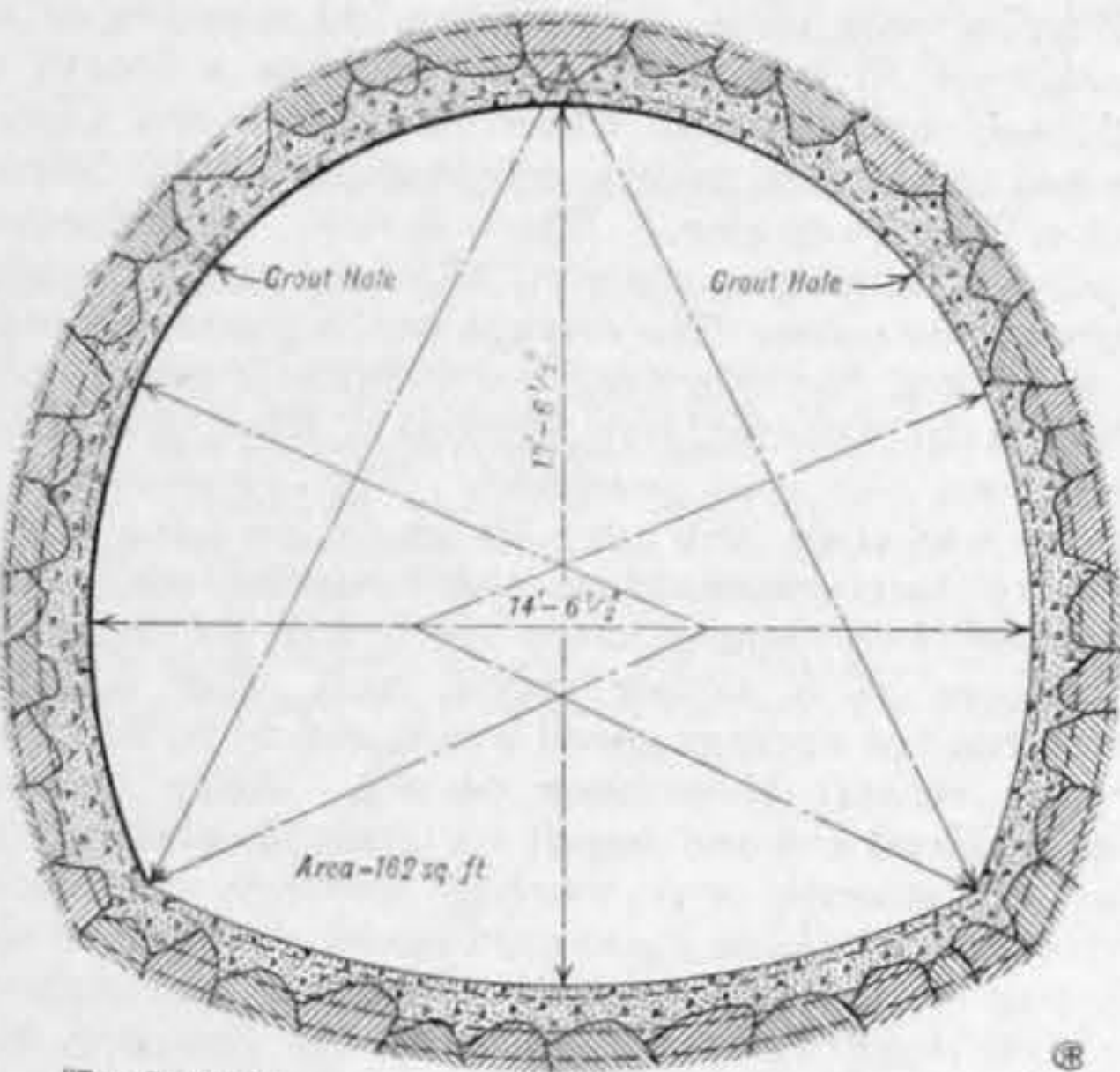
The Lochaber Water Power Scheme.

No. V.

(Concluded from page 563, May 29th).

LAGGAN-TREIG TUNNEL.

ALTHOUGH the Laggan-Treig tunnel is neither so long nor so great in cross section as the Ben Nevis tunnel, and although there was no such problem to be faced as that of opening its inlet portal 100ft. below the waters of a great loch, it is,



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FIG. 29—SECTION OF LAGGAN-TREIG TUNNEL

nevertheless, an interesting work. It was first broken through on October 15th, 1932, and has a total length of 14,600ft., or just under 3 miles, with a fall of 1 in 1000. In cross section it is horse-

The tunnel passes from the southern end of the Laggan Dam through the shoulder of a mountain to the outlet portal about 100 yards upstream of the Treig Dam. It was excavated from five points, the



FIG. 30—LAGGAN-TREIG TUNNEL MORaine SECTION

two portals, a sloping adit, a horizontal adit, and a shaft. The greatest length between adits was 4800ft. and the least 2450ft. No special difficulties were experienced in making the survey necessary for setting out the tunnel, as the ground under which it passes is flatter and less rugged than that on the flanks of Ben Nevis. In the actual work of driving a high rate of progress was maintained, considerably

encountered for almost the entire distance. The bench was maintained at a height of 6ft. to 10ft., and spoil was loaded by means of air-driven scraper loaders of Holman and Sullivan patterns into trucks running on rails laid in the tunnel. Near the outlet portal about 250ft. of glacial gravel and clay necessitated a modification of the shape of the tunnel. While boring through this strata the tunnel was securely timbered. Later it was lined with cast iron segmental lining pieces, similar to those used in the London tube railways, and when finished with concrete had a circular section. The last 80ft. at this end was made by cut and cover. The tunnel is lined with concrete from end to end, and the material was applied in a manner identical with that adopted for



FIG. 31—CONCRETING CARRIAGE IN TUNNEL—MAY, 1933

its Ben Nevis counterpart. The carriage employed for the purpose is illustrated in an accompanying engraving. The completed tunnel is capable of a free maximum flow from Loch Laggan to Loch Treig of 1400 cusecs.

THE TUNNEL PORTALS.

The intake portal is illustrated in accompanying line and half-tone engravings, Figs. 32 and 33. The rock

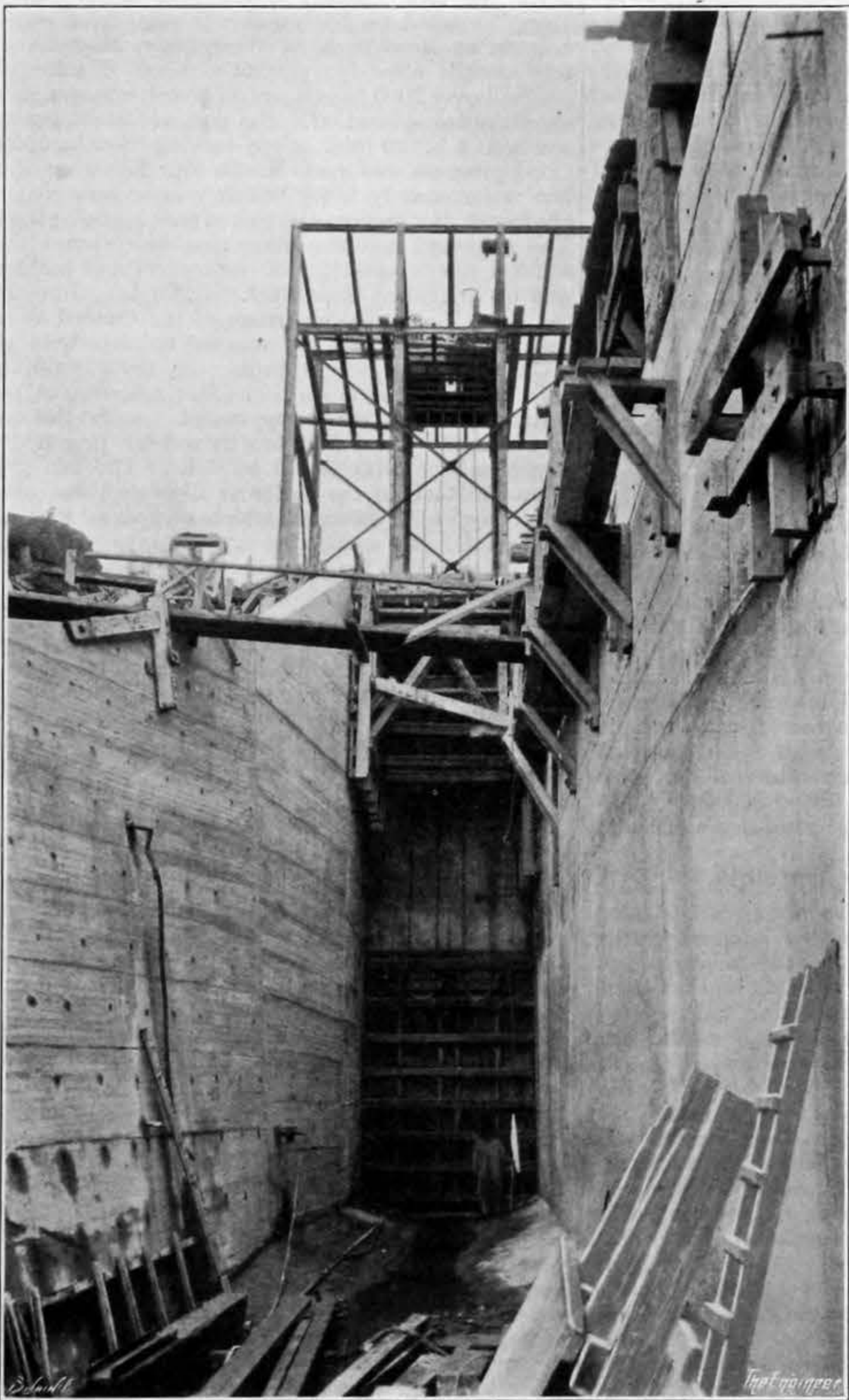
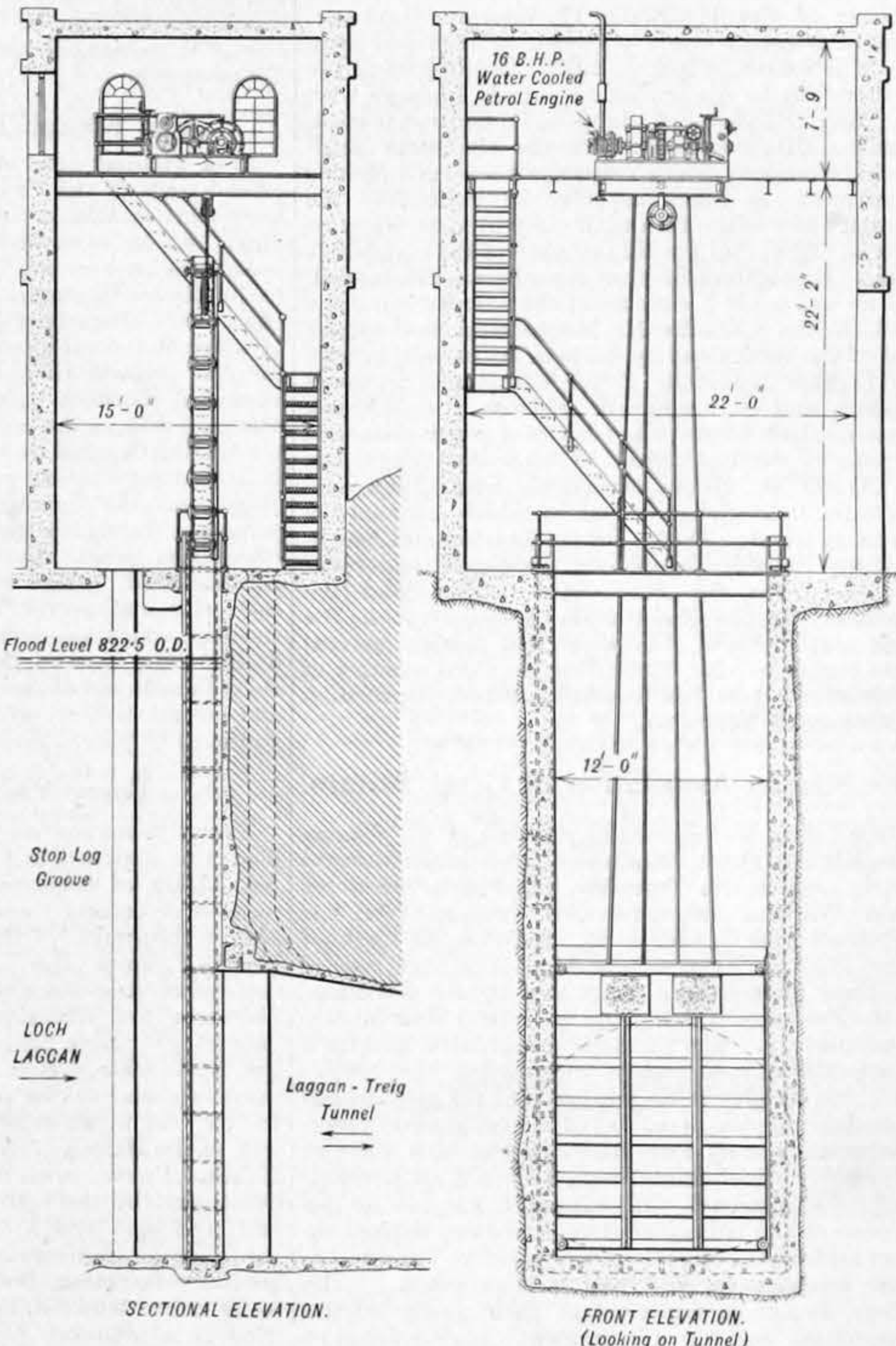


FIG. 32—INLET WORKS TO LAGGAN-TREIG TUNNEL—MAY, 1934



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FIG. 33—ARRANGEMENT OF INLET GATES TO TUNNEL

shoe in shape—see Figs. 29, 30 and 31—with a sectional area of 162 square feet, and is therefore not very much smaller than the Ben Nevis tunnel, which it much resembles in most other respects.

in excess of that achieved in boring the earlier work. Not only were the men more practised in their tasks, but also the uniformity of the strata and the greater use of machinery facilitated the work. Granite was

was excavated for some distance into the mountain-side and the face of the dam itself forms one of the sides of the channel leading to the tunnel. The rock on the further side of the channel has been protected

by a lining of concrete from the possibility of erosion. Entry of water to the tunnel is controlled by an 18ft. by 12ft. Glenfield and Kennedy sluice gate operated by a petrol engine from the valve house above. The outlet portal of the tunnel, Fig. 34, is at a level

loch. Consequently, in order that the water from the tunnel might run off towards the loch at times when the storage had been much drawn upon, an outfall channel was constructed to carry it upstream. This channel was dredged out of the old river bed whose

be seen that a small pool is created by the construction of a dam with a height of about 8ft. above original stream level. To gain entrance to the tunnel, the water must flow over a low weir which holds back boulders and gravel, and through a screen which retains floating debris, such as trunks of trees that might be brought down when the stream is in spate. Beyond the screen there is a 4ft. diameter sluice gate which admits the water to the shaft. The latter, like those at the Ben Nevis tunnel, is concrete lined and divided by a cross wall into two passages, one 4ft. diameter for the falling water and the other 2ft. 6in. diameter for the escape of air. A 4ft. by 3ft. hand-controlled sluice is placed low down in the dam, not only for the discharge of the water when it is not being admitted to the tunnel, but also to act as a scour valve for the discharge of silt, &c. A spillway is provided to meet conditions of very heavy spate when the capacity of the intake shaft might be over-taxed. Although intakes A and C differ from intake B in general arrangement, owing, of course, to the different nature of the sites, they are similar in detail. Arrangements at the bases of the intake shafts are also similar to those on the Ben Nevis tunnel.

THE TREIG DAM.

Loch Treig had a normal level 784ft. above O.D. and the permissible minimum level is 695ft. above O.D. By the construction of the Treig Dam at the northern end of the loch the top water level has been raised to 819ft. above O.D., or just 1ft. below the level of the Laggan reservoir. By this means the storage capacity of the loch has been increased to 7800 million cubic feet, as compared to the 1500 million cubic feet of Loch Laggan. Loch Treig is therefore the main storage reservoir of the Lochaber power development.

The Treig Dam—see page 598—has a height above the original ground level of 39ft., and is situated on a deep bed of glacial gravel and sand. The conditions are particularly suited to an earth fill dam, with a concrete core wall, and the design is shown by the line engraving, Fig. 38. The core wall is reinforced

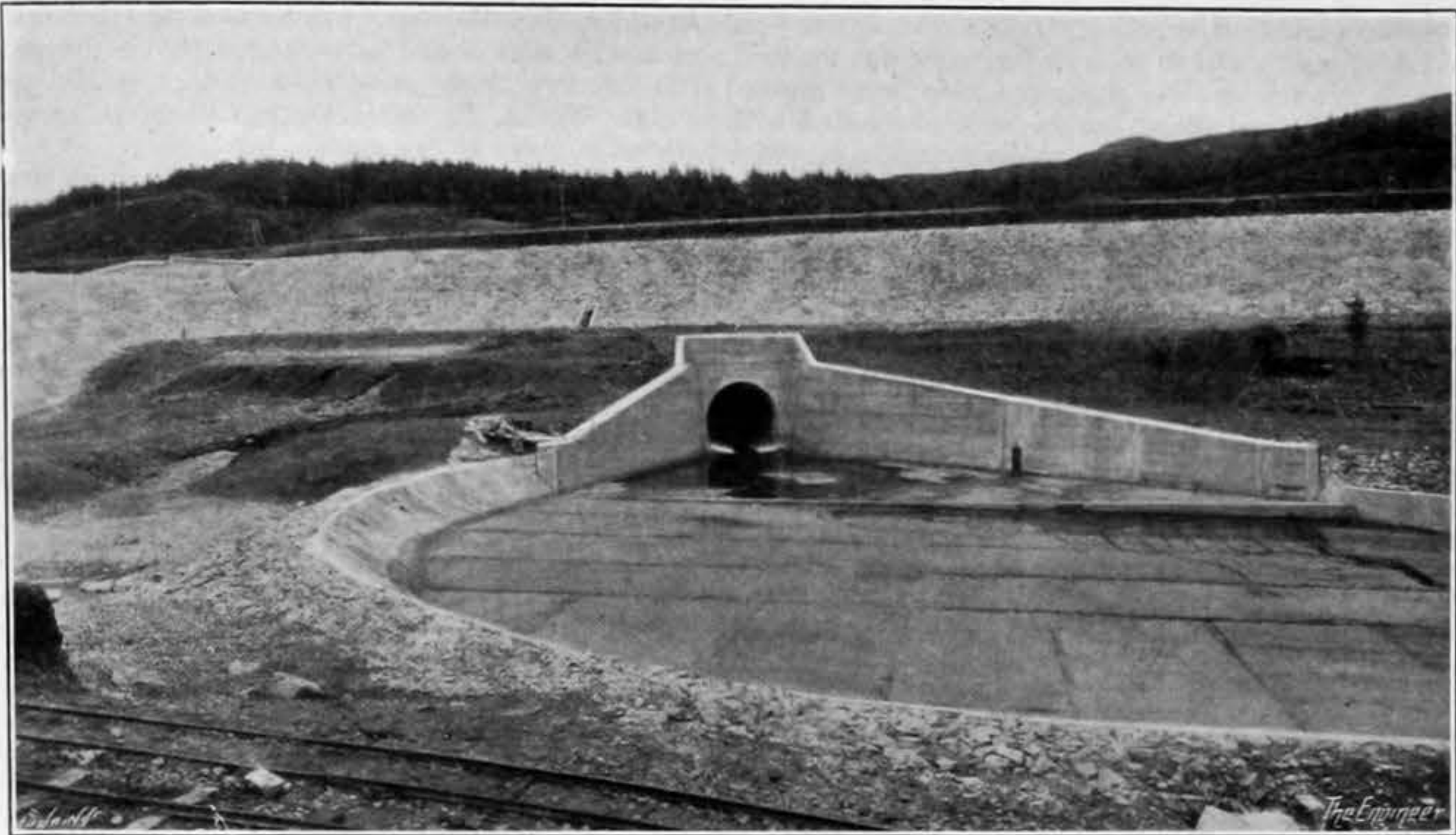


FIG. 34—OUTLET PORTAL OF LAGGAN-TREIG TUNNEL—OCTOBER, 1934

considerably below that of the spillway of the Treig Dam and is actually at about the normal level of the loch. In order to facilitate its construction, therefore, arrangements were made by which the level of the loch was drawn down, so that the work could be carried out in the dry. There is nothing worthy of

windings it follows and concreted to preserve its contour in the clay and gravel encountered.

INTERMEDIATE INTAKES.

The waters of three streams whose courses cross the line of the tunnel are diverted into it. The arrange-

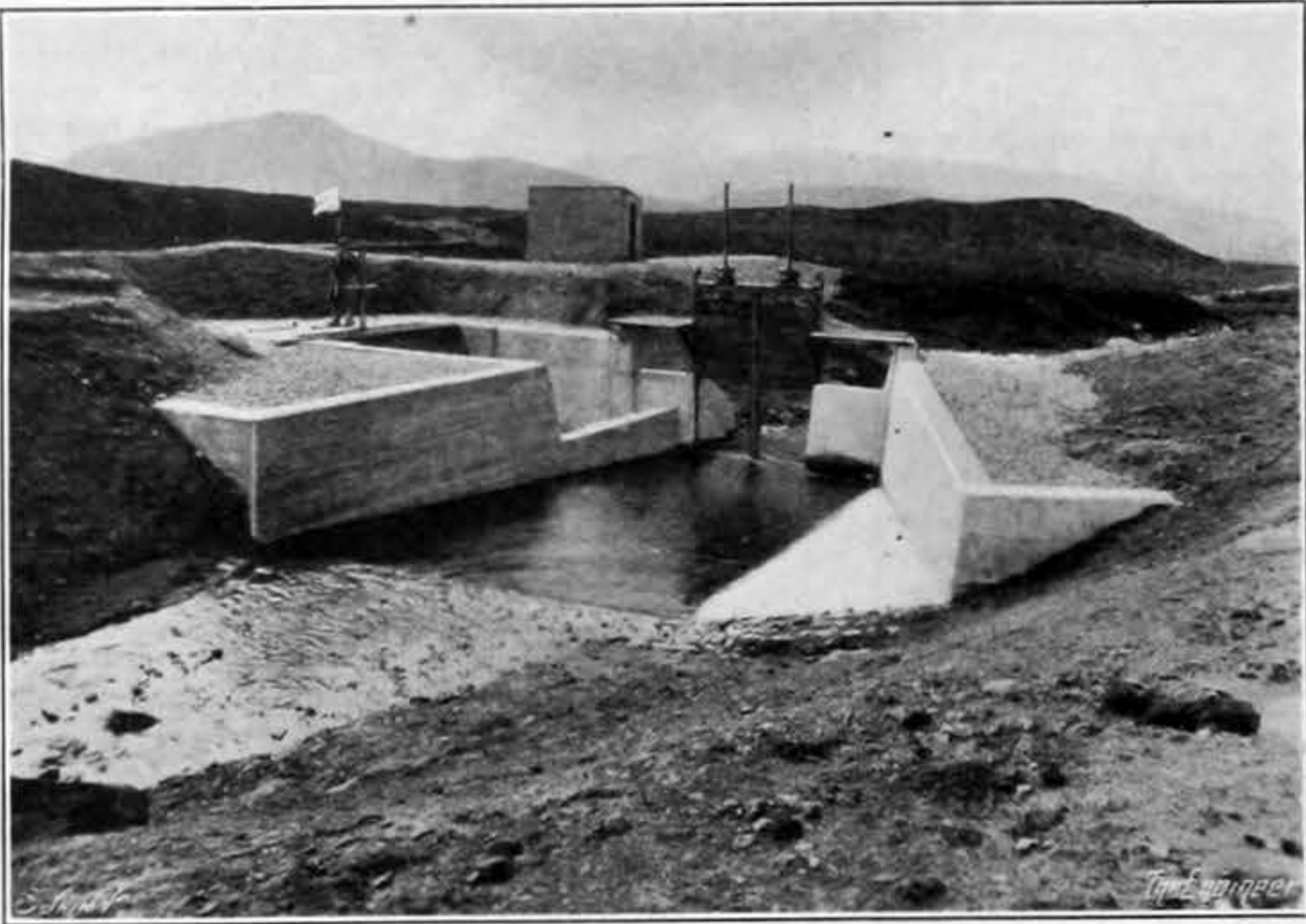


FIG. 35—DAM AND SLUICES AT INTAKE "A"

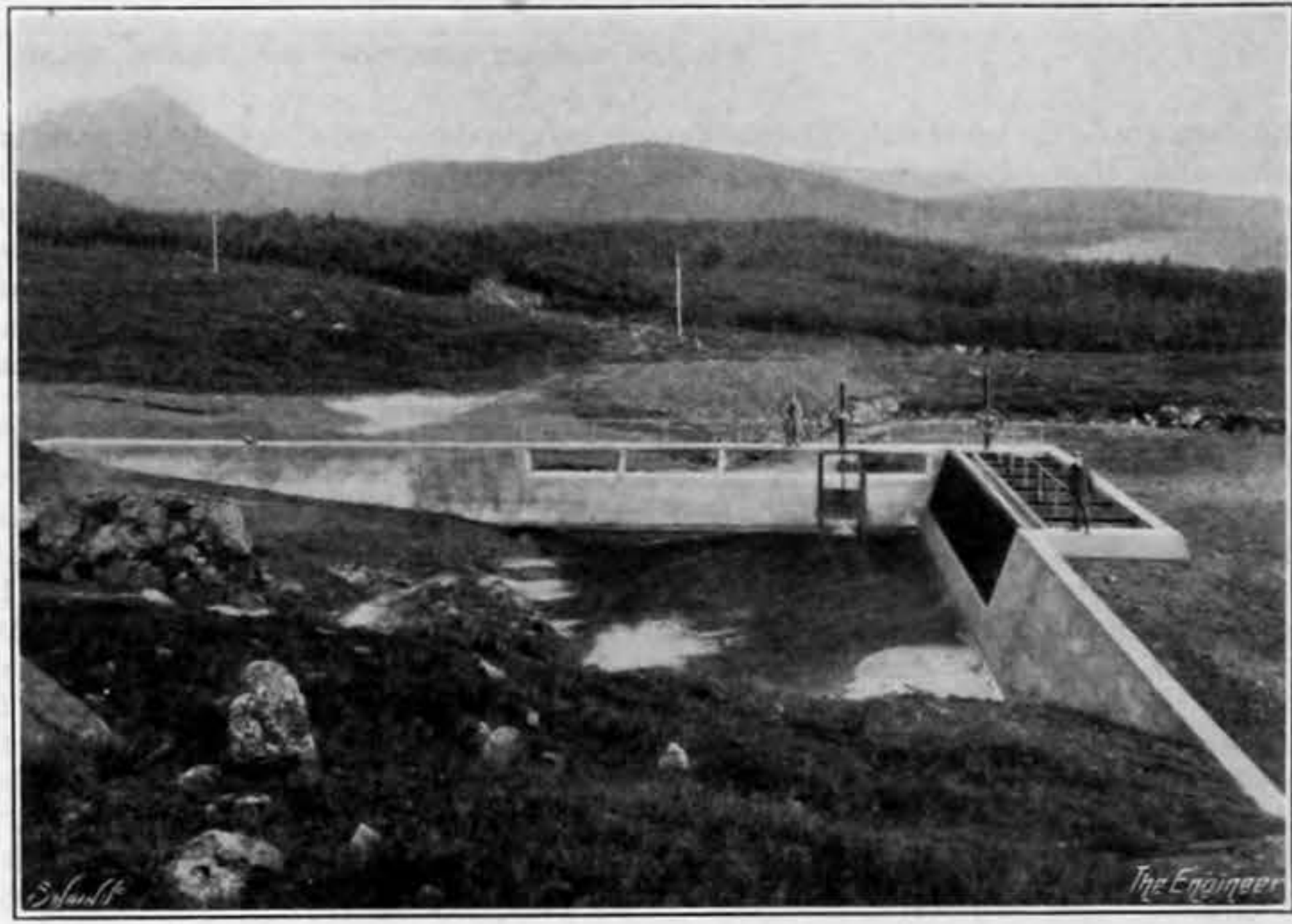


FIG. 36—DAM AND SLUICES AT INTAKE "B"

special remark as to the portal itself, except to mention that the ground on each side of it is protected by concrete flanking walls. The site of the Treig Dam is some distance downstream of the actual loch, so that the tunnel opens into the old river bed, which, of course, has a gradient towards the dam and not towards the

ments for collecting the waters of these streams are similar in general character to those above the Ben Nevis tunnel and only differ from them in that the sites were more easy of access. Views of intakes A and B are reproduced with this article in Figs. 35 and 36, and Fig. 37 is a drawing of intake B. It will

above original ground level on the upstream side and extends down to sound rock. Specially selected clayey material was filled directly against it, consisting of clayey material upstream and hand-picked rubble downstream. The rest of the upstream fill consists of soft material laid to a slope of 3 : 1, and protected

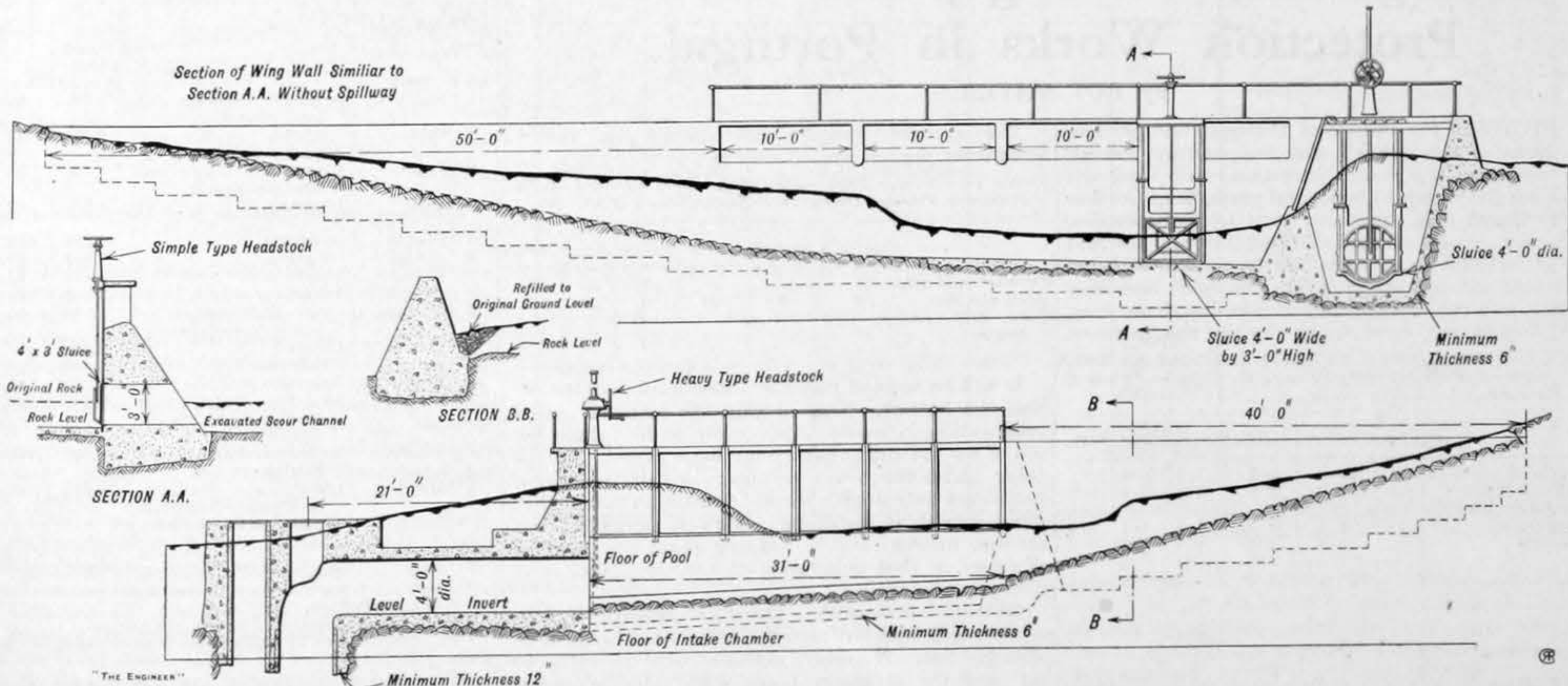


FIG. 37—ARRANGEMENT OF DAM AND SLUICES AT INTAKE "B" TO TUNNEL

deemed advisable to deal with minor schemes during the first part of the six-year period, so as to gather gradually the necessary experience to be made use of when the opportunity should come for works of considerable magnitude to be carried out. Thus the Sado Valley, Idanha, Magos, Alvega, Burgaes, Cela, and Loures schemes, covering an area of 35,826 acres, and estimated at a total amount of £1,329,054,

firm of contractors, working in co-operation with Messrs. Campeon Bernard, of Paris.
(4) *Sado Valley (First Section).*—The Sado Valley scheme is particularly interesting from an economic point of view in that it will supply water for the irrigation of rice in a section of the country specially suitable for the growing of this crop. Rice is a staple food of the Portuguese people, and it is to be expected

site was thoroughly investigated, and it gave occasion to a lengthy discussion amongst geologists and grouting experts. Eventually, the erection of a rock-fill dam was decided upon. The principal features of this dam, a cross section of which is shown in Fig. 2, are the following:—Maximum height, 183ft.; top width, 16.4ft.; maximum base width, 535ft.; length of crest, 630ft.; water slope, 1.25 to 1; downstream

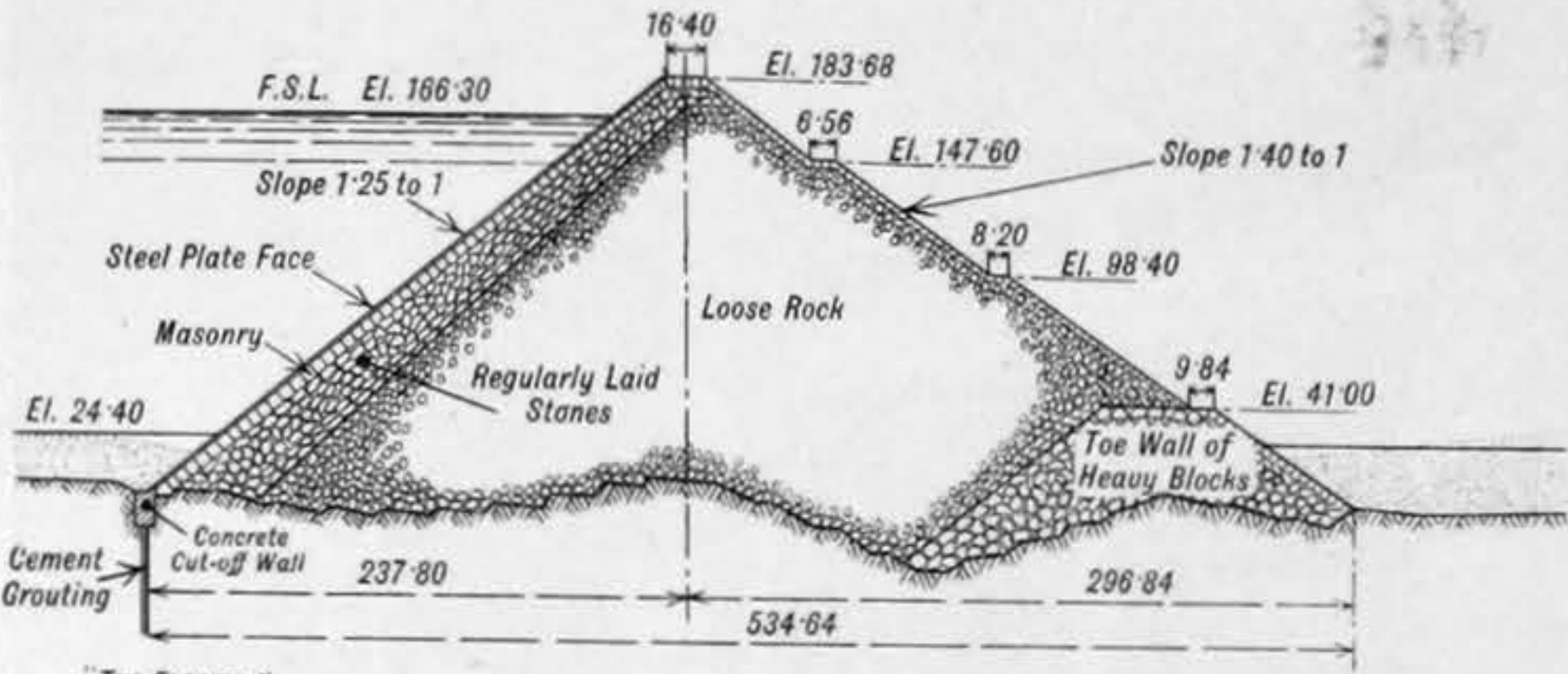


FIG. 2—SADO VALLEY DAM

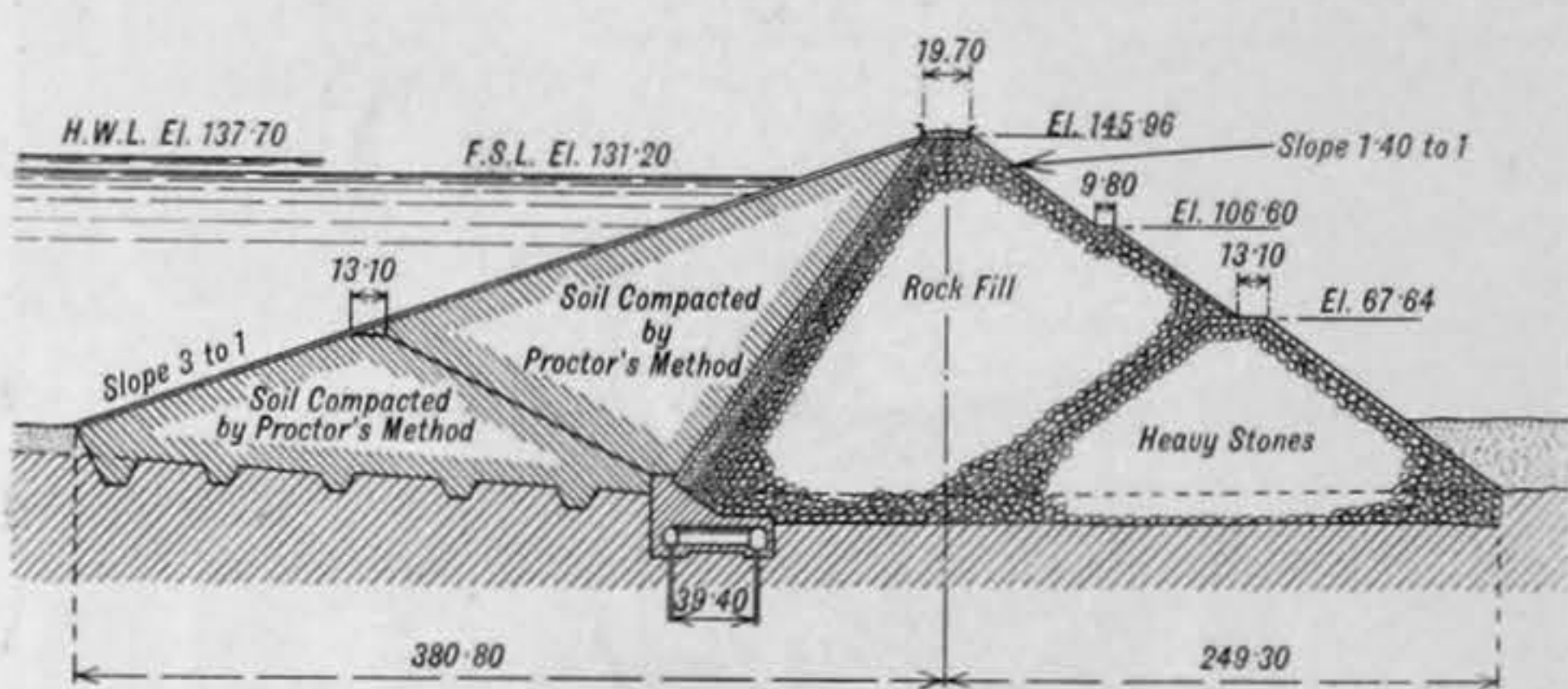


FIG. 4—VALE DE GAIO DAM

have been studied in detail. Plans for the Campilhas, Silves, and Faro schemes are nearing completion. As to the first major scheme to be carried out (Sorraia), the plans are to be submitted to the Government before the end of the year.

The Board has made it a strict rule always to bear in mind that, as pointed out by Sir Hanbury Brown, "Irrigation" (and the same applies to drainage) "is agricultural in its object," and has accordingly devoted earnest attention to the investigation of agricultural conditions as a basis for the study of the developments. Soils and crops, as well as farming methods to be adopted, are carefully gone into by a body of specialised agricultural experts, who endeavour to find out the possibilities of the land and to make as close as possible an estimate of the returns that may reasonably be expected from the improved farms. The civil engineer is only called upon to design the structures when the scheme has been shown to be justified from an economic standpoint. Again, the Board always takes into consideration the fact that the expense of preparing the land for irrigation is a very important item, sometimes reaching 60 per cent. of the total cost per acre, as shown by the following examples:—

TABLE IV.—Total Cost per Acre as Compared with Cost of Land Levelling.

Scheme.	Total cost per acre.	Cost of land levelling.
Sado Valley	£43 13 10	£10 1 11
Idanha	£36 13 6	£9 3 8 to £16 10 6
Alvega	£22 10 6	£12 17 1

A.—The following are the schemes for which plans have been prepared:—

(1) *Magos.*—This scheme provides for the improve-

ment of some 13,000 acres of good soil will contribute towards decreasing the price of this commodity.

The irrigation water is to be stored in a reservoir with a capacity of 2825 million cubic feet. It is estimated that 176 million cubic feet of water will be

slope, 1.40 to 1. Along the upstream toe a concrete cut-off wall is provided, underneath which a grouted cut-off wall will be extended into bedrock or into suitable impervious material. The rock-fill is to be protected from percolation and sloshing by a water-tight welded diaphragm of steel plates placed on the

TABLE V.—Particulars of Dams.

SCHEME	NAME OF DAM	SUPERFICIAL AREA Sq. M.	STORING CAPACITY Acre-feet	HEIGHT OF CREST ABOVE		LENGTH OF CREST Feet	CHARACTER OF DAM	OUTLINE
				STREAM BED Feet	DEEPEST POINT OF FOUNDATION Feet			
Magos	Magos	395	4,864	45.9	49.2	2,280	Earth	
Burgães	Castelo	12	324	71.5	75.4	187	Concrete	
Sado Valley 1st Section	Pego do Altar	1,987	64,860	159.0	183.6	630	Rock-fill with metal face	
Idanha	Ponsul	1,675	63,240	144.3	167.2	469	Concrete	
Sado Valley 2nd Section	Vale de Gaio	1,359	48,640	124.6	168.9	122	Earth and Rock-fill	
Silves	Arade	472	23,025	142.7	164.0	817	Earth and Rock-fill	
Sorraia	Maranhão	6,523	16,215	165.6	178.7	649	Earth and Rock-fill	
do	Fragusta	1,380	32,430	103.3	116.4	630	Rock-fill with concrete facing	
do	Montargil	—	105,400	131.2	157.4	1,380	Earth	
do	Divor	—	48,640	—	—	—	Earth	
Vilarica	Sabor	—	324,000	328.0	—	107	Concrete	
Mondego	Azere	3,634	321,870	341.0	—	1,558	Concrete	
Campilhas	Campilhas	815	17,025	83.6	88.5	2,270	Earth with clay core	
do	Sado	—	33,241	abt. 130.0	—	—	Rock-fill with reinforced concrete facing	

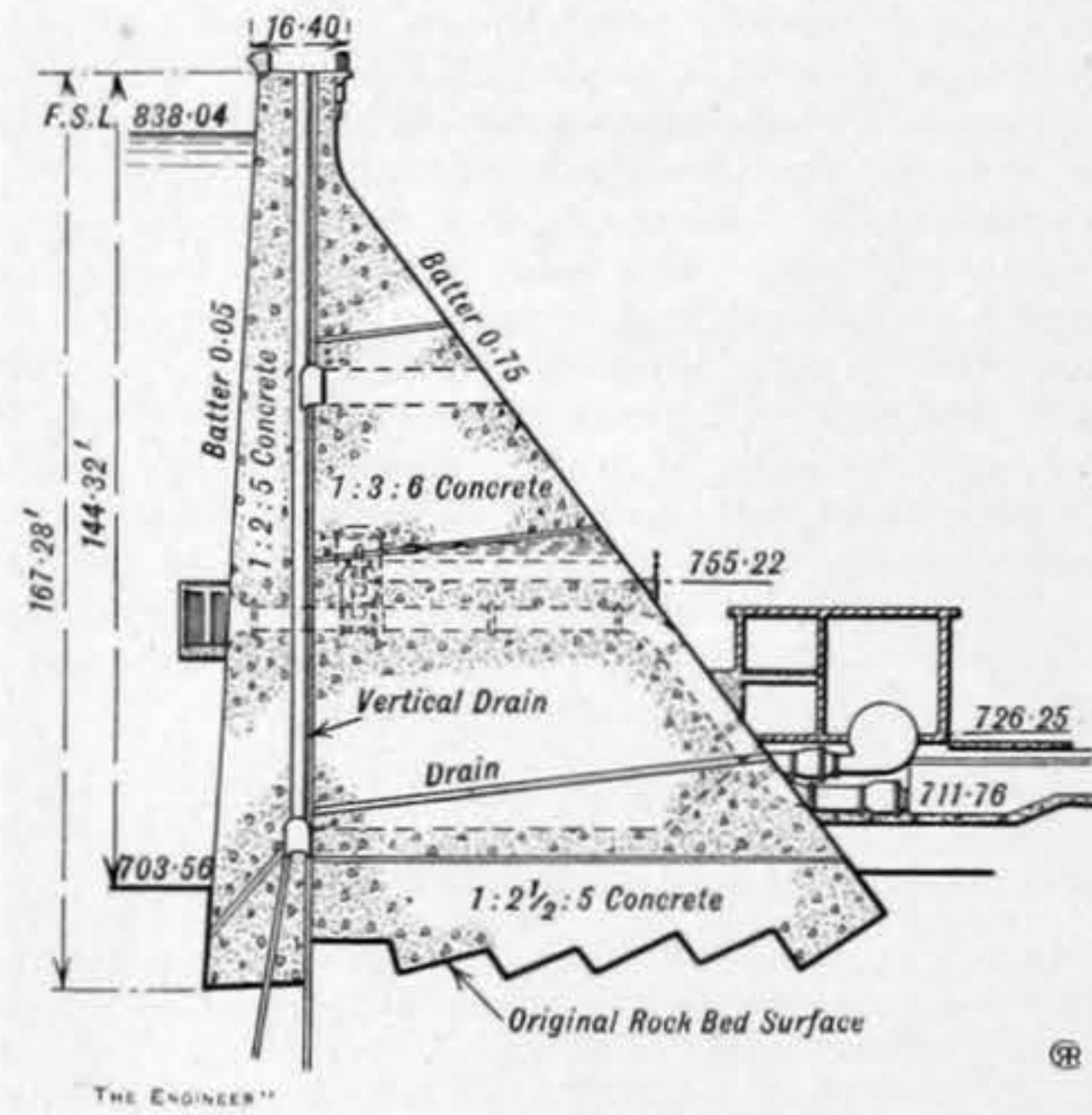


FIG. 3—GRAVITY DAM ACROSS PONSUL RIVER

ment of 1716 acres of swampy land. It includes an earth dam by means of which about 318 million cubic feet of water will be impounded, an embankment to prevent overflowing of the land at high flood stages of the Tagus, a main drainage ditch and a drain system. A pumping station is also provided for lifting drainage water. The material for the dam and for the embankment is compacted by the Proctor method to a minimum dry density of 125 lb. per cubic foot. Rollers of the "sheep's foot" type are part of the equipment, and have proved very efficient. This is the only case where the construction work was undertaken directly by the Board. In all the other projects, such work is carried out by contractors.

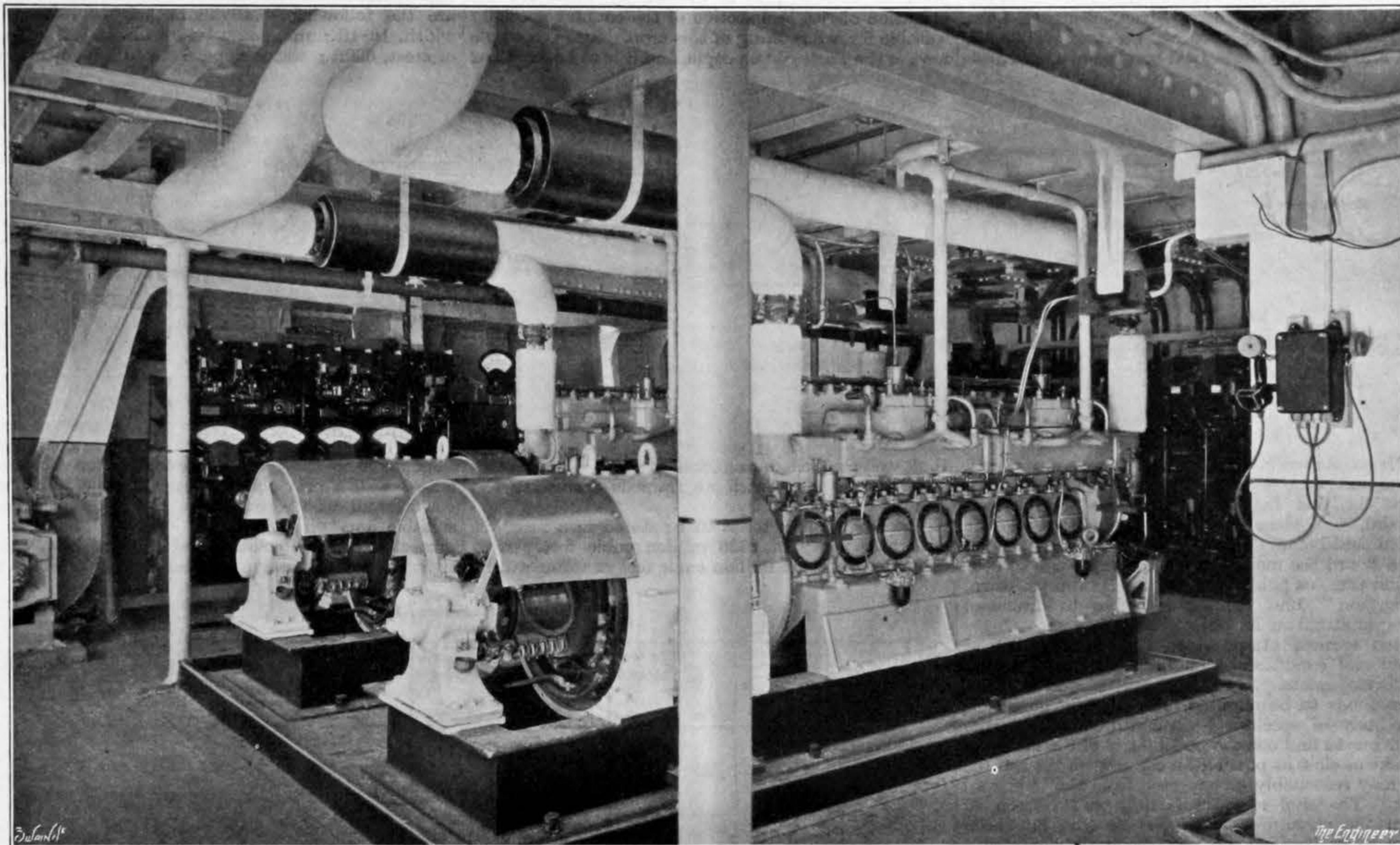
(2) *Cela* and (3) *Loures.*—The main purposes of these schemes are protection against floods and drainage of low-lying lands. Plans for both were prepared by Sir M. MacDonald and Partners, of London. The construction work is being dealt with by a Portuguese

lost through evaporation and seepage in the reservoir itself, and 26 per cent. of the remainder in the canal system. Thus the amount of water actually available to be delivered to the crops will be reduced to about 45,000 acre-feet.

The nature of the foundation materials at the dam

upstream face of the dam. The plates will be 4 in. thick, 24 ft. by 8 ft. in size, with expansion joints, and will be laid on a concrete backing, 4 in. thick. Next to this, there is a wall of dressed stones laid in cement mortar, 6.5 ft. wide at the base of the dam and 2.6 ft. wide at the top. A section of the rock-

THE LINER "QUEEN MARY"—EMERGENCY GENERATOR ROOM WITH PARSONS OIL ENGINES



fill, 26.2ft. wide at the base and 9.8ft. wide at the top, is composed of regularly laid stones, 70 per cent. of which must weigh 1100 lb. each or more. Another section of the rock-fill is formed by stones dumped with no attempt at systematic arrangement, 70 per cent. of which must weigh over 350 lb. each. At the downstream toe there is a wall of regularly placed stones, each weighing 3300 lb. at least. A decking of 3300 lb. blocks protects the downstream face.

The outlet sluice has a capacity of 9000 cubic feet per second, the flow being controlled by two sets of two slide gates, each 4ft. by 5ft. in size. A concrete tower, 150ft. high, is provided, to which is connected a 60in. diameter pipe leading to the power plant and to the main irrigation canal. The admission of water into this pipe is controlled by three hydraulically operated slide valves placed at three different levels. Control of discharge into the turbine and irrigation canal is provided by a needle valve and a butterfly valve.

The spillway is situated about 1 mile upstream from the dam site. The weir has an effective length of 984ft., and is designed to discharge about 35,000 cubic feet per second, with a maximum depth of water of 5ft.

A hydro-electric plant will be installed near the dam. This plant consists of a reaction turbine operating under a head varying from 126ft. to 79ft., direct connected to a 2000-kVA alternator, designed to deliver three-phase, 50-cycle current at 6000 volts, a transformer delivering 60,000-volt current and accessory equipment. An annual output of 5,200,000 kWh will be obtained.

The main irrigation canal is 8 miles long, and has a capacity at the head of 250 cubic feet per second. The amount of water supplied to the crops will be about 185 cubic feet per second. During the most critical month (August) the duty of water is estimated at 70 acres per second-foot.

The study of economic conditions indicates that as a result of irrigation the value of the agricultural production of the land covered by the Sado Valley scheme will increase from £57,900 to £260,345, and the net revenue from £22,740 to £114,900 per year. In addition to this, a revenue of about £8000 from the power development is reckoned upon.

(5) *Idanha*.—The principal feature of the Idanha scheme is a straight gravity dam, built of cyclopean concrete, to be erected across the Ponsul River. A typical section of this structure is shown in Fig. 3. The dam is 148ft. high above the stream bed, and 170ft. high above the deepest point of the foundation, and has a top length of 470ft. It has a thickness at top of 17ft. and at base of 118ft. The upstream batter is 5 per cent. and the downstream batter is 75 per cent. A geological survey of the site led to the conclusion that a certain amount of grouting will have to be carried out in order to seal crevices and cut off percolation under the dam.

The outlet sluices are two tunnels, 5ft. in diameter, equipped with electrically operated gates. Provision for drawing water from the reservoir into the powerhouse which adjoins the dam is made by means of a

steel penstock, 60in. in diameter, which passes through the dam, and which can deal with a discharge of 300 cubic feet per second at high water. The control is effected by means of an electrically operated gate. The spillway, designed with a generous margin of safety, will discharge 24,700 cubic feet per second under a head of 9ft.

The power plant, located at the foot of the dam, consists of a horizontal shaft Francis type turbine, running under a head varying from 117ft. to 66ft., direct connected to a 2000-kVA alternator. This plant will supply energy for two small pumping stations included in the distribution system, and will facilitate rural electrification.

The area of irrigable land is over 16,000 acres, but only about 3000 acres will be irrigated in the near future. No substantial economic results are expected from this scheme, the main purpose of which is to improve conditions of the working class in the Idanha district.

The main canal has a capacity of 300 cubic feet at the head, and is about 22 miles long. For the first 4 miles a concrete flume of circular cross section will be used, the remainder being a concrete-lined canal with trapezoidal cross section. Several distributary ditches are taken out of this canal.

(6) *Alvega* and (7) *Burgas*.—Although they are located in different parts of the country, these two small schemes have been included in the same contract.

At Alvega an area of 1082 acres will be irrigated by water pumped from the Tagus. The pumping station is composed of two units, each consisting of one 20in. centrifugal pump driven by a 180-kW electric motor wound for 500 volts. The power will be supplied by a private company. The maximum lift is 93.5ft., and the plant has a capacity of 35 second-feet. Water will be delivered to two canals. Provision has been made for silting up an area of 170 acres previous to irrigation.

The Burgas Dam is a small gravity structure, 71.5ft. high above stream bed. It will impound water from the Caima River, to be used mainly for summer irrigation of meadows.

B.—Schemes Nos. (9), (10), (11), and (12). Plans for these schemes and for the extension of the Sado Valley scheme are still being prepared.

C.—The principal features of the three major schemes will now be briefly summarised:—

(13) *Sorraia*.—One of the purposes of this scheme is to regulate the discharge of the streams of the Sorraia watershed by means of four reservoirs with a combined capacity of 15,000 million cubic feet, distributed as follows:—Maranhao, 7000; Montargil, 4500; Divor, 2000; Fragusta, 1500 million cubic feet (see Table V).

The Maranhao Dam will be a combination earth and rock-fill structure, and is by far the most important work contemplated by the Board. Except for the dimensions, it is very similar to the Vale de Gaio Dam, a cross section of which is shown in Fig. 4.

At Montargil and across the Divor River, earth dams will be erected. At Fragusta a rock-fill dam with the water slope protected by a concrete facing will be built. Hydro-electric plants will be installed at the foot of the dams. Their output is estimated at approximately 28,000,000 kWh. The water stored in the reservoirs will feed a canal system with a total length of about 125 miles. Irrigation water will be delivered to some 90,000 acres of alluvial soils. A road system will have to be established, and is included in the project.

(14) *Ribatejo (Tagus Valley)*.—This scheme embraces an area of 30,000 acres on both sides of the Tagus to be irrigated by water drawn from the river by a diversion dam of the open type. The main canals will have a total length of about 30 miles. The most important problem to be dealt with is the protection of land against floods. Provision is made for draining the protected land, either by gravity or by pumping, should the flood water enter it.

(15) *Mondego*.—This scheme provides for the protection, drainage, and irrigation of 36,000 acres of flat land in the Mondego Valley. A dam, 300ft. high, built of cyclopean concrete, will store 14,000 million cubic feet of water, which will be directed into the river and diverted by a weir into a distributing system. The main irrigation canals will have a total length of about 75 miles. A power plant will be installed at the foot of the reservoir dam, its output being estimated at 47,000,000 kWh.

A GLASGOW FIRM'S JUBILEE.

SATURDAY, June 6th, has been chosen to commemorate the fiftieth anniversary of the establishment in Glasgow of the Cathcart works of G. and J. Weir, Ltd. The event is to be marked by granting a holiday with pay to all those in the firm's employ, and special gifts will be made to employees to mark the celebration. We may recall that the firm was founded in the 'seventies by the brothers James and George Weir, with offices in Hydepark-street, Glasgow. By that time Mr. James Weir had already patented a number of useful inventions, including starting valves for compound engines, the hydrokineter boiler circulator, and various feed heaters. The offices were moved first to Jamaica-street and then to Commerce-street, Glasgow. Mr. James Weir became greatly interested in the problem of corrosion in marine boilers, and carried out a great deal of research work from which he evolved the Weir de-aerating contact feed heater. Feed pumps followed, and in 1886 new works were built at Cathcart for the specialised manufacture of marine auxiliary plant. A little later the first Weir marine evaporators were designed and built, and the use of the auxiliaries manufactured by the firm was greatly extended in naval and mercantile ships, both at home and abroad. In 1891 the firm became a limited liability company, and when in 1920 Mr. James Weir died, the present Lord Weir, his son, became its chairman. The board of directors now includes Mr. J. R. Richmond and Mr. C. R. Lang, joint managing directors; Mr. James G. Weir, Mr. John Craig, Mr. J. R. Lang (works manager), the Hon. Kenneth Weir, Mr. H. Hillier, Mr. M. L. Jamieson, and Mr. J. Spittal.

The Cunard White Star Liner "Queen Mary."

No. IV.

(Continued from page 568, May 29th.)

ELECTRICAL DISTRIBUTION SYSTEM.

IN concluding our last article, which dealt with the water softening installation and the electric generating plant for the machinery and hotel services, we made reference to the main machinery switchboard, which is arranged in the after turbo-generator room. The switchboard for the hotel services is accommodated in the forward turbo-generator room and it has a total length of 37ft. It is generally similar in design to the machinery switchboard and it controls the three turbo-generators in the forward room and feeds the various ring mains.

AUXILIARY SWITCHBOARDS.

In Figs. 28 and 29 we illustrate two typical examples of auxiliary switchboards which were, like the main

the board down to a minimum the links in question have been actually fitted to run on the bus-bars and in all cases the cable terminals on them have been fitted in the run of the cables in such a position that they have been kept clear of the back of the switchboards. As a result the run of the cables is simplified.

The forward ring and mid rings on "A" deck and the after ring on "B" deck are all fed from the hotel supply. These three rings can be kept entirely separate from each other or arranged as one complete ring if so desired. An interesting and important feature is incorporated on the switchboards on these decks; all radiator and fan circuits on each board are supplied through a single-pole circuit breaker which is controlled from the bridge. In the event of fire the radiator and fans in the affected area can be shut off

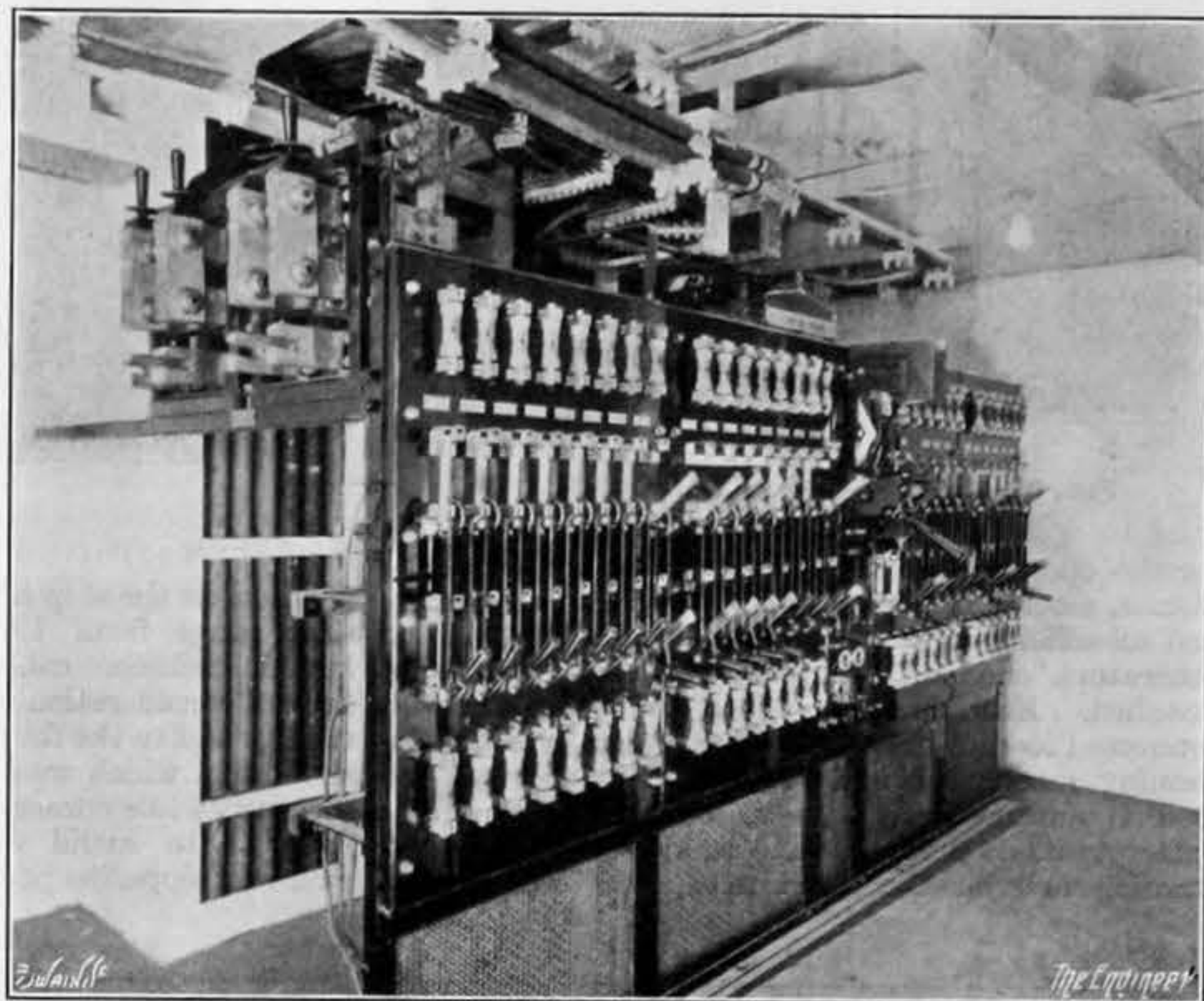
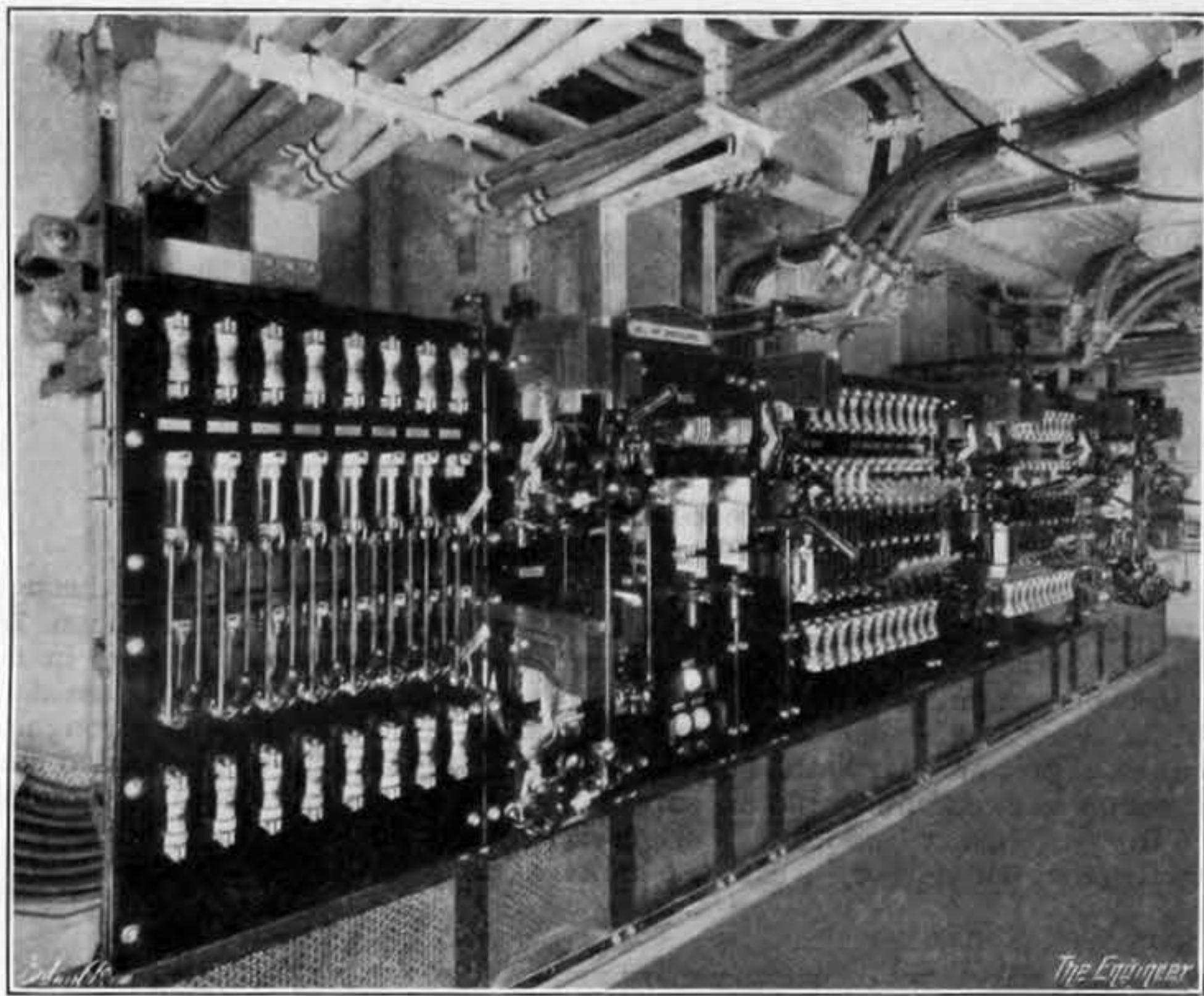
gear and impulse starter. The regular governor gear is fitted to control the speed within fine limits for direct lighting at any load, and the exceptionally smooth running properties of an eight-cylinder engine are valuable for plant which has to be installed on the upper deck and adjacent to passenger accommodation. In addition, an emergency trip governor is fitted which switches off the engine in the event of any mishap tending to dangerous overspeeding.

The generators, which were supplied by the British Thomson-Houston Company, Ltd., of Rugby, are 75 kW, compound wound, 220 volts, open type machines and are canopy protected.

To cool the circulating water Heenan and Froude coolers, the fans driven by drip-proof B.T.H. motors connected directly across the generator terminals, are employed, so that the cooler motors and fans start with the build up of the generator voltage, and it is impossible to start the engines without the cooling equipment coming into action.

The engines, we may state, are of the standard Parsons type and are designed to comply with the special requirements of the Board of Trade, Lloyd's Register of Shipping, and Cunard White Star Line for ships' emergency generating plants.

The emergency switchboard, a view of which is given in Fig. 30, is divided into two sections, which are remote from each other, one of which controls the generators and the other the feeder sections. The



FIGS. 28 AND 29—TWO TYPICAL AUXILIARY SWITCHBOARDS—WHIPP AND BOURNE

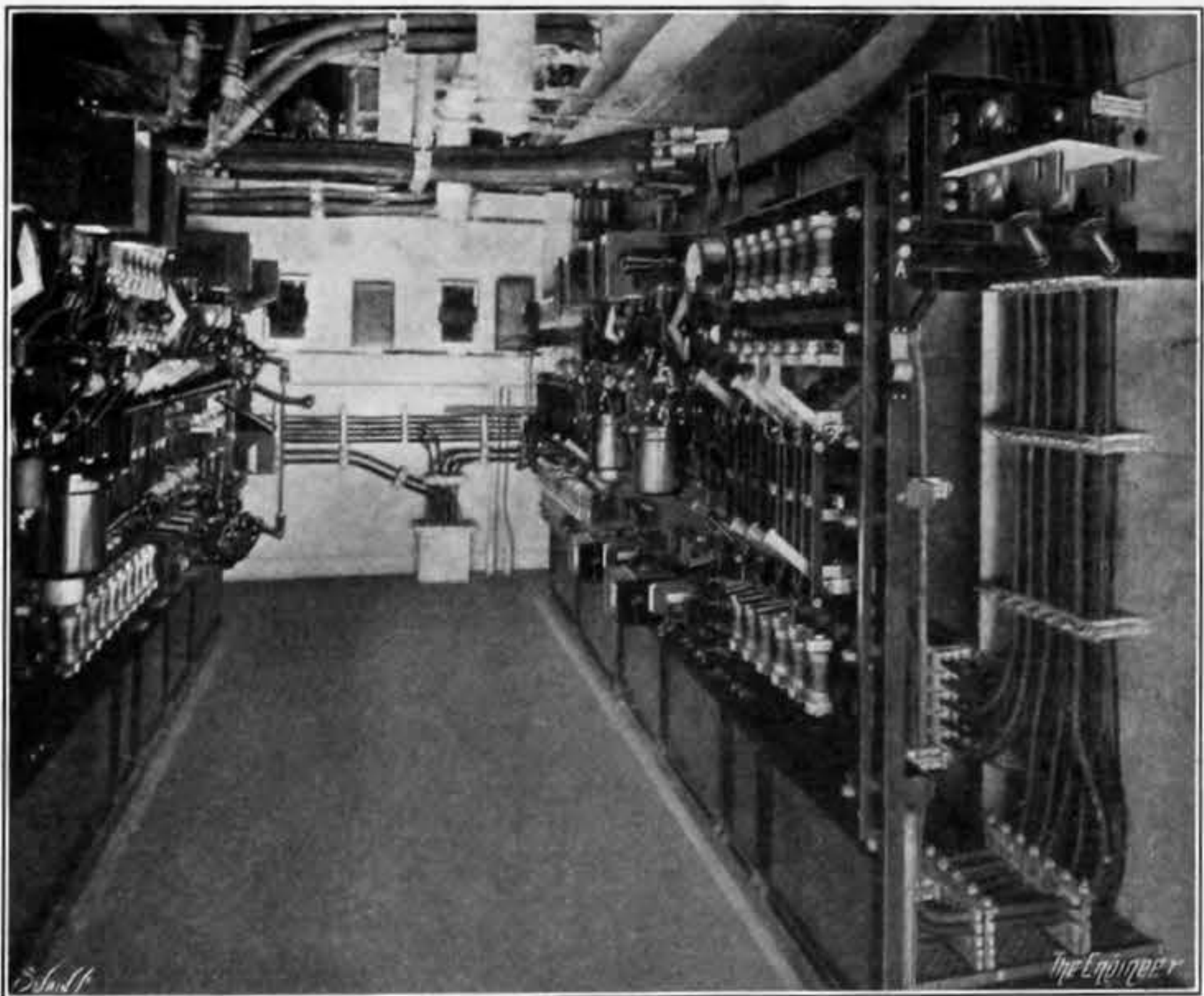


FIG. 30—EMERGENCY FEEDER PANEL

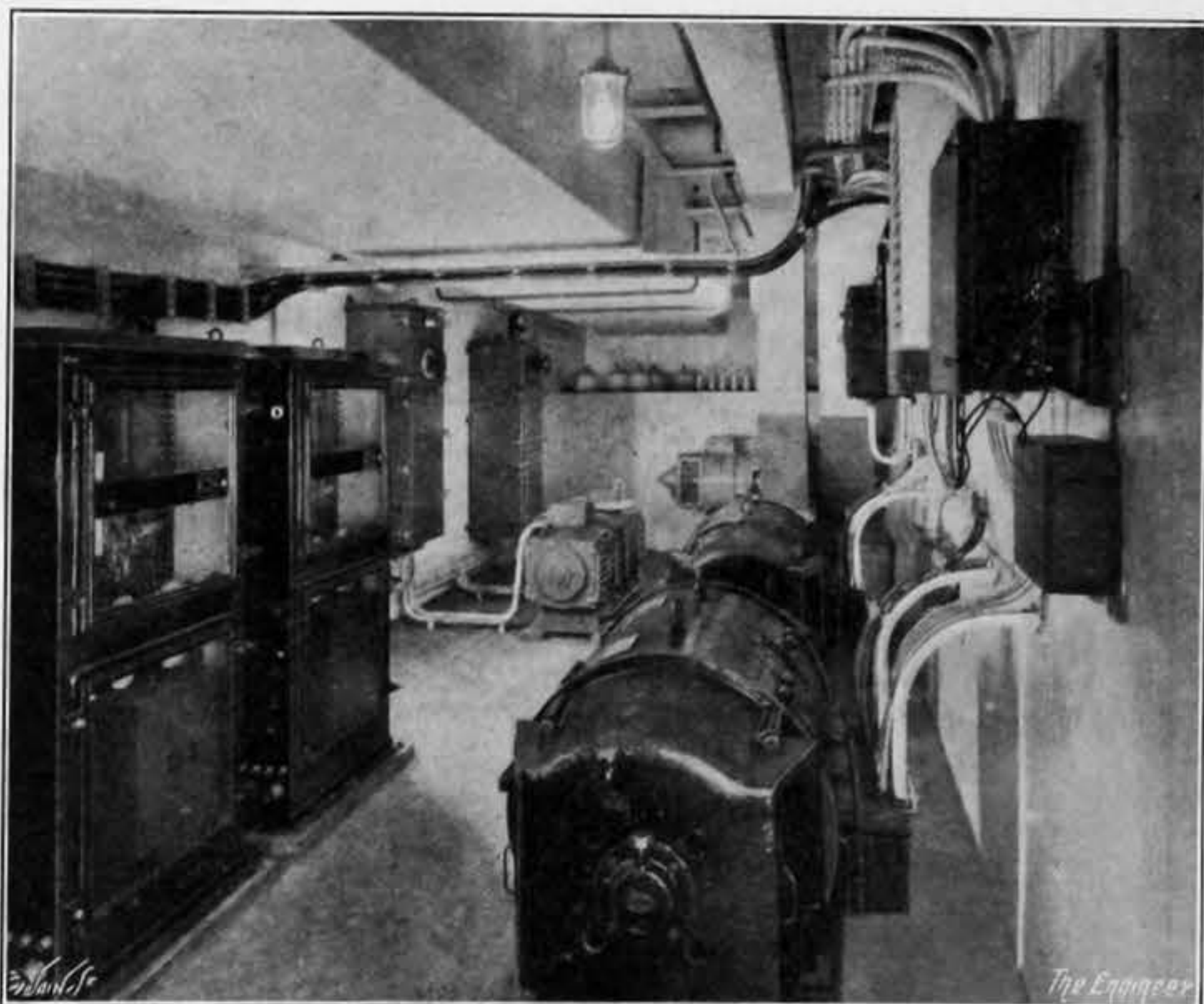


FIG. 31—LOW-VOLTAGE MOTOR GENERATORS—B.T.H.

switchboards, supplied by Whipp and Bourne, Ltd., of Castleton, near Manchester.

The auxiliary switchboards on the machinery decks, which are normally supplied from the machinery board, are arranged so that the supply from the hotel board can be used if necessary. This is made possible by means of links on the auxiliary boards, which are so arranged that the change cannot be made inadvertently.

Each auxiliary board is fitted with the necessary breaker and switch fuse circuits for the control of the apparatus in the immediate vicinity, and each board can be completely isolated by means of a system of links and electrically operated breakers without disconnecting any other boards. To save as much space as possible by keeping the dimensions of

and cannot be put in circuit until the control switch on the bridge is opened.

EMERGENCY GENERATORS AND SWITCHBOARD.

The emergency plant, a view of which is given on page 592, consists of two 75-kW generating sets, each comprising an eight-cylinder Parsons engine, constructed by the Parsons Oil Engine Company, Ltd., Southampton, having 7in. bore and 8in. stroke, and designed to develop 150 to 160 H.P. at 850 r.p.m. when working on paraffin fuel. The whole plant has an overload capacity of about 25 per cent. for a limited period.

A 12-volt electric starting system is fitted to each engine, supplied from an independent starter battery, but the engine is also supplied with hand starting

generator section consists of three panels, one for the control of each machine, and one for the supply to the feeder section; the feeder section is so interlocked that it cannot be operative unless at least one of the emergency generators is running.

It is supplied from three separate sources—the hotel supply, the machinery supply, and the emergency supply, but is interlocked so that only one of these is feeding the bus-bars at one time, and therefore there is no risk of paralleling the various supplies.

Normally it is fed from the hotel service, but should that supply be cut off the board it is automatically switched over to the machinery service. Immediately the hotel supply is again available, the supply is taken from that source, the machinery supply being cut off at the same time. When the emergency

generators are in service, both the previous supplies are cut out, but are available when the generators are shut down. The whole of the changes we have referred to are automatic, so that there is no likelihood that a supply to this board will not be available. In addition, there is a switching arrangement whereby the emergency generators can supply current to either or both of the main boards should all the main generators be stopped, as may be the case between voyages.

For the low-voltage supply, such as is required

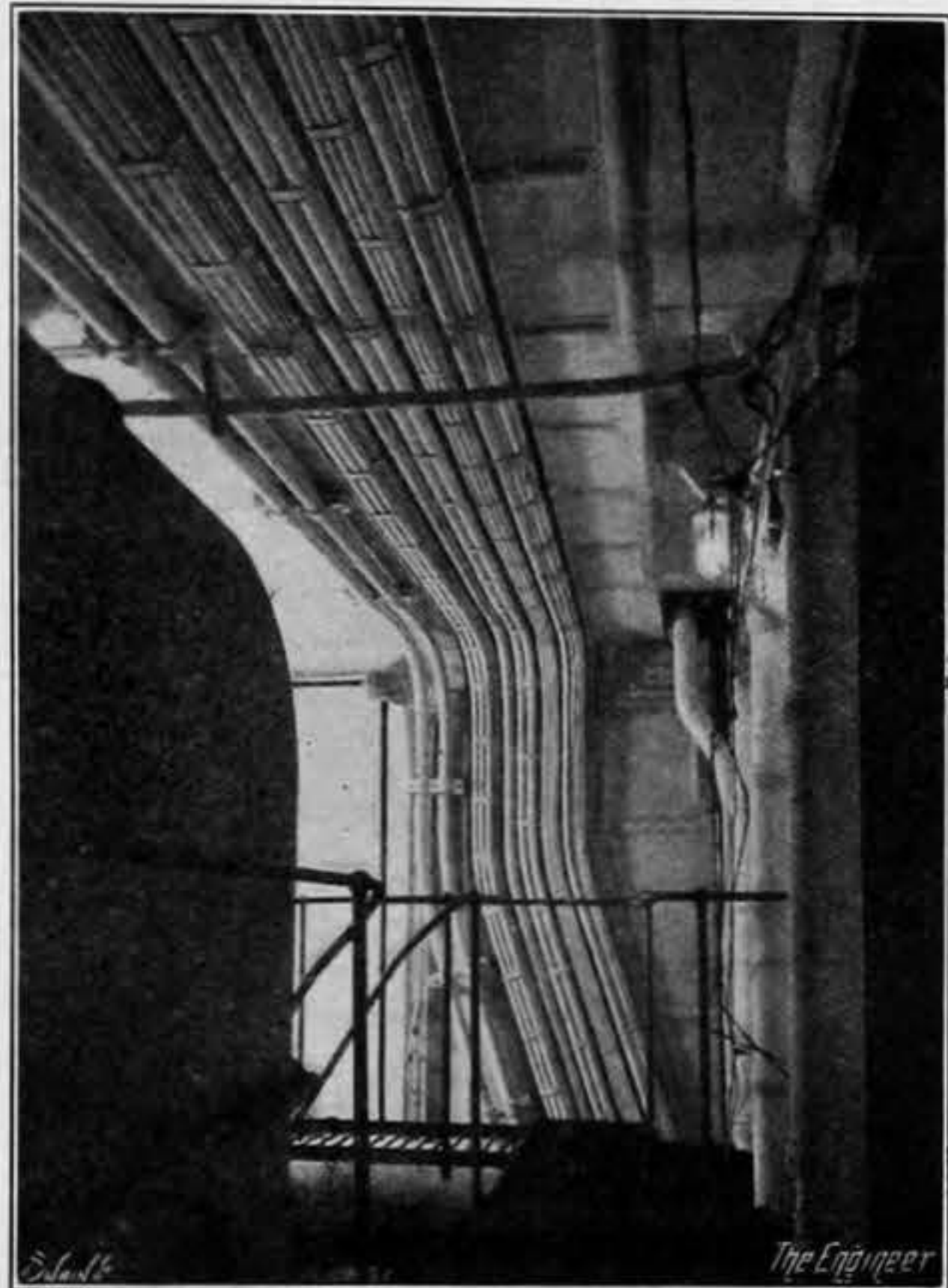


FIG. 32—CABLE RUN IN ENGINE-ROOM

for the operation of telephones, cabin call bells, fire alarms, clocks, passenger and crew emergency gongs and miscellaneous systems of this nature, two motor generators, each of 2-kilowatt capacity, have been installed. Each is designed to deal with the full connected load of the system, but in the event of the running machine being inadvertently stopped, the load is automatically thrown on to a nickel iron battery, and at the same time an indicating lamp and warning bell on the main machinery switchboard

thyatron control of the public lighting, is given in Fig. 31.

Two low-power ring mains are fitted for the distribution of the low-power supply, one for the forward part of the vessel and the other for the aft, and each consists of a pair of 19/0·064 cables. They are connected to suitably placed double-pole fuse-boxes, which, in turn, are linked up to the various low-power services throughout the ship.

ELECTRIC CABLES.

The electric cables, the major portion of which were supplied by Callender's Cable and Construction Company, Ltd., vary in type according to the duty and

cables therefore are used throughout the vessel. All ring mains and large cables to circulating pumps, steering motors, capstans, and windlasses are supported throughout on porcelain insulators. This method has also been adopted for the sub-mains and has been found from previous Cunard practice to give a maximum of freedom from insulation breakdown. A typical view of the cable run in the after engine-rooms is reproduced in Fig. 32.

The remainder of the cable was supplied by British Insulated Cables, Ltd., of Prescott, Lancashire, and it included the equipment in the crew's quarters where the cables are run in solid drawn galvanised steel tubing.

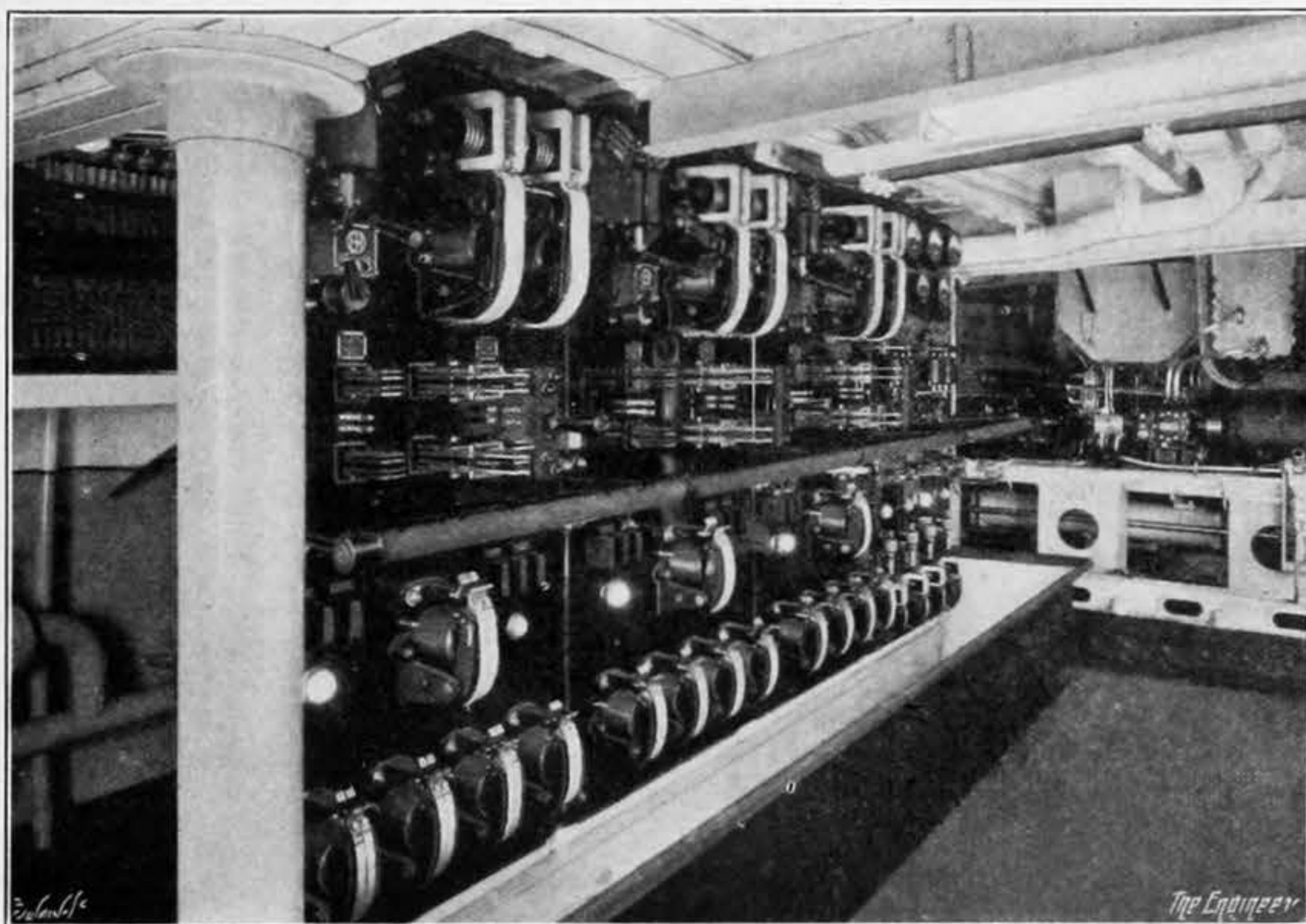


FIG. 34—STEERING GEAR SWITCHBOARD—BROOKHIRST

position on the ship in which they are installed. The sizes range from 1/0·036in. to 127/0·103in., and include multicore cables of from two to twenty cores. Special consideration was given to cables run in wood casings and to the fireproofing of the timber and cable sheathing, which was carried out as a precautionary measure, while corners of wood casings were carefully rounded to avoid abrasion. In positions where cables of opposite polarity have to cross each other,

The total length of electric cable fitted throughout the entire ship amounts to no less than 735 miles. A number of colours are employed in the finish of the various cables, in order to assist in identifying the many different circuits throughout the ship, and over 8½ miles of Harco perforated steel plates, supplied by G. A. Harvey and Co., London, Ltd., were used in fixing the cables and wires.

Electric motors, ranging from 0·25 to 285 H.P.,

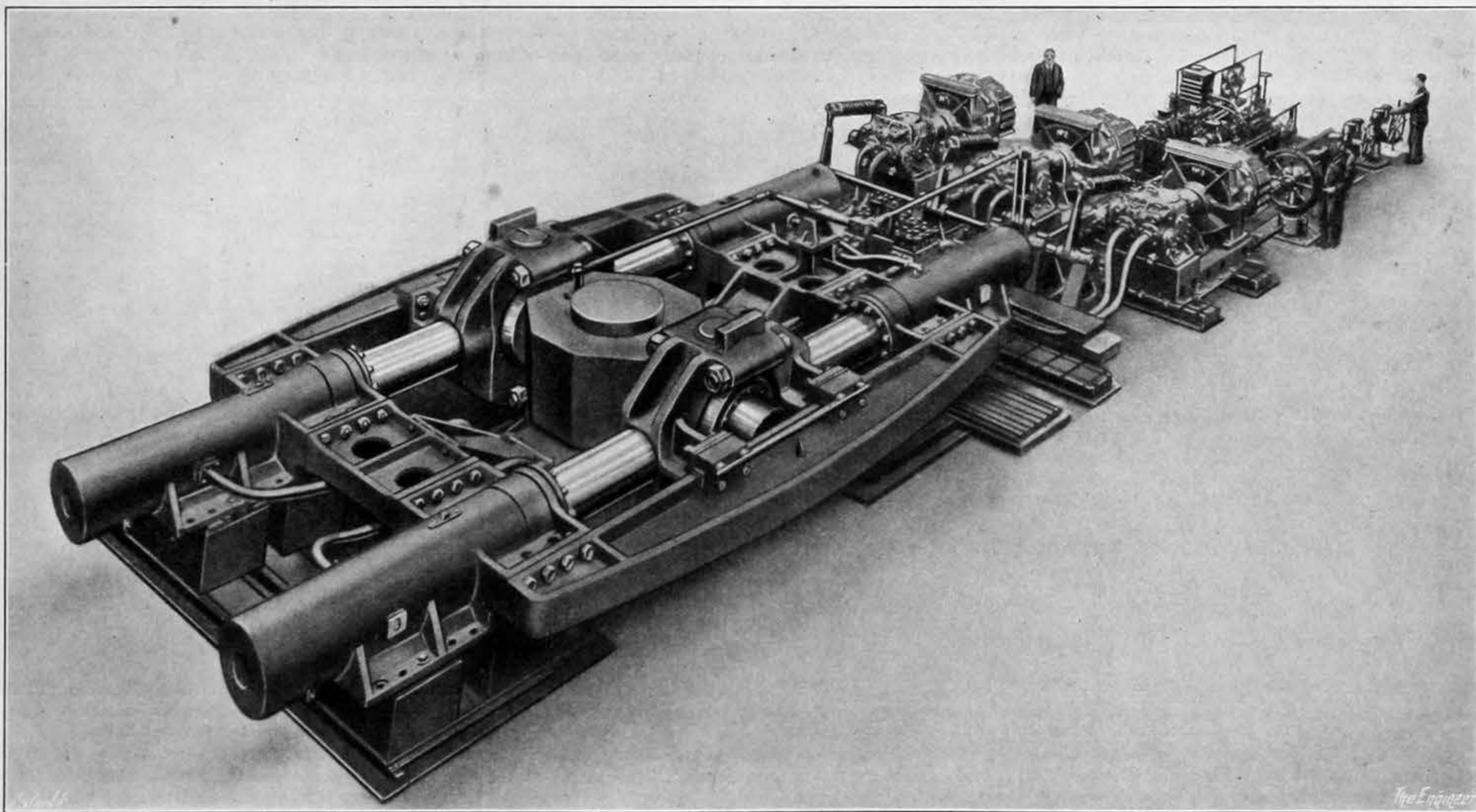


FIG. 33—ELECTRO-HYDRAULIC STEERING GEAR—BROWN BROTHERS

come into operation, warning the attendant of the stoppage.

The battery, which was supplied by Batteries, Ltd., of Reddish, consists of eighteen nickel-iron cells, with a designed output of 20 amperes for a period of five hours. It is charged from the main 220-volt supply. The motor generators and switchboard are placed in a special compartment on "E" deck near the entrance to the after turbo-generator room. A view of these motor generators, also those for the

specially designed crossing pieces are fitted which preclude any possible chance of contact, thereby eliminating the possible danger of fire.

Owing to the great length of the ship and to the fact that the hotel service generating plant is placed in a position considerably forward of the main electrical centre, on account of volt drop difficulties, advantage could not be taken of the higher density which might have accrued from the use of paper or cambric as an insulating medium. Rubber insulated

have been installed in the ship and, excluding cabin fans and other fractional horse-power motors, of which there are several hundreds, the aggregate of the more important motors reaches the figure of 17,818 H.P. The number and individual powers of the motors, the capacity of the generators, and other details of general interest have been tabulated and compared with those of the "Mauretania" and "Aquitania." The comparison which shows the great development in the use of electricity on board

ship is given in Table I below. The figures in each case represent the position when the vessels were built, and do not take into account any subsequent alterations or additions. All the motors fitted throughout the ship were constructed to the specification of the Cunard White Star Line; they were also approved by Lloyd's Register of Shipping, and Board of Trade, and meet the requirements of the Institution of Electrical Engineers.

TABLE I.

	Gross tonnage.		Completed.	
"Mauretania"	30,696		1907	
"Aquitania"	45,647		1914	
"Queen Mary"	80,744		1936	

Electric motors.	"Mauretania."		"Aquitania."		"Queen Mary."	
	No.	B.h.p.	No.	B.h.p.	No.	B.h.p.
Engine-room machinery	18	400	17	333	77	4,640
Boiler-room machinery	16	800	14	700	37	3,957
Machinery space ventilation	29	276	30	479	19	388
Accommodation ventilation	69	208	88	387	235	1,119
Deck machinery	8	48	5	56	28	5,768
Steering Gear	—	—	—	—	3	750
Kitchen machinery	—	20	—	131	32	40
Various small motors ..	3	15	12	14	78	256
Elevators and hoists ..	14	114	10	95	40	268
Refrigerating machinery	4	64	—	—	5	150
Boat-hoisting machinery	4	108	2	60	24	480
Totals	165	2,053	178	2,255	578	17,818
Total capacity of generators, including emergency sets ..	1,500 kW		1,630 kW		9,250 kW	
Number of lamps, approximately ..	6,600		10,000		29,000	
Length of cables in miles, approximately ..	150		200		735	
Cooking apparatus ..	Very small		Very small		1,450 kW	
Radiators, &c. ..	70 kW		—		420	

ELECTRICAL CONTROL GEAR AND LIGHTING.

Motor control gear on a vessel of the "Queen Mary's" size and importance must necessarily be of the type to ensure a continuity of service, and special consideration was given to the design and manufacture of such apparatus with a view to securing accessibility and immunity from breakdown. The following manufacturers were entrusted with the work on this equipment:—Allen West and Co., Ltd., of Brighton; Brookhirst Switchgear, Ltd., of Chester; and Laurence Scott and Electromotors, Ltd., of Norwich.

The general lighting of the ship was carried out to a very high standard and throughout the cabin class passenger accommodation and corridors the lighting equals that of the most modern first-class hotel ashore. The general lighting in the tourist and third-class accommodation is also of an unusually high standard.

Special lighting is arranged to be controlled from the bridge for boat lighting and for use in launching the lifeboats. Two 18in. Sperry search-light projectors are fitted on the bridge house and four 1000-watt flood-light projectors—two forward on the aft side of the bridge and two aft of the aftermost lifeboat illuminating the ship's side and lighting the water, while twenty-four boat inspection lanterns and twelve overside lights of 300-watt capacity illuminate the boats in their housed and embarkation positions. These lights have been arranged on port and starboard emergency circuits and are controlled from the bridge by contactors through specially designed push button switches.

Flood-lighting of the funnels and bridge front has also been arranged and fifteen 1000-watt B.T.H. flood-light projectors placed in specially selected positions and controlled from the bridge provide very fine illumination of these outstanding features of the ship. The general lighting of public rooms will be referred to later.

STEERING GEAR.

An electrically operated auxiliary of unusual interest is the steering gear. The exceptional size of the ship and the necessity of accurate manoeuvring at high and low ship speeds called for the installation of a rudder of large area. The rudder, which is of the streamline unbalanced type, requires a steering gear exerting a turning moment of approximately three times the power of the largest steering gear previously built in this country, and weighing approximately 180 tons, and the design finally agreed upon was only arrived at after long and careful consideration of all factors by both the owners and shipbuilders. All the different types of known steering gears were considered, and the conclusions arrived at pointed to an electro-hydraulic steering gear being the only solution of the problem of efficiently controlling the rudder and providing the maximum possible safeguards by duplication of essential parts. The design and construction of the complete steering gear—from the telemotors on the bridge to, and including, the massive rudder head bearing—was entrusted to Brown Brothers and Co., Ltd., of Rosebank Ironworks, Edinburgh.

The final design, shown in Fig. 33, is a steering gear with four cast steel hydraulic cylinders arranged in pairs on either side of the rudder stock with the rams of each pair coupled together and forming double bearings in which pivot the vertical pins of the cast steel crossheads. The crossheads are fitted with

bronze bushes and are free to slide on the circular arms of the forged steel tiller which is keyed to the rudder stock, this combination of pivoting and sliding movement enabling the straight line motion of the rams to be transmitted to the angularly moving tiller arms. The total weight of tiller and rudder is carried on a rudder bearing of the makers' special design.

The pressure fluid is supplied to the cylinders by "VSG" Mark III, Size 50, high-pressure variable delivery pumps, each driven by a 250 B.H.P. Laurence Scott motor controlled from a special Brookhirst switchboard equipped with automatic starters for all motors. The board, an illustration of which is given in Fig. 34, is supplied from the main and emergency switchboards. The fluid delivery from the pumps is controlled by a system of control and hunting gear, and as the effort required is naturally high for normal manual control a complete servo-gear has been provided. The servo-gear is of the electro-hydraulic type, with all parts duplicated, and it has two "VSG" Mark III, Size 1, variable delivery pumps, each driven by a 4 B.H.P. Laurence Scott motor, which supplies fluid to duplicated cylinders operating the main steering gear control gear. The servo-gear is in turn controlled from the bridge by duplicated hydraulic telemotors, so arranged that either may be used at will, the change from one to the other being simply a matter of the steersman moving from one wheel to the other. A third distinct link from the navigating bridge to the steering gear is provided by a Sperry gyro-pilot connected direct to the servo-control gear, giving either hand or complete automatic steering on a predetermined course. A third telemotor is provided on the docking bridge for emergency use.

When the steering gear is in normal operation at sea the two main pumping units are running, and they supply fluid to the main cylinders and rams connected to the tiller, with both servo-units running and both navigating bridge telemotors connected up. Movement of the bridge telemotor wheel is transmitted to the telemotor receiving cylinder which controls the servo-pumps supplying fluid to the servo-cylinders, which in turn operate the main steering control gear. This gear controls the delivery of fluid to the main rams, which, through the swivel crossheads, act on the arms of the tiller, causing the rudder to respond instantaneously and move proportionately to the movement of the telemotor wheel. The sensitive control of the rudder has been demonstrated on trials, the rudder stock, 1000ft. away from the telemotor transmitter, responding to a movement of one spoke of the small steering wheel.

In order to ensure against any possible breakdown at sea the four operating rams and cylinders are connected up through a system of valves and pipes which permits the gear to operate with any of five combinations of cylinders, all normal manoeuvring being carried out on any two opposed cylinders. Although three main pumping units are provided, any one of them is capable of moving the rudder to hard over with the ship steaming at full speed, and any pumping unit can be brought into action by simply starting up its driving motor from the main or emergency switchboard. A complete system of electrical alarm equipment ensures immediate warning of the failure of supply or stoppage, from any cause, of any motor. The servo-gear, which is duplicated, can carry on its duties equally well with either one or both of its pumping units, which automatically take up duty when their driving motors are started up. As already stated, the navigating bridge telemotor installation is completely duplicated and a docking bridge telemotor is also provided, while in the steering gear compartment a pedestal is provided carrying a wheel controlling the servo-gear independent of the telemotor installation. In addition, a large pedestal with a hand wheel provides for the control of the steering gear independent of the servo control. The gear can thus actually be controlled from six distinct wheels.

PUMPS.

Any description of the steering equipment of the ship would be incomplete without some reference being made to the "VSG" variable delivery pressure pumps, which provide the pressure fluid in whatever quantity is required at any moment for any desired movement of the massive rams which act direct on the tiller ends and give a balanced effect about the rudder post.

The "VSG" pumps were manufactured at Elswick and were supplied by Variable Speed Gear, Ltd., to Brown Bros. and Co., Ltd., Edinburgh, for incorporation in the steering gear. They are specially designed for marine duty and are of an improved design, based on the Williams-Janney principle with axially disposed pistons. They incorporate main and radial thrust bearings of the Michell type. The no-load condition under which the pumps run when not actually delivering fluid is an important factor in the conservation of power. The results obtained on the trials confirmed the economy of the electro-hydraulic system we have described.

(To be continued.)

A LARGE number of the Ruhr mining companies are interested in a process for the production of oil from coal by a pressure-extraction method. The new method is a solvent process using tetralin.

Letters to the Editor.

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

CENTRIFUGAL PUMP EFFICIENCIES.

SIR,—As it has been suggested in your columns that this question is worthy of further discussion, I trust that you will consider the following remarks sufficiently interesting to occupy space in your journal.

The reliability of efficiency figures—whether those of centrifugal pumps or any other engineering product—depends upon three main factors:—Time devoted to obtaining the test, instruments used to determine the data, and persons employed in carrying out the test. These factors can influence results materially without any reference to country of origin, though, personally, I do not consider it a recommendation when a British firm sends members of its test staff abroad to receive instruction. This has happened.

Reported test figures have necessarily to be accepted with considerable tolerance, for the very good reason that most data published are the results of commercial—by no means the same as scientific—tests, carried out with the help of commercial instruments by a staff skilled in obtaining the results required (but not necessarily educated in the precise use of precision instruments) at such a speed as may not hamper production nor unduly raise costs.

It is an undeniable fact that cases exist in which test room staffs have been bullied into producing the results expected, under the argument that what has once been done can be repeated. In the absence of special precautions, flattering inaccuracy is liable to be perpetuated in this way. In other cases the test room staff, though frequently asserted to be too unintelligent to be capable of faking results, delights in its ability to disprove the assertion.

Often, too, the probable accuracy of commercial tests is highly overrated. Generally the rate at which a string of tests under varying conditions is recorded precludes the possibility of a state of stability ever having been arrived at. Whilst even if the time spent upon the series were devoted to obtaining a single reading under constant conditions, the result would mostly be scientifically useless, because each instrument used would have but a commercial degree of accuracy no greater than the margin within which the result to be determined is supposed to be correct; and even these instruments would not have been read simultaneously.

A pump efficiency of 80 per cent. ± 2.5 per cent. is usually acknowledged to mean (80 ± 2.5) per cent.; 80 per cent. with 2.5 points margin to allow for inability to test within closer limits. How much wider of the mark the results really can be becomes clear when it is remembered that the motor efficiency is not guaranteed accurate within finer limits; nor the precision electrical instruments either. Vacuum and pressure gauges are still less accurate, and the water gauge may perhaps be as accurate if used properly. This final condition applies equally well to all the other instruments used, and means barring pulsation and unsteadiness of all kinds. No pointer should swing; no fluid column or surface, surge. Such a condition is only possible with the hydraulic gauges if they are throttled sufficiently—made sufficiently less sensitive than they naturally are, in order to facilitate reading. The electrical instruments are not so easily dealt with, so their pointers are continuously jumping and swinging through wide ranges under the influence of varying shop loads, neighbouring tramway services, and possibly even of both these disturbances.

Added to all these unavoidable contributions to inaccuracy are those arising from misuse of the assembled machines and instruments. One of the most frequent arises from the fact that although a motor necessarily changes its speed as the load varies, the test staff usually endeavours to impose a constant speed upon the motor. This contributes in no small measure to the conditions of instability which preclude the obtaining of accurate results, and, incidentally, provides easy means of introducing adjustments or making mistakes.

A test-bay foreman was once overheard expressing his dissatisfaction of his manager because "he didn't know there was more in testing than reading instruments." Managers do not, as a rule, countenance inaccurate tests, but, nevertheless, they sometimes cause them. It was, at one time, fashionable to call in an impartial expert to confirm unusually good results. The records achieved were marvellous. The fashion has passed.

Whilst thoroughly agreeing with most of that which has been suggested by your various correspondents, I would like to go one better than Mr. Cameron. Interesting as are the figures quoted in his table on April 24th last, Mr. Lupton's thanks and praise would be better earned if the table were completed by a statement concerning the number of eyes employed in each pump listed. The specific speeds could then be determined, and efficiency, apart from specific speed, is no definite criterion of perfection.

It is suggested that when efficiency figures are put forward it should be standard practice to make reference to the British Standard Specification. That would be a long stride in the right direction, and, being an easy one, it is strange that it has not been more usually adopted already.

B. M. WOODHOUSE.

June 2nd.

ELECTRICAL DRIVE IN THE CARPET WORKS OF E. WEBB AND SONS, LTD., WORCESTER

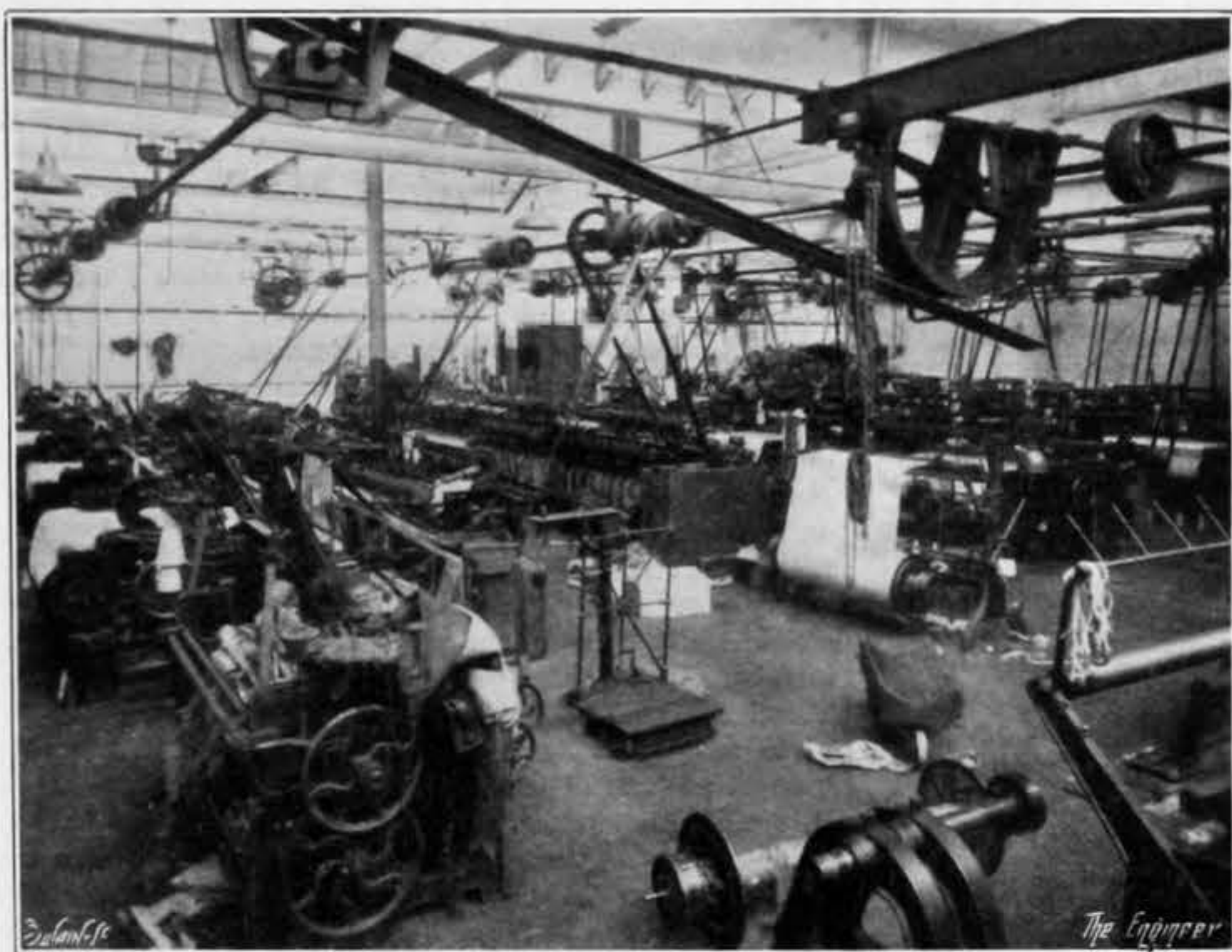


FIG. 1—PART OF ORIGINAL WORKS

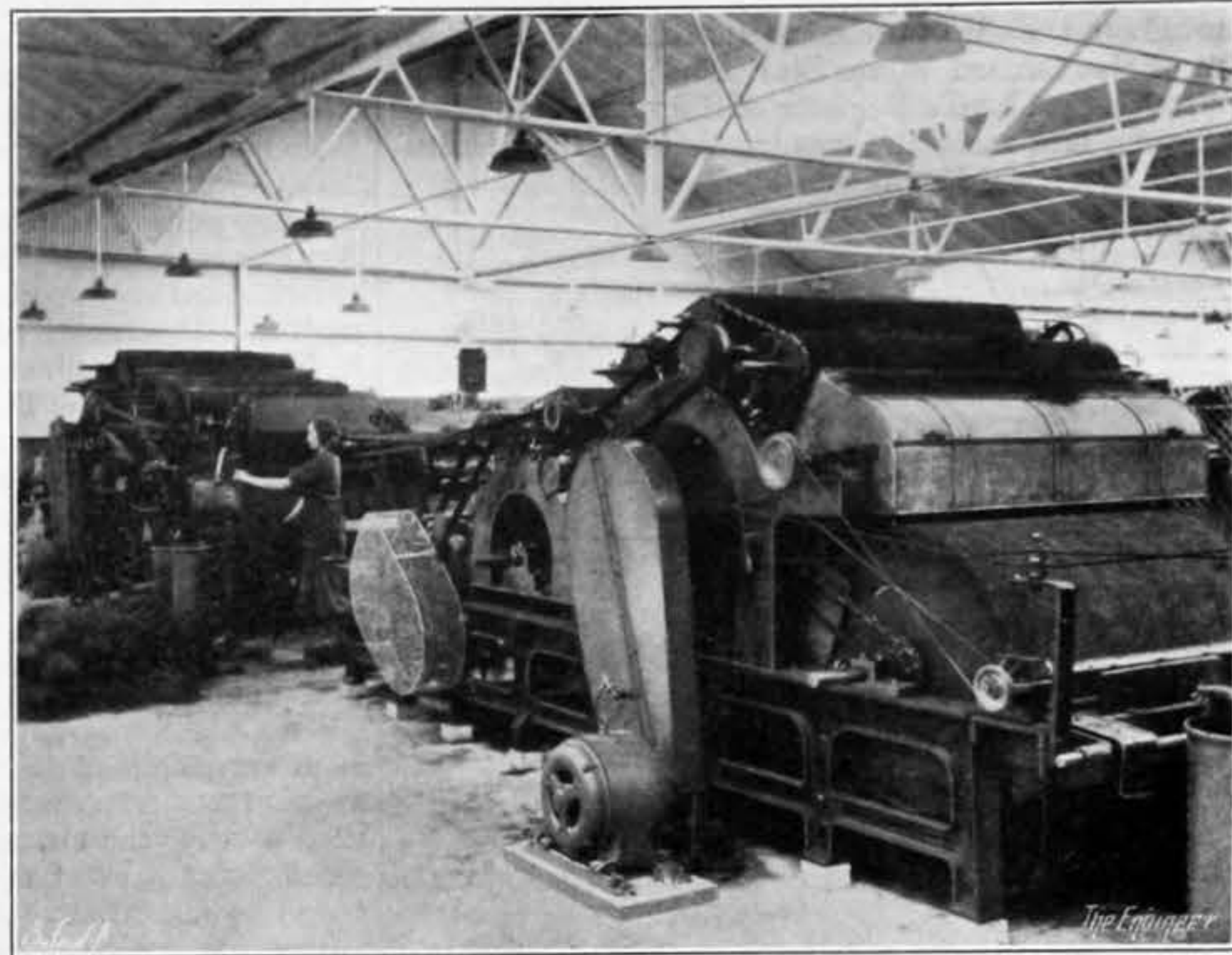


FIG. 2—CARDING MACHINES

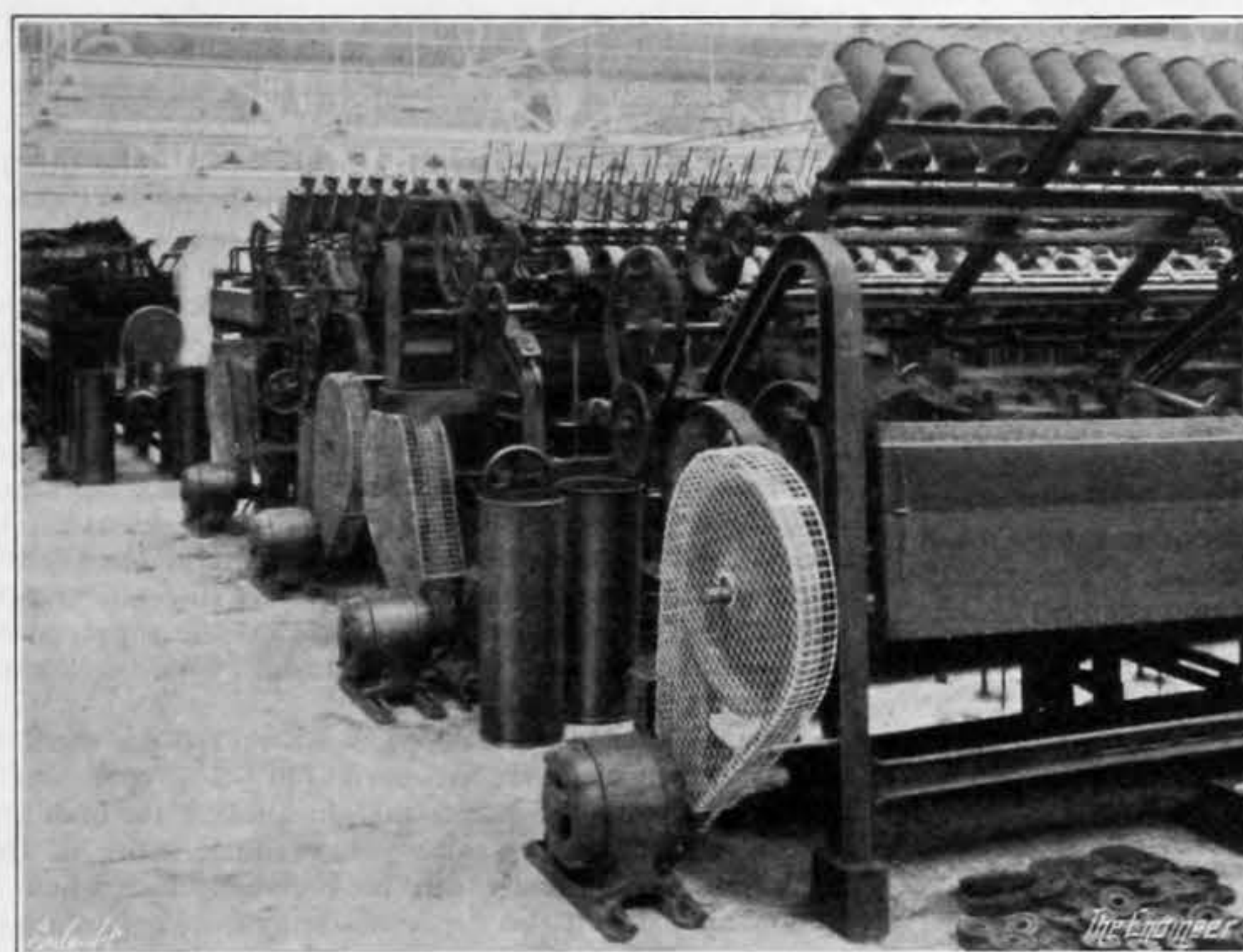


FIG. 3—HORSE-HAIR PREPARING MACHINES

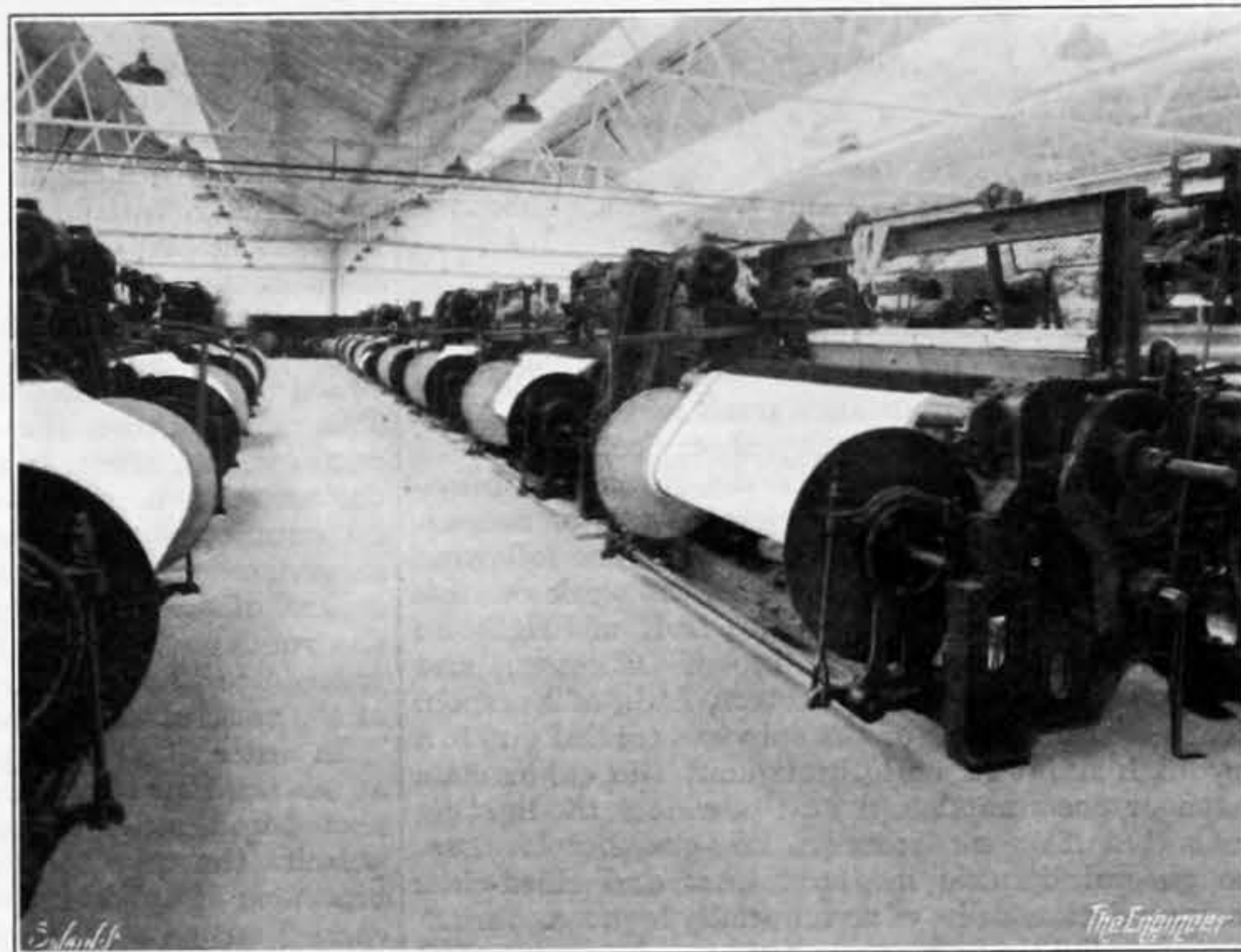


FIG. 4—AUTOMATIC LOOMS

Electrical Equipment in a Carpet Works.

WHILE it rarely happens that descriptions of electrified works reveal anything very new in the way of electrical practice, it does not follow that they are devoid of interest to industrialists dissatisfied with their driving arrangements. The present description relates to the new works of Edward Webb and Sons (Worcester), Ltd., who started a horse-hair seating and hair cloth business in the centre of the town of Worcester as far back as 1835. From time to time the original factory was extended, and in April last the business was transferred to an entirely new factory, covering 55,000 square feet, on the outskirts of the town. With its small rooms, low roof, narrow passages, and winding stairs, the old building proved unsuitable for efficient production, and although electric driving had been employed for a long time, as Fig. 1 indicates, the equipment was scarcely all that could be desired. Shafting, pulleys, and belts have now been eliminated by the adoption of the individual drive, which has made the new light, airy, one-storey building thoroughly up to date, and devoid of transmission obstructions. In all, there are about 190 Crompton-Parkinson hair motors, practically all of the squirrel-cage type, with an aggregate of approximately 400 H.P. For the most part, the machines have outputs less than 5 H.P., and the power factor is at present rather low, but condensers are being installed to raise it to about 0.95. Contrary to what may appear to be desirable, ordinary protected motors have been adopted throughout, as experience in the old factory, in which the conditions as regards the presence of cotton and wool fluffs and hairs were very much worse than they are in the new factory, showed that they were perfectly satisfactory.

A 440-volt, 50-cycle, three-phase supply is taken from the Worcester Corporation's mains, and after passing through an Ellison main switch panel with draw-out type, four-pole breakers it is fed by a lead-covered cable to splitter boards in the works, and thence to distribution boards, all the cables, which are of Henley's manufacture, being carried under the floor, thus providing a neat and serviceable lay-out.

The chief raw materials are horse-hair, goat-hair, cotton, and wool, most of large quantities of hair needed being obtained from South America. The poorer qualities of hair are curled and sold for filling upholstery and mattresses, while the best quality is used for hair cord carpets and for the manufacture of high-class horse-hair canvas, known as "Laptair," which tailors employ as an interlining in the shoulders and lapels of coats.

Work begins with the arrival of the bales of horse and goat-hair, which is cleaned by passing it through dust extractors with fans driven by 7.5 H.P. motors. The best quality of hair passes through various processes in the hair preparation department, in which it is made ready for spinning. It is then carded on large carding machines,

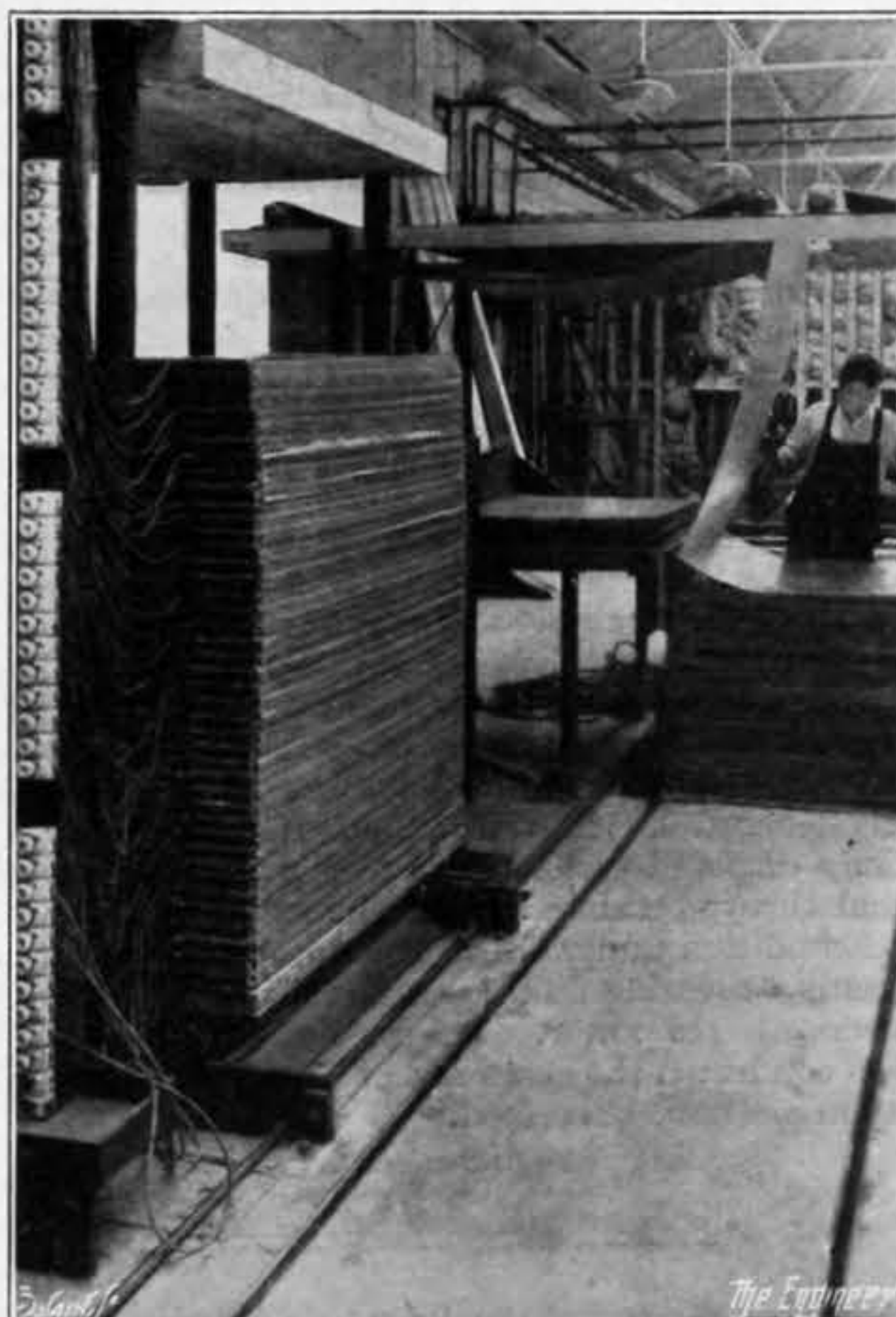


FIG. 5—APPARATUS FOR PRESSING AND DRYING "LAPTAIR"

two of which are shown in Fig. 2. These are driven through chains by 4 H.P., 720 r.p.m. Parkinson motors, which, like most other motors in the works, are controlled by Donovan push-button units. As shown on the left of this illustration, the hair enters the machines as a tangled mass, and after passing through the wire brush surface of the rollers comes out as a continuous loosely twisted sliver or coil, about 1 in. in diameter.

The row of 2 H.P. motors shown in Fig. 3 are driving some of the many horse-hair preparing machines, on which the coils of hair are reduced in size and wound from reel to reel. The final stage is reached when a string of about eight hairs thickness has been obtained. This is then bound round in a criss-cross pattern with cotton thread throughout its length, thus forming a strong thread suitable for weaving. The weaving of the firm's "Laptair" horse-hair canvas interlining, composed of worsted warp and horse-hair weft, is done on a battery of Northrop automatic looms, as exemplified in Fig. 4. Each loom is driven by a 1 H.P., 940 r.p.m. motor, through V ropes. The woven fabric is then steamed and shrunk in the blowing and steaming machine shop, driven by a Parkinson $4\frac{1}{2}$ H.P. geared motor, giving a final speed of 57.5 r.p.m. Process steam is obtained from a separate boiler-house, which also supplies steam for the thermostatically controlled works heating system. In this boiler-house electric motors provide the power required for operating the stoker feed pump, fan, &c.

The apparatus shown in Fig. 5 has been developed for pressing and drying "Laptair." In the background, the material is to be seen being stacked ready for pressing. The canvas is unrolled and passed to a motor-driven conveyor, which drops it into position for folding into a pack about a yard wide, a thin sheet of aluminium being placed between each thickness of material, whilst at about every six folds a special heating element with sheets of press-pahn on either side is inserted. When the stack is complete, it is placed in position in the hydraulic press, to be seen on the left, and current is supplied to the elements from a 75-kVA, B.E.T. 50-volt transformer.

The section of the factory devoted to the production of hair cord and Axminster carpets and velvets is also fully electrically equipped. As in every other part of the works, the individual drive is used exclusively, and much better working conditions exist than those which prevailed in the old factory. For lighting the works, 100-watt Crompton lamps in Verity's "Overlamp" fittings are used throughout, there being 240 lighting fittings in the hair preparing department and 220 in the carpet department, supported from the roof trusses at 10 ft. centres. Working in close collaboration with Mr. Guy Webb, Mr. Horton Smith, of Abell and Smith's Electrical Company, Ltd., of Worcester, was responsible for the selection and installation of the electrical equipment.

Rail and Road.

On the Southern Railway the station hitherto known as "Tinsley Green" has been renamed "Gatwick Airport."

To relieve the congestion caused by tramcars in the main streets of Moscow all tramlines are to be removed and these vehicles will in the future run through parallel side streets.

THE directors of the London, Midland and Scottish Railway have appointed Mr. S. R. Beale to the board of directors. Mr. Beale has, since 1930, been a member of the local Scottish Committee.

ON June 2nd, the L.M.S. "Ulster Express" left Crewe for London seventeen minutes late, and arrived at Euston on time, having covered the 77 miles between Rugby and Willesden at an average speed of 70 miles an hour.

ON the London, Midland and Scottish Railway, on Friday last, when the 7.38 a.m. train from Bletchley to Euston was passing another train outside Willesden Junction, a portion of a horse-box struck it and killed one passenger. Four other passengers were cut by flying glass.

THE Minister of Transport having appointed Mr. John Pike to act as a member of the Railway Rates Tribunal during the absence of Mr. John Quirey, the 1936 review of the standard charges and exceptional charges of the four amalgamated railway companies, postponed because of the illness of Mr. Quirey, will begin at 10.30 a.m. on Wednesday, June 17th.

In a paper read at Glasgow before the Industrial Transport Association, Mr. F. Smith suggested a National Transport Board to organise and co-ordinate this country's transport services. He said that purely railway activities should be limited to the haulage of bulk loads between important centres and the concentration on and distribution from these centres should be performed by motor vehicles.

So successful have been the tests made during the past eighteen months on six lorries fitted by the Wallasey Corporation Gas Department to run on compressed coal gas carried in cylinders, that the Town Council has equipped a double-decker motor bus to run on the new system. The bus has been in regular service as a petrol-driven vehicle and no alterations have been made for it to run on gas fuel.

ON the recently electrified lines in the United States between New York, Philadelphia, Baltimore, and Washington the whole of the services have been speeded up. According to the *Railway Gazette*, between Wilmington and Baltimore twenty-six trains are booked every day to cover the 68.5 miles in from 61 to 67 minutes, a general overall average of 64.7 m.p.h. At an average time of 4 hours 8 minutes over thirty trains run daily between New York and Washington, a distance of nearly 225 miles.

THE Great Western Railway has at present seventeen oil-engined railcars operating 132 daily services and travelling some 20,000 miles a week, as compared with one railcar, running 1500 miles a week, two and a-half years ago. All of these railcars were built by the Associated Equipment Company, Ltd., and with the exception of the first single-engined experimental unit all are driven by two of the makers' standard engines each developing 130 H.P. The mileage to date of the first unit to enter service is over 130,000.

WHAT is said to be the longest railway bridge in the world has been completed across the Mississippi at New Orleans, in the United States. According to the *Railway Gazette*, the bridge structure is 4.4 miles long with the approaches. The main bridge over the river is 3525ft. long and consists of a three-span through truss cantilever structure with a 790ft. central span, two 530ft. flanking spans, and a 530ft. bowstring side span. From the east the bridge is approached by four deck truss spans and the land approaches consist of plate girders supported on steel trestles. The bridge is for both road and rail traffic and has two railway tracks, an 18ft. roadway, and two 2ft. 6in. footpaths.

IMPROVEMENTS to a section of the Great North Road are proposed by the West Riding County Council in a scheme for which the Minister of Transport has made a grant from the Road Fund. Where the road passes through Darrington, about 13 miles north of Doncaster, it is intersected by the road from Pontefract to Womersley. The corners of this junction are "blind" and a little further to the north there is a dangerous "S" bend. The present scheme contains special proposals for improving traffic conditions at these points. A large central island will be provided at the cross roads, and to avoid the dangerous bend the road will be diverted for a distance of about 400 yards. Including the diversion, the road will be widened and reconstructed for a total length of 1160 yards. The improvements will begin at a point 340 yards south of the cross roads, and a total width will be obtained throughout the section of 120ft. The improvements are estimated to cost nearly £30,000. They will be put in hand as soon as the necessary land has been acquired, and it is expected that the work will be completed in 1938.

In addition to other extensive modernisation work on existing coaches, the London, Midland and Scottish Railway Company is building 687 new passenger vehicles. During the past six years a total of over 3580 new passenger-carrying vehicles has been put into service by this railway, representing over 20 per cent. of the total stock. All corridor vestibule and restaurant vehicles are now being fitted with low-waisted windows, and approximately 2400, or one-third of the total stock of such vehicles, are now so fitted. Nearly 1000 third-class corridor coaches have now been provided with arm rests and shoulder lights for reading. In 1933 the replacement was begun of seventy of the older dining cars, and up to date forty-two have been placed in service and the remainder will be finished within a short while. A programme for the replacement and renovation of the whole of the company's first-class and composite sleeping cars was begun in 1934 and by July this year there will be 115 of these vehicles in service. The company has a stock of nearly 17,000 passenger-carrying coaches and over 6400 vehicles for parcels and other goods carried on passenger trains.

Miscellanea.

WE regret to note the death of Sir Thomas Putnam, who was for many years managing director of the Darlington Forge, Ltd.

DURING 1936 forty-two steel companies in the United States spent 9,200,000 dollars on research, according to the American Iron and Steel Institute.

BASED on coke consumption the efficiency of modern coke ovens in the United States is over 80 per cent., according to Dr. J. Johnson in a paper read before the American Society for Metals.

Two factories are to be erected in the Irish Free State for the manufacture of cement, one will be near Limerick, the other near Drogheda. It is expected that the plant for the equipment of these works will be imported from this country.

IN South Africa there are two coke-oven plants in operation; the larger one at Pretoria comprises fifty-seven coke-ovens with a capacity of 180,000 tons of metallurgical coke annually. The other, at Waschbank, has fifty ovens and an annual capacity of 72,000 tons.

THE American Navy is using a new boiler scale-preventing composition, according to the *Chemical Trade Journal and Chemical Engineer*. The compound consists of a mixture of 47 per cent. of disodium phosphate, 44 per cent. of soda, and 9 per cent. of maize starch.

To enable the delegates to the International Congresses on Chemical Engineering, Refrigeration and Welding to visit the low temperature exhibition at the Science Museum the exhibition will remain open until the end of June. It was originally intended to close the exhibition at the end of May.

A CORRESPONDENT in *The Times* states that the Royal Agricultural Society of England has had discussions during recent months with the various tractor interests, and it is understood that a committee is proposed to supervise a scheme of tractor testing at the Institute for Research in Agricultural Engineering, Oxford. What form the scheme will take, and when it will start, have yet to be decided.

FOR the production of cams and other discontinuous circular forms a lathe may be used by pulling it round by hand through part of a rotation and back again. This crude method has been replaced in a new German machine tool by reciprocating a rack in contact with a spur wheel keyed to the spindle. The rack is operated by a crank pin and slot gear familiar on shaping machines, and has, therefore, a quick return motion. The amplitude of oscillation of the work is adjustable between 90 deg. and 340 deg.

ANSWERING a question in the House of Commons recently the Secretary of State for War said that the War Office has had under consideration the provision, in localities less open to air attack, of certain of the factory activities now carried on at Woolwich Arsenal and Waltham Abbey. Two sites have been selected for factories for the operation of filling ammunition with explosives, one at Chorley, in Lancashire, and one at Bridgend in South Wales. A third site in Scotland is under consideration for a factory for the manufacture of explosives.

THE latest publication of the Mineral Resources Department of the Imperial Institute is entitled "Platinum and Allied Metals." It has been prepared on the same lines as others in the series of Imperial Institute reports on the mineral industry. The first part deals with the minerals of the platinum group, their mode of occurrence, mining, and concentration. It also surveys the metallurgical processes used in extracting, refining, and working the metals, the properties of the metals and their principal alloys, and their uses in various industries, concluding with a discussion on world production, marketing, and prices. The main body of the book deals with the world's resources and contains descriptions of the deposits and workings, together with statistical information concerning production and trade. The platinum production of Canada probably exceeds that of all other countries together. Russia and Colombia contribute largely to the output, South Africa is also an important producer, and Alaska's production was estimated to exceed 9000 oz. in 1935. The British Empire provides an important part of the world's production of platinum metals, and the world's largest refinery is at Acton, London, where 300,000 oz. of these metals can be refined annually.

A NOTE in *Nature* gives particulars of a method of dialing ships at sea by radio telephone. When the radio telephone was first applied to ships at sea the ship receivers, connected either to a loud speaker or an operator's headset, were always "on the air" and thus heard all calls. Stations were called by name, and all other stations listening on the same frequency would hear the call. With the increasing use of ship to shore radio service, a method of signalling one ship only became highly desirable, as this would obviate the necessity of keeping the loud speakers or telephone receivers "on the air" all the time. In the *Bell Laboratories Record*, from which journal these particulars were taken, a method of doing this is described. With the new system each ship has a three-digit number assigned to it. When the operator at the telephone switchboard wishes to place a call, he merely dials the number of the ship wanted, and this sends out a series of tone pulses which are received by all the ships within range. The called ship is the only one that receives an audible signal. On this ship a telephone bell rings and the operator picks his handset off the hook and replies in the usual way. When a call is answered the handset is removed from its switchhook, thus operating the transfer relay. This removes the selector set from the radio receiver and connects the telephone receiver in its place. It also stops the bell ringing. When the telephone conversation is finished the handset is returned to its hook and this releases the relay. The signal receiving set is automatically reconnected in preparation for receiving calls. This system is now being used by a number of coasting and harbour ships in America, and promises to become applicable to a much wider field.

Air and Water.

THE 13,000-ton Union-Castle steamship "Armada Castle" has been sold to shipbreakers.

THE air race round the Isle of Man, held on June 1st, was won by Mr. R. F. Hall, flying a "Hillson Praga," at a speed of 89.5 m.p.h.

THE ultra light type of aeroplane known as the "Flying Flea" is to be tested by the French Air Ministry in its wind tunnel at Meudon.

ATTEMPTS are being made to save the sailing ship "Herzogin Cecilie," which went on the rocks at Sewer Mill Cove, near Salcombe, some weeks ago.

IT is reported that in Japan orders for 584,000 tons of shipping are in hand and the Nippon Yusen Kaisha are contemplating ordering six liners for the Yokohama-London service.

A REPORT says that the Douglas Aircraft Corporation in the United States is to construct a new land type aeroplane capable of carrying forty passengers. It will weigh some 50 tons and be propelled by four 1000 H.P. engines.

At the Royal Aeronautical Society's annual reception at the Science Museum, the Wilbur Wright lecture was presented by Mr. D. R. Pye. The title of the lecture was "Slippery Surfaces" and dealt with lubrication and lubricants.

FLYING a "Hillson Praga" monoplane with a "Praga B" 40 H.P. engine, Mr. H. L. Brook has flown from this country to the Cape in 16 days 4½ hours. The machine is of wooden construction and has a maximum speed of 93.3 m.p.h. with a cruising speed of 79.6 m.p.h.

A CONTRACT has been placed for an air survey for the revision of certain Ordnance sheets in selected areas of some 490 square miles in extent in Staffordshire, Derbyshire, Nottinghamshire, Northamptonshire, Leicestershire, Worcestershire, and Warwickshire. The results are to be used for town and country planning purposes.

A SCHEME for the construction of a canal from the Tyne to the Solway has been rejected by a committee of experts set up by the North-East Coast Development Board. It was estimated by the committee that the cost of the canal would be between 140 and 150 million pounds and would not be an economic proposition from the engineering standpoint.

At the annual conference of representatives of British and Dutch shipping and air line companies with interests in the Far East, held at The Hague, it was decided to continue the agreement under which steamship and aeroplane tickets are interchangeable, so that a passenger to the East may change *en route* into any vessel or air liner of the companies covered by the agreement.

FOLLOWING the resignation of Mr. John Johnson, the chief engineer of the Canadian Pacific Steamship Services, to take up work as a consulting engineer, Mr. J. A. Sykes has been appointed chief superintendent engineer, Atlantic Service, and Mr. C. G. Ramsey his assistant, while Mr. G. A. Vine has been made the superintendent engineer at Liverpool and Mr. D. Coupar superintendent engineer in London.

A TWIN-SCREW motor passenger and cargo ship has been ordered from the Fairfield Shipbuilding and Engineering Company, Ltd., by the Anchor Line (1935), Ltd. The new vessel, which will be completed in time to enter the company's Indian service in the autumn of 1937, will be of 11,000 tons gross register, and have a speed of 17 knots. This is the first ship in the building programme of the reorganised Anchor Line.

IN the air race from Hanworth to the Isle of Man, on Saturday last, May 30th, eleven of the twenty starters completed the distance. The race was won by Mr. A. Henshaw, flying a "Leopard 85" machine. After deducting the handicap and an hour's wait at Speke, Liverpool, the winner's time was 1 h. 46 min. 59 sec. and his speed 126.75 m.p.h. The second and third places were taken by Mr. C. F. Hugeson, flying a "Tomtit Moth," and Mr. W. Humble, flying a "Miles Hawke" respectively.

ACCORDING to an official statement from Dublin, the British Government has agreed to the operation of Cross Channel air services by a Free State company, and the Free State Government has approved of the operation of similar services by a British company. The Free State Government announced that this co-operation is aimed at securing the best possible development of air services, and that legislation will be introduced to enable the Government to hold the controlling shares in the new Irish company. The first flights from Dublin to Bristol, the Isle of Man, and Liverpool have been made.

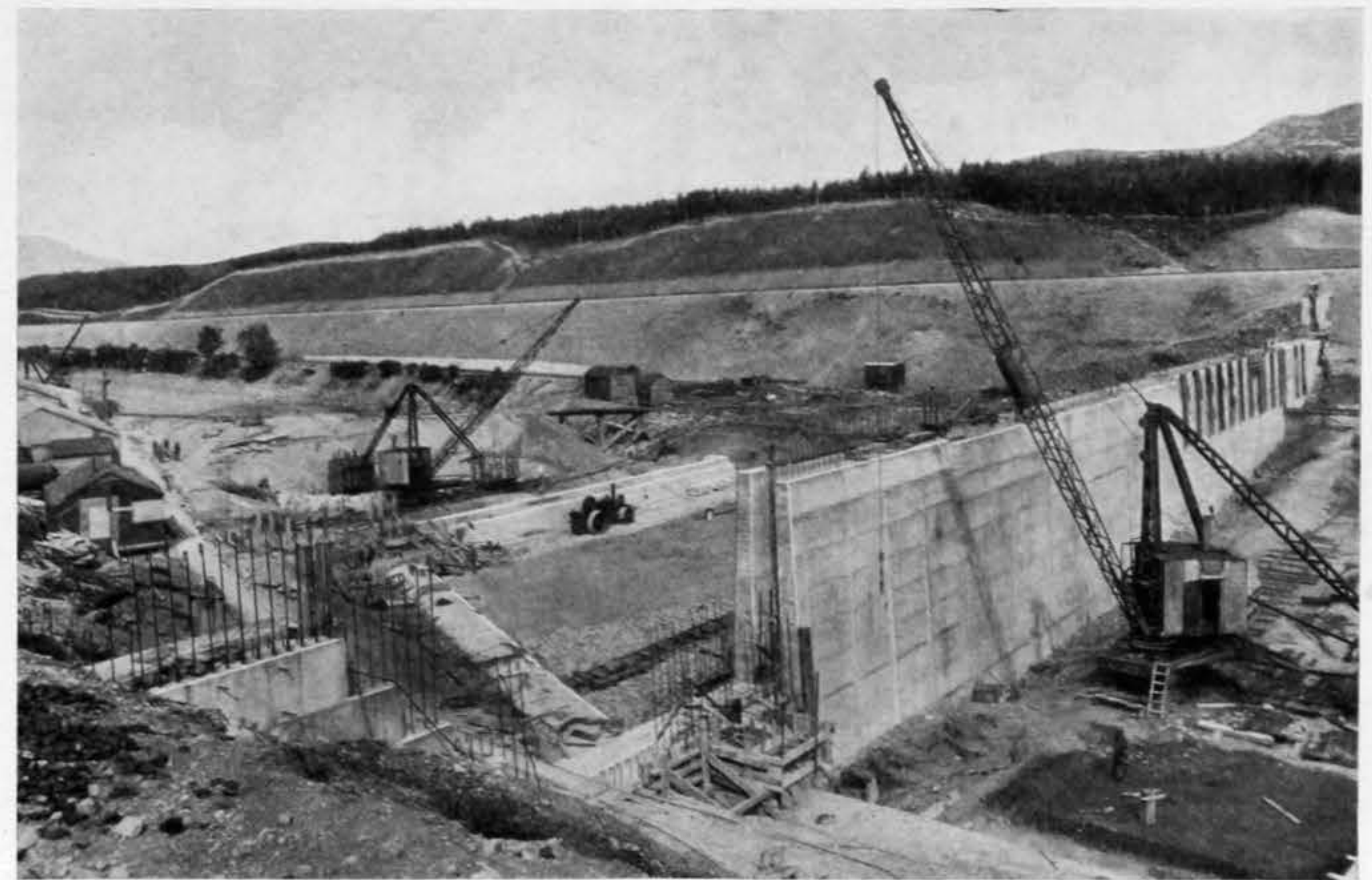
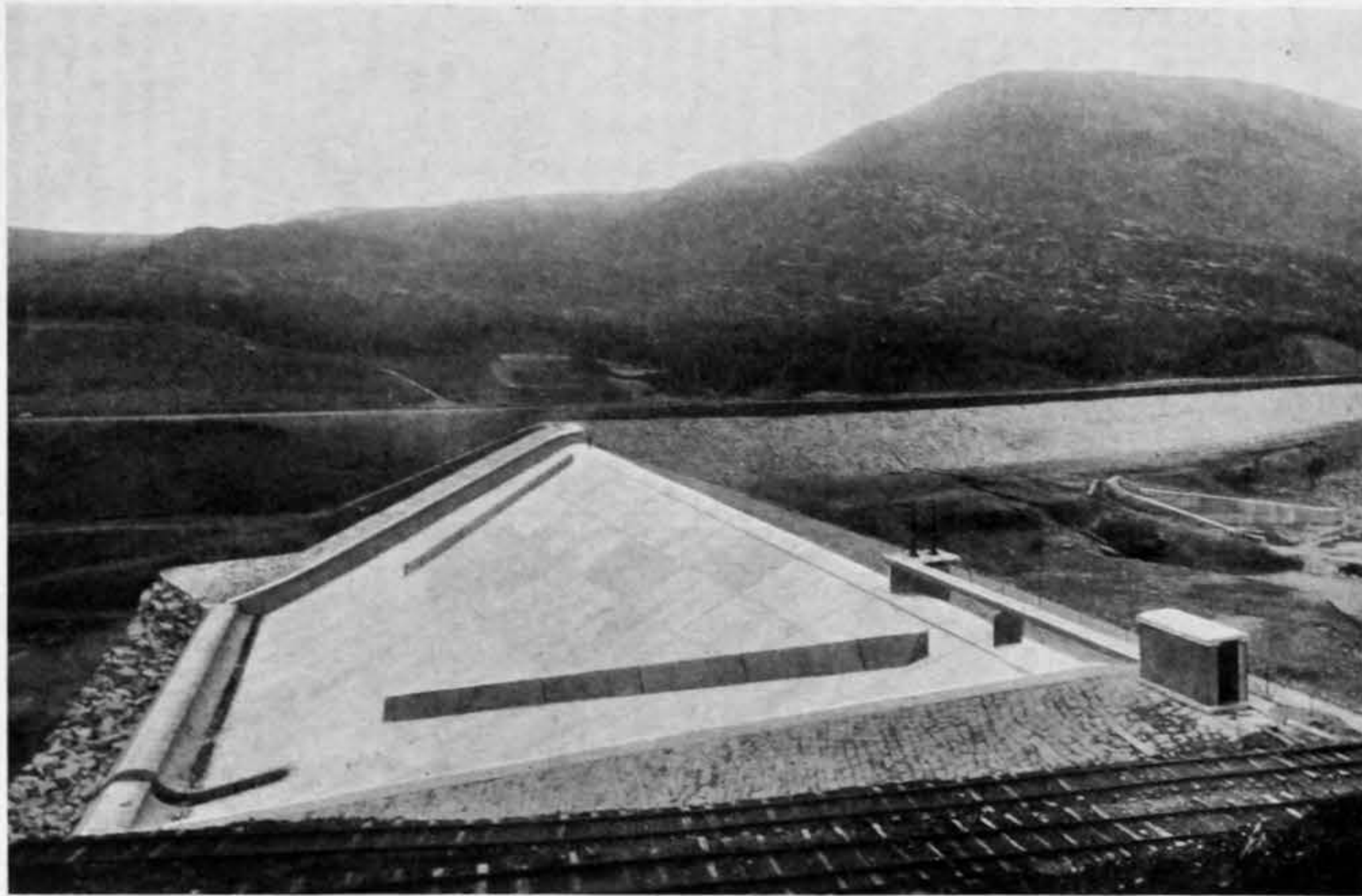
THE Navigators and Engineer Officers Union has been elected to membership of the Trades Union Congress. The formation of this union was announced on January 1st, 1936, and it has already enrolled over 5400 members, comprising captains, navigating and engineer officers in British merchant ships. The President is Admiral Philip Nelson Ward, M.V.O., and the Trustees comprise the Rt. Hon. Lord Headley, Master Mariner, and Engineer Rear-Admiral Turnbull. The union is federated, together with eight other British officers' organisations, throughout the Empire, in the Officers (Merchant Navy) Federation.

THE Spanish Air Force has adopted the Hawker "Fury" with the Hispano Suiza engine as its standard single-seater fighter. According to *Flight*, from whence come the following particulars, the initial order for three machines has been completed by the Hawker Company, and before long three squadrons will have been equipped with aircraft of the same type manufactured under licence by the C.A.S.A. and Hispano Suiza companies in Madrid. The Spanish Government has also acquired the Hawker "Osprey" with the same power unit, both as a landplane and seaplane. The first machine was delivered a few months ago and a squadron is now under construction in the shops of C.A.S.A. at Getafe. As a landplane the Spanish "Osprey" has a maximum speed of 180 m.p.h., and as a seaplane is capable of 170 m.p.h. The Hispano Suiza "12 Xbrs" engine develops 690 H.P. at 13,120ft., and gives the "Fury" a maximum speed of 236 m.p.h. The climb to 16,400ft. takes six minutes.

LOCHABER POWER DEVELOPMENT—CONSTRUCTION OF THE TREIG DAM

MESSRS. C. S. MEIK AND HALCROW, WESTMINSTER, ENGINEERS; BALFOUR BEATTY AND CO., LTD., CONTRACTORS

(For description see page 588.)



LOOKING EAST ON DOWNSTREAM FACE—OCTOBER, 1934
LOOKING EAST ON UPSTREAM FACE—NOVEMBER, 1933

CONCRETE COREWALL FROM UPSTREAM SIDE—JUNE, 1933
LOOKING WEST ON DOWNSTREAM FACE—NOVEMBER, 1933

The Engineer

JUNE 5, 1936.

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NOTICES TO READERS.

. If any Subscriber abroad should receive THE ENGINEER in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.

. For Subscription rates, see page 2 of Advertisements.

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

. No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.

CHANGES OF ADDRESS.

. Will Subscribers please note that in all advices regarding changes of address it is necessary to have both the old and new addresses, as our lists are kept alphabetically by towns. Advices of this nature should reach us by the first post Wednesday morning prior to the alteration.

IRON AND STEEL PRICES.

FOR some months it was known that the British steel makers felt that an advance in the prices of steel was overdue, and it had been generally assumed that it would take place this month. This anticipation has been realised more fully than the most complacent consumer anticipated in the shape of a rise in quotations ranging from 2s. 6d. per ton on basic pig iron to 12s. 6d. on joists and sections. Notwithstanding many warnings, the announcement of the advance created surprise, since following a meeting of the steel makers and the British Iron and Steel Federation at the end of April it was stated that the prices then current would be maintained until June 30th and that after that date quotations would be increased. It was understood that the authorities had held the steel industry to a pledge given when it was granted protection that prices would not be raised unless the costs of production justified such a course. The indefinite nature of the position with regard to prices in the second half of the year proved irritating to consumers as well as to steel makers, since it made forward business difficult to arrange and left the manufacturers with a feeling that they were not being fairly treated by the Government. It is a little difficult, however, to understand in what way circumstances changed during May sufficiently to warrant such substantial price increases and, furthermore, why in the face of the statement of April last, they should be brought into immediate effect. At the most the market expected a maximum advance of 10s. and the general belief was that the prices of joists and sections would not be raised by more than 5s. to 7s. 6d. The natural impulse of consumers will be to protest against a price advance of such magnitude being imposed so suddenly, but it has to be admitted that the matter has been conducted according to the rules laid down when the steel industry was given its constitution and an unprecedented degree of protection in the way of duties. The British Iron and Steel Federation obtained comprehensive statements of costs and submitted them to the Import Duties Advisory Committee,

and on the strength of these statements the advance was made with official sanction. Whether this explanation will console consumers, particularly those engaged in selling their products in the export markets, may be doubted. In a number of cases users have covered their requirements for a long time forward. For instance, it is said that the shipbuilders have arranged for supplies sufficient to last them for the remainder of the year, although presumably this only applies to the work they have in hand. The majority of the general engineering and constructional engineering firms can scarcely be in such a good position and they are likely to feel increased difficulty in their attempts to secure foreign orders.

It cannot be denied that, judged by ordinary commercial standards, the British steel makers are justified in substantially raising their quotations. The demand warrants it, the works are running at capacity, the competition in the home market has been eliminated, and whilst the boom lasts home trade buyers may be expected not to protest very vigorously. That is a position which, in the past, has always been recognised as providing a reasonable excuse for higher prices. Wherein the present prosperity differs from preceding booms is that it arose as a result of the protection given to the steel industry, and its continuance rests largely upon requirements arising directly and indirectly from Government and other public authorities. In former days such great schemes of expenditure in themselves frequently provided a reason for raising prices; but to-day the position is reversed, and politicians and the public alike act as watchdogs. Consumers, also, are not likely to forget that when the steel makers were struggling to obtain protection, their argument was that they would be able to reduce prices through the saving effected by running their works at capacity. It is now claimed that the increase in the costs of production has discounted any benefits accruing from the reduction in overhead charges. It stands to reason, however, that when the need for steel is sufficient to employ the industry at capacity there must be a corresponding expansion in the demand for raw materials. That there have been increases in the cost of pig iron, coke, coal, and scrap—materials essential to the manufacturer of steel—is not open to question, and although in many cases these are produced by works associated with steel-making concerns, that is not so in every instance. The steel makers, therefore, may argue with justice that increasing costs have pressed heavily upon some of their number; that under their present constitution prices are fixed for the whole industry; and that the circumstances of the less efficient works must be taken into account. Since the constitution was accepted by the Government with all its imperfections as a reason for giving the industry protection, the force of this argument must be admitted. In effect, however, prices have been raised indirectly by the withdrawal of concessions which were previously granted to important buyers, and by the revision of extras lists, whilst in the case of several descriptions of steel not so completely controlled by the Federation as joists and sections there have been important price increases.

Ironically enough, it is the benefits that have been showered upon the British steel industry that place it in a position apart, and result in the methods by which it is conducted becoming the object of careful scrutiny. The steel makers met the wishes of the Government and provided themselves with a constitution which was founded upon the reorganised British Iron and Steel Federation. By doing so they earned an abundant measure of protection from Continental competitors in the home market. In their negotiations with foreign steel makers they used the weapons given them by the Government with adroitness and have established themselves in an unshakeable position. Other industries may protest at having to pay higher prices, and at some of the terms upon which steel is sold; but so long as the Federation is backed by the Import Duties Advisory Committee and the steel makers act through their official organisation, it is unlikely that the objectors will obtain much satisfaction. It may be a source of irritation to consumers of steel that the check to an increase in the prices of British steel by the importation of foreign material has been removed by the agreement with the Cartel; but the moment to make an effective protest was whilst these negotiations were proceeding. We may take some credit to ourselves for pointing out the dangers inherent in such an arrangement. It must be remembered that the agreement limits imports, whilst the arrangements which have been made for selling Continental steel in this market prevent

anything in the nature of competition, as the prices must be kept within an agreed margin of the British quotations. It follows, therefore, that the regulation of steel prices must depend upon co-operation between the steel makers and the authorities, and the interests of users should be most carefully considered before any important step is taken which may seriously affect them. In the case of the present price advance some of the more important consumers' organisations appear to have been taken by surprise at its magnitude, and this indicates a regrettable absence of consultation, not to say co-operation.

Streamlined Locomotives.

IT is not unreasonable to expect that when Mr. Gresley delivers his presidential address to the Institution of Mechanical Engineers in the autumn we shall hear something about the economics of high-speed train operation. High speed on the rail as elsewhere has to be paid for. Usually, it is very costly, the consumption of power augmenting approximately as the cube of the velocity. In the case of ships there is very little possibility of escape from this high figure. Thousands of different hull forms have been tested in tanks and in the open sea, and the limits of streamlining, for designs otherwise economical, have been attained. To double the speed, assuming other things to remain as they are, approximately eight times the power must be supplied. In the air the conditions are very different. The aeroplane or airship is completely immersed in the medium through which it moves and is, in great part at least, free from some of the varied resistances which a ship encounters. But more important and more significant is the ability of aircraft to rise out of dense air to heights at which the density is lower. In these regions the drag is reduced, and the power no longer varies as the cube of the speed at a lower level, but falls as greater heights are reached. The resistance of trains on rails may be said to lie between these two. The body is completely immersed in the medium through which it moves, but its propulsion is acquired by the resistance which the fixed rails offer to the rotating wheels. The medium is approximately constant in density, but it may be in constant motion, developing resistances by its unbalanced pressure on the train. Moreover, the rails offer a rolling resistance which cannot be overcome by any conceivable design of wheel and can only be partly reduced by special forms of axle-boxes. On the top of these things there are gradients unknown to ships and to aircraft in horizontal flight, curves which offer far more resistance and are more frequent than the turns in ships and aeroplanes, to say nothing of other resistances caused by the nature of the track. Hence, whilst the aeroplane has to consider little else but air resistance, and the ship, in still air, little but the resistance of the water, the train is faced with the resistance of the road and with the resistance of the air as well.

Years ago sporadic and half-hearted attempts to reduce the air resistance of trains were made, but as long as passengers were content with an average of about 60 m.p.h. the track resistances were so much greater than that of the air that no such attempts were worth while. Much higher speeds are now in contemplation, and, in a few instances, in use. In some of these cases a streamline form ought to give an advantage that is worth seeking; in others, fashion, rather than actual necessity, appears to dictate its adoption. The Australian engineer who designed the locomotive illustrated in our issue of May 22nd, satirises this motive by painting on the sides of the engine streamlines and doing little else to reduce the air resistance. It is, we suggest, only when trains are run at consistently high speeds for long distances that any material advantage can be set against the increased cost incurred by applying a streamlined covering to the engine. Hence, in relatively small high-speed vehicles or trains of two or three coaches, it may be worth while, whereas it is of still doubtful use in the ordinary type of train, hauled by the ordinary type of locomotive and of necessity travelling at very variable speeds. We say it is "still doubtful" because, although both at home and abroad a great deal is heard about streamlining and a certain amount has been done, very few reliable figures have been published. Most of the arguments are based upon wind tunnel experiments, none of which can be regarded as conclusive. In the testing of aeroplane models the conditions of actual flight can be simulated with fair closeness;

but the model tests of a locomotive and train can never be carried out with any approach to the conditions which prevail in practice. The only complete and satisfactory answer to the question must be sought in the comparison of the running costs of streamlined and non-streamlined trains on identical services for a long period. Or, since such a straight experiment is not likely to be made, by the accumulation of results sufficiently numerous to allow a statistical examination to be carried out.

Whilst such data are lacking, locomotive engineers are perfectly justified in their cautious approach to the problem. With one exception—the "Silver Link" class—there is no fully streamlined train in the kingdom, and it would seem that, in general, streamlining of locomotives is being carried out rather as a concession to popular opinion than from real conviction that it is profitable. Abroad, a little, but not much more, has been done. For example, both Henschel and Borsig have produced engines completely enveloped in a smooth integument. Unfortunately, these

engines, as usually happens, are not strictly comparable with others, and their merits have to be estimated rather than ascertained by trial. M. Kandaouroff has recently given in *Le Genie Civil* an estimate of the kind using a corresponding Nord engine as a basis of comparison. A few of the figures may be quoted. Taking the Nord engine as 100, then the consumption per gross ton kilometre of the Borsig and Henschel streamlined engines would be 113.2 and 119.9 respectively, but speeds would be 100, 120.1, and 121.8. These figures show, indeed, that with the streamlined engines a greater speed could be attained for a smaller consumption of coal per kilometre, but they still leave us greatly in the dark, for we do not know what the consumption of the Nord engine would have been at the speeds assumed for the other engines. It must be added also that the engines are dissimilar in several critical respects. We have mentioned these estimates less for their actual value than to illustrate the haziness which still enshrouds the economics of streamlined locomotives.

The Royal Society's Conversazione.

AMONG the exhibits of a mechanical or physical nature shown at the Royal Society's Conversazione held at Burlington House on Thursday May 28th one of the most interesting was the Blackburn network calculator. This instrument, invented by Mr. Charles L. Blackburn, was constructed for Messrs. Merz and McLellan by Electrical Calculators, Ltd., and is designed to facilitate the determination of the distribution of current and voltage in complicated electrical networks. In the past simple calculating boards employing resistances and operating on direct current have been used for this purpose but such boards cannot deal fully with problems involving alternating current. A few alternating current calculators have been made abroad but they have on the whole been too expensive and complicated for general use. The Blackburn calculator, it is claimed, makes use of a new principle which simplifies the construction and increases the flexibility of the instrument with reference to the problems to which it may be applied. The methods employed, it is of interest to note, are applicable to general calculations involving complex numbers or vector quantities and for the determination of stresses in structural frameworks. The complete calculator as made for Messrs. Merz and McLellan consists of forty-eight panels, of which eight were shown at the conversazione. The panels each of which represents a variable resistance and reactance can be interconnected in any desired manner by means of multiple flexible leads. A metering desk forms part of the equipment and provides means for accurately measuring the currents and voltages in the network. The desk is also provided with a cathode ray tube on the screen of which a visual indication is given of the vectors representing the quantities measured.

Among the exhibits shown by Sir Robert Hadfield was a self-recording dilatometer invented by Professor S. Sato of the Imperial University, Sendai, Japan. This instrument is designed to record on a chart the changes in dimensions of metals with temperature. As demonstrated at the conversazione a test specimen of 0.9 per cent. carbon steel was being heated in an electric furnace and quenched and throughout both the heating and the cooling periods the length of the specimen was being recorded automatically by a pen moving over the surface of a chart. The instrument makes use of a standard specimen of nickel-chromium steel which is arranged parallel with and close to the specimen to be tested. The two specimens are coupled up through a pantograph arrangement to the recording pen in such a way that the movement of the pen induced by the expansion or contraction of one specimen is at right angles to that induced by the second specimen. The expansion and contraction of the standard specimen being known, the curve drawn by the pen in this way becomes a graph of its dimensions on a temperature basis. The specimens remain in contiguity and in operative connection with the pen both when they are in the furnace and when they are withdrawn from it and plunged into the quenching bath. By substituting a silica rod for the standard specimen and by replacing the chart holder with a rotating drum the variation of the length of the specimen with time can be recorded. Further if with this arrangement the standard specimen is substituted for the test specimen the efficiency of various quenching media can be examined.

The British Thomson-Houston Company, Ltd., included among its exhibits a striking demonstration of a special discharge lamp for use in the stroboscopic examination of moving machinery. Two of these lamps one giving a blue and the other a red light were arranged to illuminate a disc on which a black arrow was painted. The two lamps were arranged to

occur at a phase difference of 180 deg. with the result that when the disc was rotated at an appropriate speed—1500 r.p.m.—a stationary red arrow was seen to cross a stationary blue arrow.

Professor Andrew, Mr. Percival and Mr. Bottomley of the Department of Metallurgy, University of Sheffield, gave a demonstration of the influence of temperature and composition upon the fluidity of iron and steel alloys in illustration of work now proceeding under the auspices of the Steel Castings Research Committee of the Iron and Steel Institute and the British Iron and Steel Federation. By casting iron and steel alloys in a spiral mould from different temperatures it has been found that the length of spiral, which is a measure of fluidity, is directly related to the liquidus and solidus ranges of the thermal equilibrium diagram. The experimental methods adopted serve to give at the same time the temperature-viscosity relations of steels generally. Photo-micrographs were exhibited to indicate the effect of casting temperature upon the micro-structure.

The Cambridge Instrument Company demonstrated an instantaneous recording optical pyrometer. With this instrument an image of the hot body is focused on to a shutter in front of a photo cell connected to a mirror-galvanometer coil. When a temperature is to be measured, a motor-driven controller opens the shutter for a short period (about 0.5 second), thus deflecting the galvanometer, the displacement during the time the shutter is open being a measure of the current and a function of the temperature. By means of an optical system incorporating a relay galvanometer, controlled by a photo cell and a thermionic valve, the deflection is translated into a current of several milliamperes which can be recorded or indicated. This current is maintained for about 35 seconds, when it is switched off by the controller, and the galvanometer reset ready for the next temperature measurement.

The Research Department, Woolwich (Directorate of Ballistics Research), contributed a series of interesting photographs of conical-headed 2-pounder shell in flight at various speeds. The shadowgraphs provide three quantitative tests for the theoretical work of Professor G. I. Taylor and Dr. J. W. Maccoll on the flow of air past cones at supersonic speeds. According to theory, for a cone of given angle: (a) above a critical speed, the head-wave is in contact with the nose, and of conical shape with a calculable semi-angle; (b) there is a predictable speed of projectile, below which the speed of air flow along the surface of the head becomes less than the local velocity of sound; wavelets from the head will then disappear; (c) below another predicted speed the head-wave leaves the nose and is no longer conical. The experiments were carried out with shell having plain conical heads of three different angles. It is understood that the experiments are to be extended to shell with radiused heads.

Dr. F. P. Bowden gave a demonstration of the surface temperature of sliding metals and of its influence on surface flow, polish and the formation of the Beilby layer. The surface temperature of sliding metals, it was shown, can be measured by using the rubbing contact of two different metals as a thermocouple. The local surface temperature at the points of contact between polished metals may easily exceed 1000 deg. Cent., even although the mass of the metal is cool. This fact has an important bearing on the mechanism of friction, lubrication and polishing. With many metals the surface temperature rises to the melting point of the metal and then remains stationary. Apparently surface melting is occurring. If the melting point of the polisher is lower than that

of the metal it cannot melt the latter, and no polish occurs. If the melting point of the polisher is higher it readily causes surface flow and the production of the Beilby layer. Relative hardness is unimportant.

Professor E. N. da C. Andrade demonstrated the coagulation of smoke by sound waves. Stationary waves of both sonic and supersonic frequency, it was shown, cause smoke particles suspended in the air to coagulate rapidly. In the experiments exhibited the coagulation was in one case effected by supersonic waves of frequency about 220 kilocycles per sec., produced by a quartz oscillator, and in the other case by ordinary sound waves of frequency about 2200 cycles per sec., produced by a vibrating diaphragm. In addition an experiment was shown to demonstrate the attraction of two spheres produced by vibration of the surrounding air, when the line joining the centres is across the direction of vibration.

The Research Laboratories of the General Electric Company exhibited a model illustrating the working of a cathode ray tube in a modern television receiver. A large (12in.) high vacuum cathode ray tube was mounted alongside a full-size sectional diagram showing its construction and operation. Controls for modulation, brightness, focus, picture size and scanning frequency were available on the front of the apparatus, and their effect on the cathode ray tube could be observed and was illustrated by the behaviour of the diagram and its associated meters.

Professor J. W. Munro and Mr. E. C. Stanley demonstrated an electrolytic resistance thermometer employing an aural method of reading. This instrument consisted of a resistance thermometer comprising an electrolyte in a special capillary. The change of resistance of this electrolyte with temperature is measured by a simple but sensitive note matching device. Two notes are heard together in headphones. One is standard, the other, which tends to vary with the thermometer resistance, is adjusted to synchronise with the standard. The presence of beat notes, if the notes are not exactly balanced, enables readings to be taken with accuracy. The standard note is compensated for temperature and voltage variation, and is initially checked against a tuning fork. A dry battery supplies power.

The Research Department, Woolwich (Directorate of Radiological Research), showed a modified impedance method of detecting flaws in metals. The equipment consisted of a portable apparatus comprising a variable frequency generator, a search unit and balance unit, detector and recorder. The search unit, an alternating electro-magnet, is made to traverse the specimen under examination. Eddy currents are thereby produced in the vicinity of the search unit. This effect is demagnetising. On passing over a flaw the demagnetising effect is diminished. The usual balance of the current is disturbed to an extent roughly proportional to the size of the flaw.

French Road-Making Machinery.

ENGINEERS, contractors, and makers specialising in road-making machinery meet in congress in Paris every two years to discuss problems relating to road construction. Makers and contractors have their associations or syndicates which are grouped in a Syndicat Général de la Route, and this body has a committee to organise the biannual "Semaine de la Route," with the collaboration of the Ministry of Public Works and the various services. The Congress was held last week at the Conservatoire des Arts et Métiers, when there was an exceptionally large attendance. At former Congresses plans for a reconstruction of roads throughout the country to meet new traffic conditions raised technical problems that had to be solved before machinery makers could decide upon the manner in which they would be able to participate in the work. The adoption of tarred road surfaces appeared to offer an easy means of mechanical treatment, until the introduction of a gravel surface with quick-drying bitumen and other binding products complicated matters so far as machinery makers were concerned. The Congress was chiefly interested in materials for surface construction, and their grading and classification, and particularly in the progress made with binding materials. The technique of road building can hardly undergo drastic change when the methods employed depend largely on the use of local materials, and are generally quite satisfactory. The great motor road works, now being carried out, are for the most part the modernising of existing roads by straightening as much as possible, widening, and banking, and by diverting them from villages, rounding off crossings and providing efficient signals. The machinery maker now knows exactly what is required of him, and the past two years have therefore been a period of mechanical activity, during which the new industry has become firmly established.

There is still a question of how far the use of machinery is justified for road-making, and in a report by Monsieur Giard, on behalf of manufacturers, objection is taken to the claim that road-making is an essential factor in providing work for the unemployed. Road-making is a specialised occupation which cannot be undertaken satisfactorily by men from other trades, more particularly in view

of the fact that with the more general use of quick binding materials much less time is allowed for the work. Moreover, by the use of machinery there is a saving in gravel of from 10 to 15 and even 20 per cent. This argument was supported by Monsieur Bédier, representing the Syndicate of Road Builders, who said that skilled men could tar and spread the gravel with as much precision as is possible by mechanical means, but such men are rare and cannot always be kept in employment by one firm on account of the intermittent character of the work. Where ordinary binding materials are used, the contractor is satisfied with manual work, but the employment of rapid-setting bitumen renders the mechanical spreading of gravel indispensable, which, however, places the contractor at a disadvantage unless he can obtain some return for his additional expenditure on plant. Rapid execution of work ensures economy to the State, and it is only reasonable, said Monsieur Bédier, that the State should make over some of those economies to contractors. Nevertheless, he warned manufacturers that all the problems relating to the mechanical spreading of gravel had not yet been solved. There were too many different types of machines for that purpose, and the contractor hesitated to buy machines which he feared might become obsolete in a very short time.

Road signals came up for discussion, without offering a satisfactory solution. It is desirable that they should be international in character, and there is a tendency to leave the committee at Geneva to settle acceptable types. In the lighting of roads more progress has been made, and on the great southern road and along the Riviera stretches of many miles are excellently lighted. Statistics were given to show that there has been a considerable diminution in the number of accidents between Paris and Versailles since lighting has been improved. The importance given to this matter was indicated by a demonstration of road-lighting devices arranged at Vincennes for the benefit of members of the Congress. Monsieur Thévenin, managing director of the Hauts-Fourneaux de Saulnes, claimed advantages for cast iron as a road surface, experiments carried out in and around Paris during the past few years having given good results and provided ironfounders with practical data enabling them to utilise cast iron road sets to the best advantage. The most satisfactory way of employing such sets is, he said, to lay them on hot bitumen, which gives a cushioning effect to the surface and deadens sound, and in order to facilitate laying, which otherwise needs particular care, cast iron sets are now supplied from works with bitumen adhering to them, so that they may be laid direct after heating in a portable stove, on a forge, or by other convenient means. Monsieur Thévenin believes that in view of its non-skidding surface, durability, and appearance, the cast iron set will eventually be employed on a large scale in towns. Members were given an opportunity of seeing a stretch of road with cast iron surface, which made a favourable impression on them.

Some demonstrations of machines were arranged in the grounds at Issy-les-Moulineaux, where about a dozen firms showed plants for tarring roads and spreading gravel, as well as road rollers, graders, and other equipment. With the use of quick-drying tar products there is some difficulty in keeping up the supply of gravel, which Monsieur Rincheval solves by loading the spreader behind the tar wagon with a telescopic suction pipe on the gravel heap. Sufficient vacuum is obtained for the purpose by an oil-engined driven turbine, and the gravel is loaded into a rectangular steel body, from which it is distributed at the rear. All other loading systems are based upon arrangements of bucket elevators. The Applevage loader is a lorry chassis with bucket elevator at the rear, which discharges gravel on a horizontal belt conveyor extending over the top of the lorry and beyond to a wagon into which the gravel is delivered. Some vehicles have bucket elevators attached permanently at the rear and driven by small engines, and in one case the wagon body is mounted on a chassis with road rollers, in front of which the gravel is spread on the tar sprayed from the motor lorry hauling the entire equipment. In a S.O.M.U.A. wagon the bottom is fitted with a horizontal belt conveyor for delivering gravel on to a short conveyor near the ground, from which it is swept evenly on to the tarred surface by a rotating brush. There are several other devices for the rapid loading of spreaders capable of carrying enough gravel for continuous tarring and the number of small tarring plants and gravel spreaders implies a lack of settled ideas for dealing with the problem that leaves contractors in doubt as to whether a practical solution has yet been reached from the point of view of economy and cost of plant. Road rollers are made by several French firms, all of them with internal combustion engines, and some under foreign licences, though licences usually drop out as experience acquired with them leads to departures from methods covered by them. The plants demonstrated at Issy-les-Moulineaux, as well as those exhibited at the Paris Fair close by, revealed the activity displayed by French makers during the past few years in laying themselves out to supply requirements in road-making machinery in their own country.

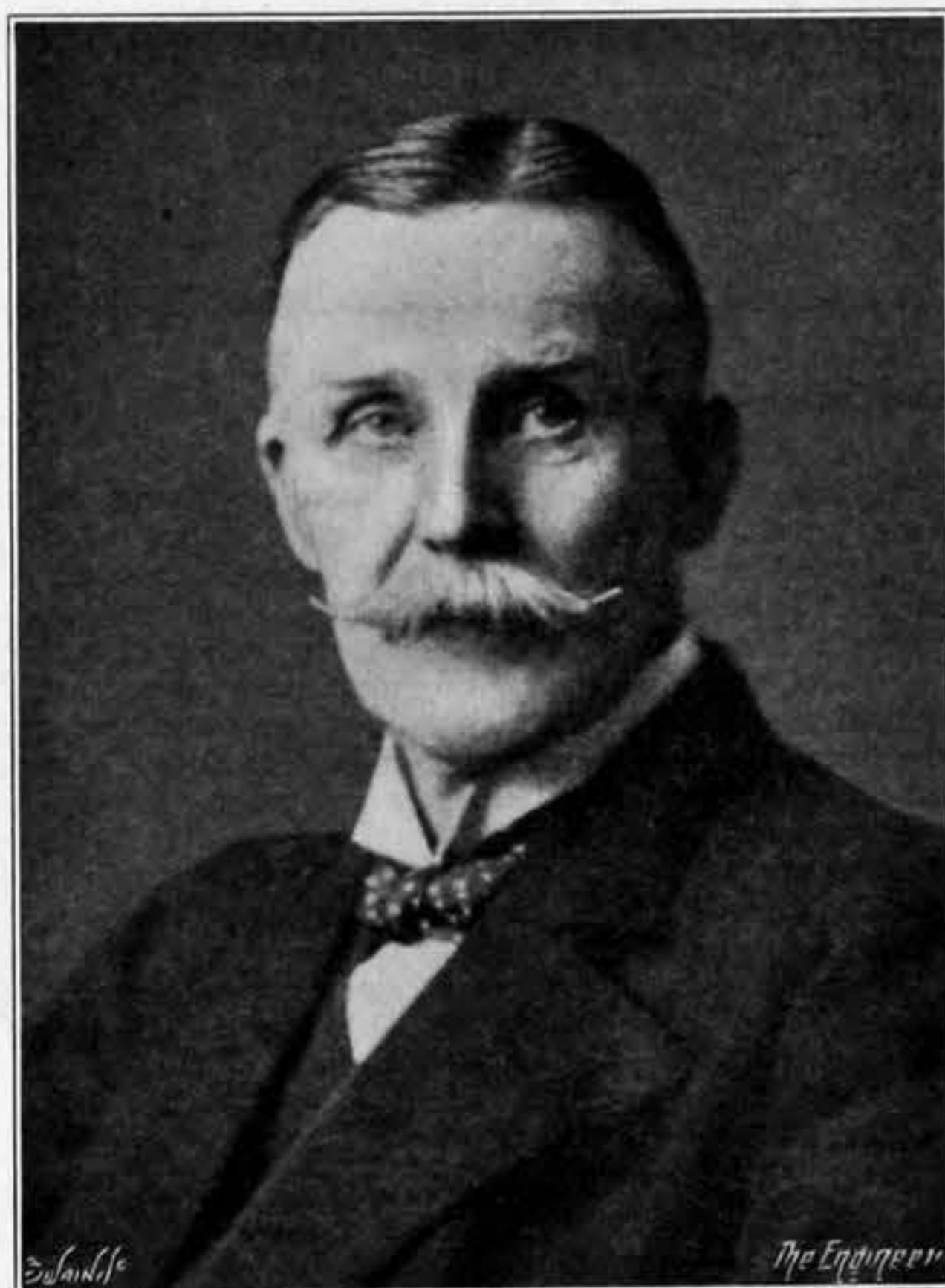
Another visit was to subterranean passages which have been completed, or are under construction, with

the object of carrying traffic along the outer boulevards under the radial roads leading out of the city. Since the levelling of the fortifications, the old military circular road, having a circumference of $21\frac{1}{4}$ miles, within the walls, has been replaced by a new boulevard, 54ft. wide, with a possible future extension to 72ft. Three underground passages are now in service, and two others are nearing completion. Eventually, there will be subways under all the main roads that intercept the circular boulevard. The tunnels are of rectangular section, with two roads for one-way traffic, each 19ft. 7in. wide, separated by central pillars, walls, or arches, as the case may be. The lighting of the tunnels is controlled by photo-electric cells, according to the amount of daylight, the required number of lamps on the central pillars being cut out or relighted automatically. The longest and most complicated of these tunnels is one at the Porte Champerret, which has a bifurcation, and necessitated the flattening of the top of the Metropolitan Railway tunnel which passes underneath, the construction of an arch in the place of pillars, and the displacement of mains. Hence it was a costly undertaking. The length of the tunnel, exclusive of ramps, is 1607ft. The service rendered by these tunnels in facilitating traffic is regarded as fully justifying their cost.

Obituary.

SIR ARCHIBALD DENNY.

By the death of Sir Archibald Denny, Bart., which took place on Friday, May 29th, at his home in Queen Anne's Mansions, London, the shipbuilding and engineering industry has lost one of its most popular members. Up to the last Sir Archibald concerned himself with the welfare of his firm, and the shipbuilding industry in general. He took a



SIR ARCHIBALD DENNY

lively interest in all that pertained to the science of shipbuilding and marine engineering, and its continuing development. Sir Archibald Denny was the fourth son of the late Mr. Peter Denny, one of the Clyde's most famous shipbuilders. He received his early education at the Dumbarton Academy, but at the early age of fourteen he was sent to the Ecole Cantonal Lausanne, where he continued his studies in science, mathematics, and languages. His training as a naval architect was begun in 1876 at the Leven shipyard. Later he studied at the Royal Naval College, Greenwich, and for some time he served on the staff of Lloyd's Register of Shipping as a surveyor in Liverpool. In 1883 he became a partner of William Denny and Brothers, and for many years was in charge of the technical and scientific work of the shipyard. During the period in which he was in control he developed the research side of the firm's business, which has been a special characteristic of it during a period of close upon 200 years, during which shipbuilding has passed from wood to iron, and from iron to steel. The name of Denny is associated with the name of many famous ships in all parts of the world. In the development of propelling machinery Sir Archibald Denny was closely associated with the late Sir Charles Parsons, and it was at the Dumbarton yard that the "King Edward," the first turbine-driven ship for passenger traffic, was built in collaboration with the Parsons Marine Steam Turbine Company. In the New Zealand Shipping Company's "Otaki," which followed, a combined system of turbines and reciprocating engines was tried out. Oil engine development was not neglected by Sir

Archibald, and Denny's were early constructors of the Sulzer oil engines. The firm, under the leadership of Sir Archibald, built many fine ships for both home and for overseas service, among which numerous cross-Channel steamers for railway service were noteworthy as embodying many new features of design and practice.

The interests of Sir Archibald Denny were, however, wider than those connected immediately with the Dumbarton shipyard and engine works, and he took a warm interest in general scientific and research work. As a member of the Council of the Institution of Naval Architects and a Vice-President for several years, he did much to further the work and the interests of that body. He was also a member of the Institution of Engineers and Shipbuilders in Scotland and one of its honoured Past-Presidents, while he was a valued member of the North-East Coast Institution of Engineers and Shipbuilders, and of the French Society, the Association Technique Maritime et Aéronautique. He was for many years closely associated with classification work, and was Chairman of the Technical Committee of the British Corporation Register of Shipping and Aircraft, and the Honorary President of that Corporation. He was a Past-President of the Institution of Junior Engineers and a member of other scientific bodies.

On many occasions Sir Archibald was called upon to serve on Board of Trade committees; these included Committees on the Load Line, the Bulkheads Committee, of which he was the Chairman, and the 1913-14 Conference on the Safety of Life at Sea, over which he presided. In 1911 the University of Glasgow conferred upon him the honorary degree of LL.D. in recognition of his work, and two years later he was included in the King's Birthday Honours, and was created a Baronet. He took always a leading part in the various visits at home and abroad arranged by the Institution of Naval Architects, and at the Summer Meeting of 1927, which took place at Cambridge, the honorary degree of LL.D. was conferred upon him by the University of Cambridge.

When Sir Archibald retired from active work with his firm in Dumbarton, he came to live in London, but remained a director of his company. He was in constant touch with the firm's work, and his opinion on technical matters was frequently sought. His London work gave him more time for the meetings connected with the various institutions with which he was connected, and his work for the British Standards Institution and other societies and institutions will long be remembered by the many friends he made and kept. Possessed of a very charming manner, his friends were almost as numerous as his acquaintances, and he will be missed by a very large circle. Some years ago he suffered from very bad health, but he appeared to have completely recovered, and only a few days before his death was full of the liveliness and good fellowship which characterised him.

BOOKS RECEIVED.

Symposium on Industrial Fuels. Philadelphia: American Society for Testing Materials, U.S.A. No price stated.

Automobile Engineering. By C. W. Tonkin, B.Sc. London: Ed. Arnold and Co., 41, Maddox-street, W.1. Price 5s. net.

The Outline of Steel and Iron. By A. Allison. London: H. F. and G. Witherby, 326, High Holborn, W.C.1. Price 6s. net.

"The Oil Engine" Operating Costs Record Book. London: The Temple Press, Ltd., 5-15, Rosebery-avenue, E.C.1. Price 1s. 6d. net.

Better Foremanship. By G. Gardiner. London: McGraw-Hill Publishing Company, Ltd., Aldwych House, W.C.2. Price 15s. net.

Deep Diving and Submarine Operations. By R. H. Davis. London: Saint Catherine Press, Stamford-street, S.E.1. Price 18s. net.

R.M.S. "Queen Mary": A Record in Pictures, 1930-36. London: B. T. Batsford, Ltd., 15, North Audley-street, W.1. Price 2s. 6d. net.

Rubber Latex. By H. P. Stevens, M.A., and W. H. Stevens, A.R.C. Sc. London: Rubber Growers' Association, 19, Fenchurch-street, E.C.3.

Foundations for the Study of Engineering. By G. E. Hall, B.Sc. London: Technical Press, Ltd., 5, Ave Maria-lane, E.C.4. Price 7s. 6d. net.

Radio Interference and its Suppression. By J. H. Reynier, B.Sc. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C.2. Price 9s. 6d. net.

Kelly's Directory of Merchants, Manufacturers, and Shippers of the World, 1936. London: Kelly's Directories, Ltd., 186, Strand, W.C.2. Price 64s. net.

MR. H. L. GUY.—In order to celebrate the recent election of Mr. H. L. Guy to a Fellowship of the Royal Society, a number of past and present members of the Committee of the North-West Branch of the Institution of Mechanical Engineers, of which he is a member, entertained him at dinner at the Engineers' Club, Manchester, on Tuesday, May 26th. Mr. J. M. Newton, B.Sc., Chairman of the branch, presided and proposed the health of the guest in an interesting speech, in which he traced the history and activities of the Society from its foundation. Mr. Leonard Massey seconded the toast and Mr. Guy responded. He said he was one of three engineers to receive the distinction this year.

The Monotube Boiler in s.s. "Kertosono."

IN our Annual Review of Marine Engineering Progress, published in our issue of January 10th, we referred shortly to the installation of the first Sulzer marine type monotube steam generator in the cargo steamer "Kertosono," belonging to the Rotterdam Lloyd Line. That ship has now resumed her regular service to the Dutch East Indies, and on her first outward voyage *via* Gibraltar, Suez, and Aden, she kept her scheduled time easily, and no troubles of any kind were encountered.

By the courtesy of Sulzer Brothers (London), Ltd., we are now able to give to our readers a fuller description of this interesting machinery installation. It may be recalled

rator in the boiler-room can be seen from drawing Fig. 1. The new monotube steam generator is in the centre of the boiler-room, with two of the existing low-pressure boilers on each side. Above, to the left, the blower which supplies combustion air to the combustion chamber through an air preheater is arranged. Fig. 4 shows a general arrangement of the boiler and some details of its construction, while the engravings Figs. 5, 6 and 7, indicate the arrangement of tube elements for the generating coils, the combustion chamber lining, and the economiser. In the diagrams Figs. 2 and 3, we illustrate the working of the high-pressure plant. The figures show the general circuit of the monotube

When the plant is "Ready for Service," it is only necessary to turn the turbine control handwheel either clockwise or counter-clockwise, according to the direction in which the vessel must move. The whole regulating system

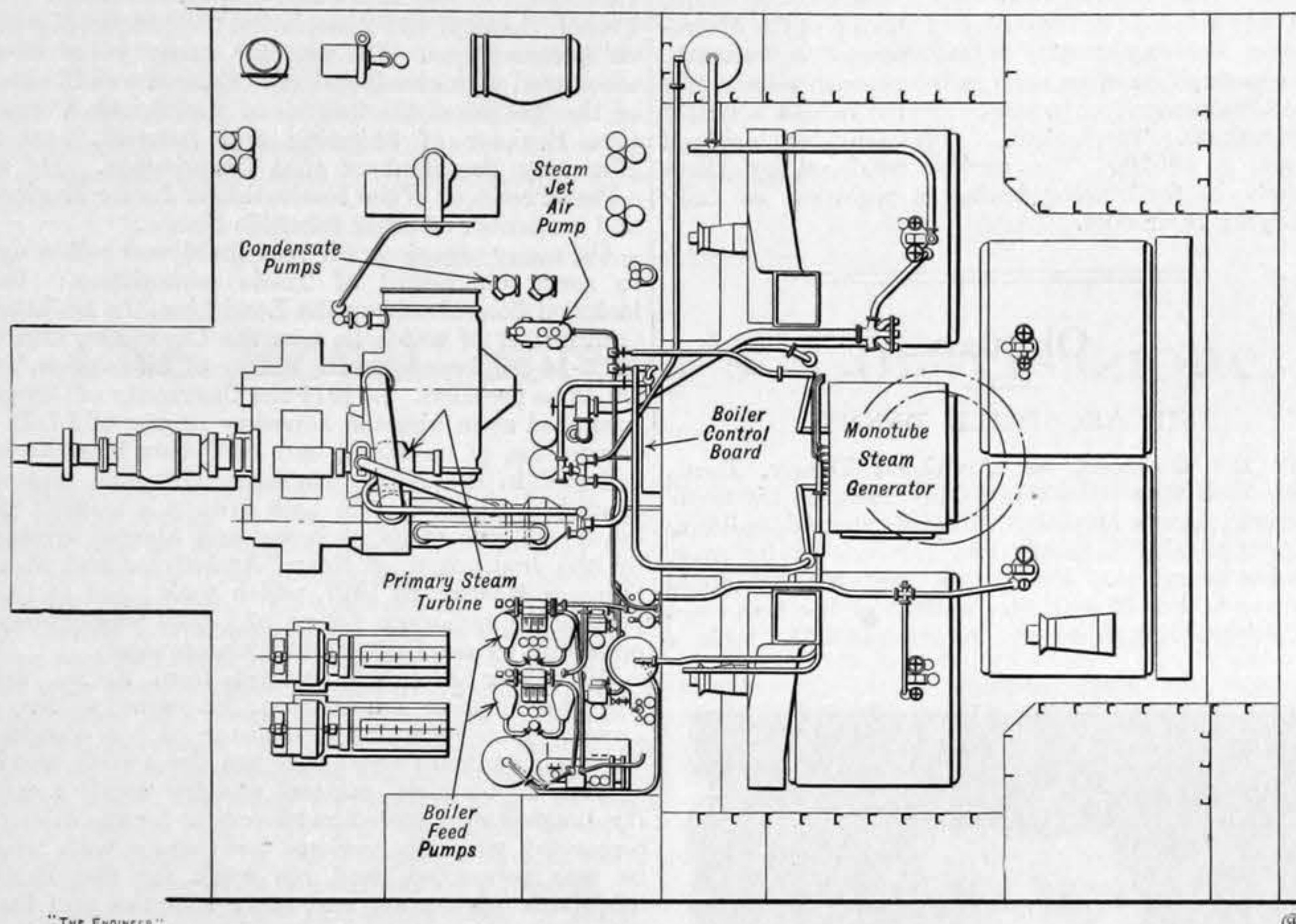


FIG. 1—PLAN OF BOILER AND ENGINE ROOMS

that when planning the conversion of this steamer of 16,500 tons, which was built in 1922 by the Kon. Jij. "De Schelde" at Flushing, the problem set was to install a high-pressure boiler, for preliminary experimental purposes, in order to increase the output and thereby give the ship a greater speed—15 knots instead of 13.

It was found sufficient to remove only one of the existing 6-ton "Scotch boilers," since the space thus left free was ample to allow the installation of an oil-fired monotube high-pressure steam generator, designed to raise 21 tons of steam per hour.

The primary plant was designed to work with steam at

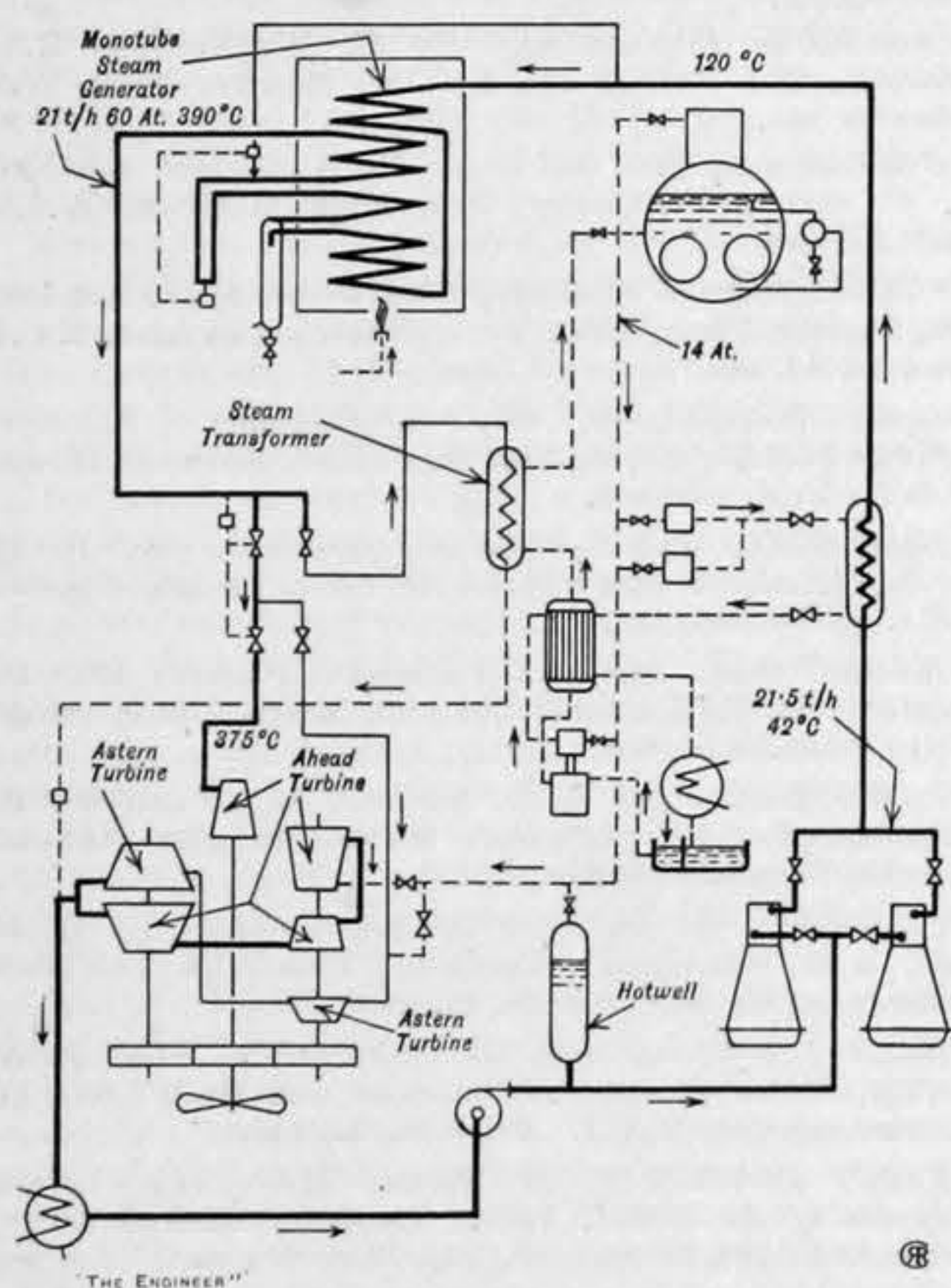


FIG. 2—DIAGRAMMATIC ARRANGEMENT OF PLANT

60 atmospheres and a temperature of 375 deg. Cent. With these new steam conditions the output could be raised from 4500 to 5800-6000 S.H.P., and the revolutions of the propeller increased from 90 to about 100 per minute. For increasing the power a new high-pressure back-pressure turbine was installed to act as primary turbine to the existing turbine plant, on which only minor alterations to the blading were found to be necessary. The plant is arranged so that it is possible in an emergency to work direct with low-pressure steam from the remaining four low-pressure boilers.

The arrangement of the new high-pressure steam gene-

boiler, the turbines, auxiliary machinery, and Scotch boilers. An important feature of the installation is the central control board on the starting and manoeuvring platform, a view of which, taken in the makers' works, is given in Fig. 8. From this board, by means of a single hand wheel, the whole propelling machinery, including the ahead and astern turbines, as well as the auxiliary apparatus for the steam generator, can be controlled. On the right-hand side are the instruments and service hand wheel for the boiler; on the left, the instruments and hand wheel for the turbine. The right-hand instrument panel carries, in addition to the pressure gauges and temperature indicators, a number of gauges showing the feed-water pressure and the oil pressure in the various parts of the regulating system, and also the conditions in the by-pass

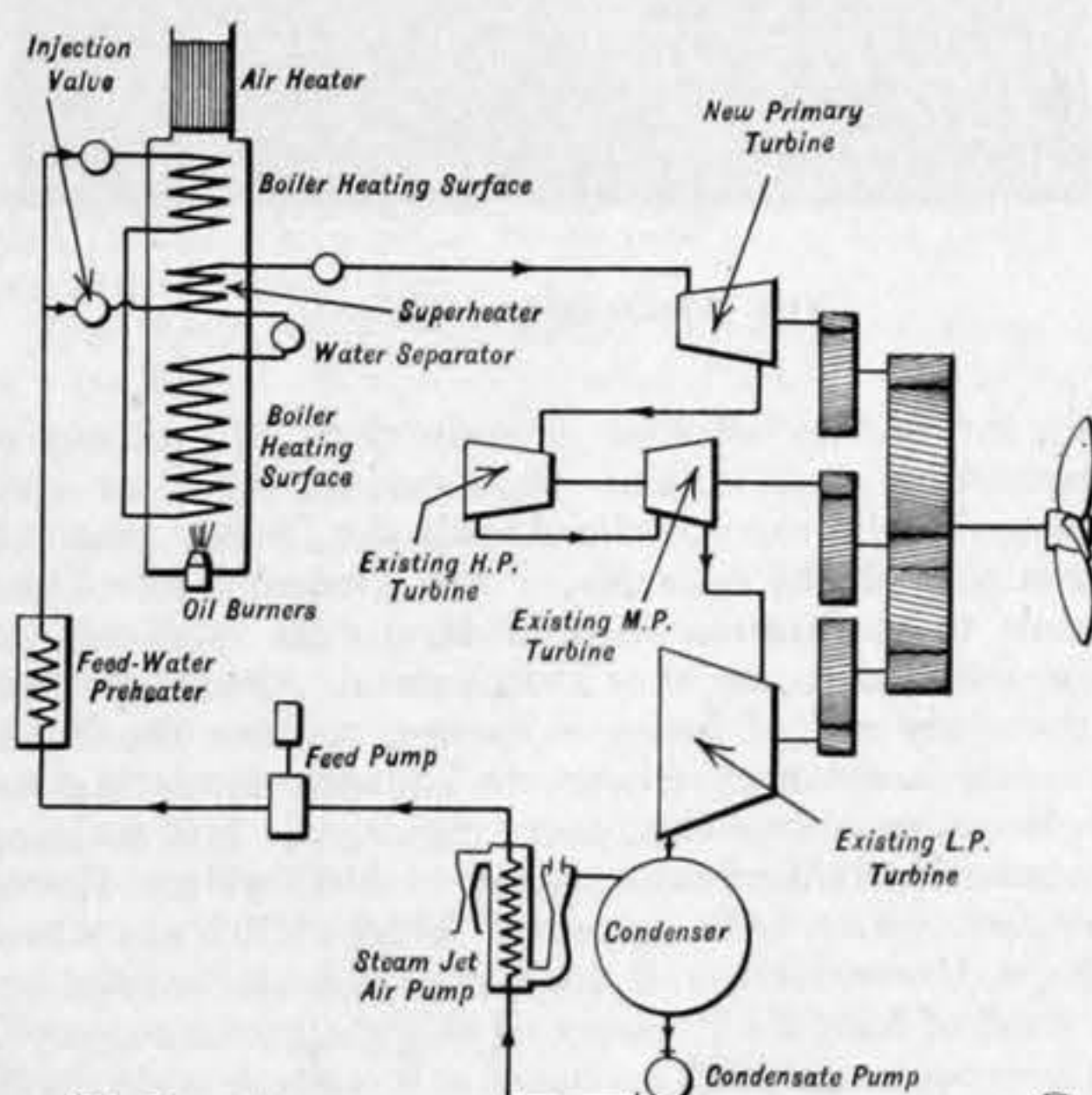
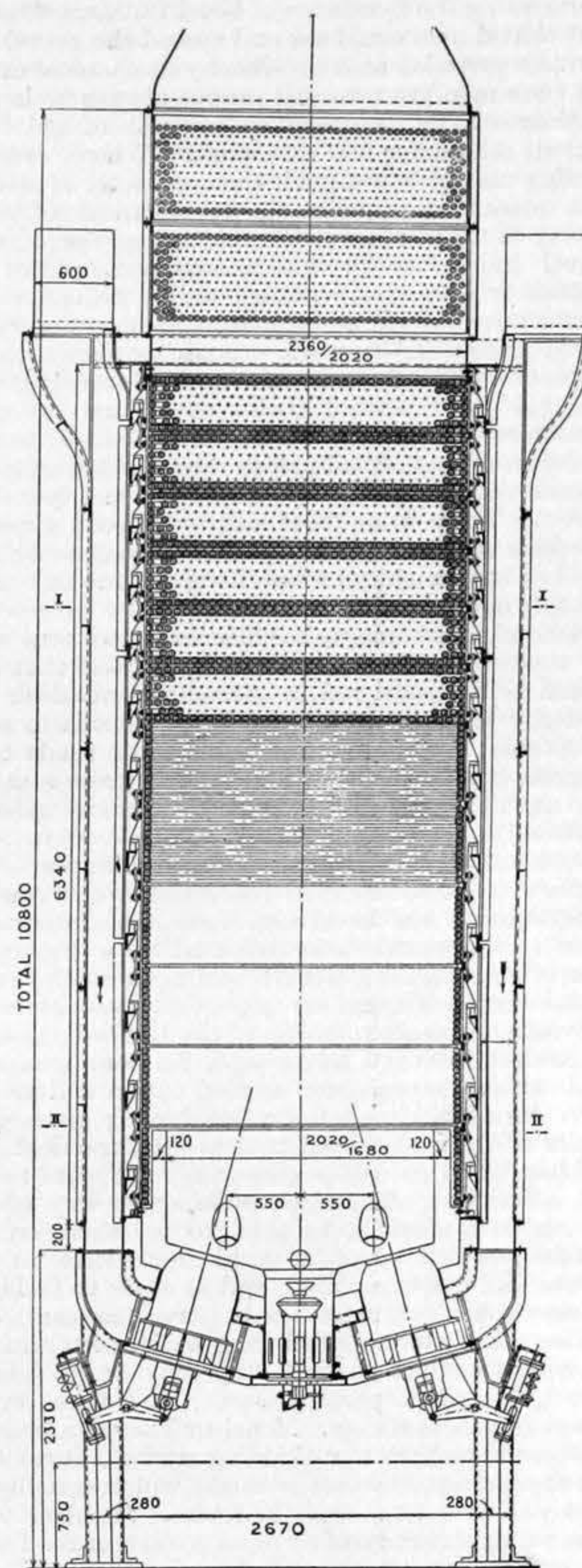


FIG. 3—H.P. STEAM CIRCUIT

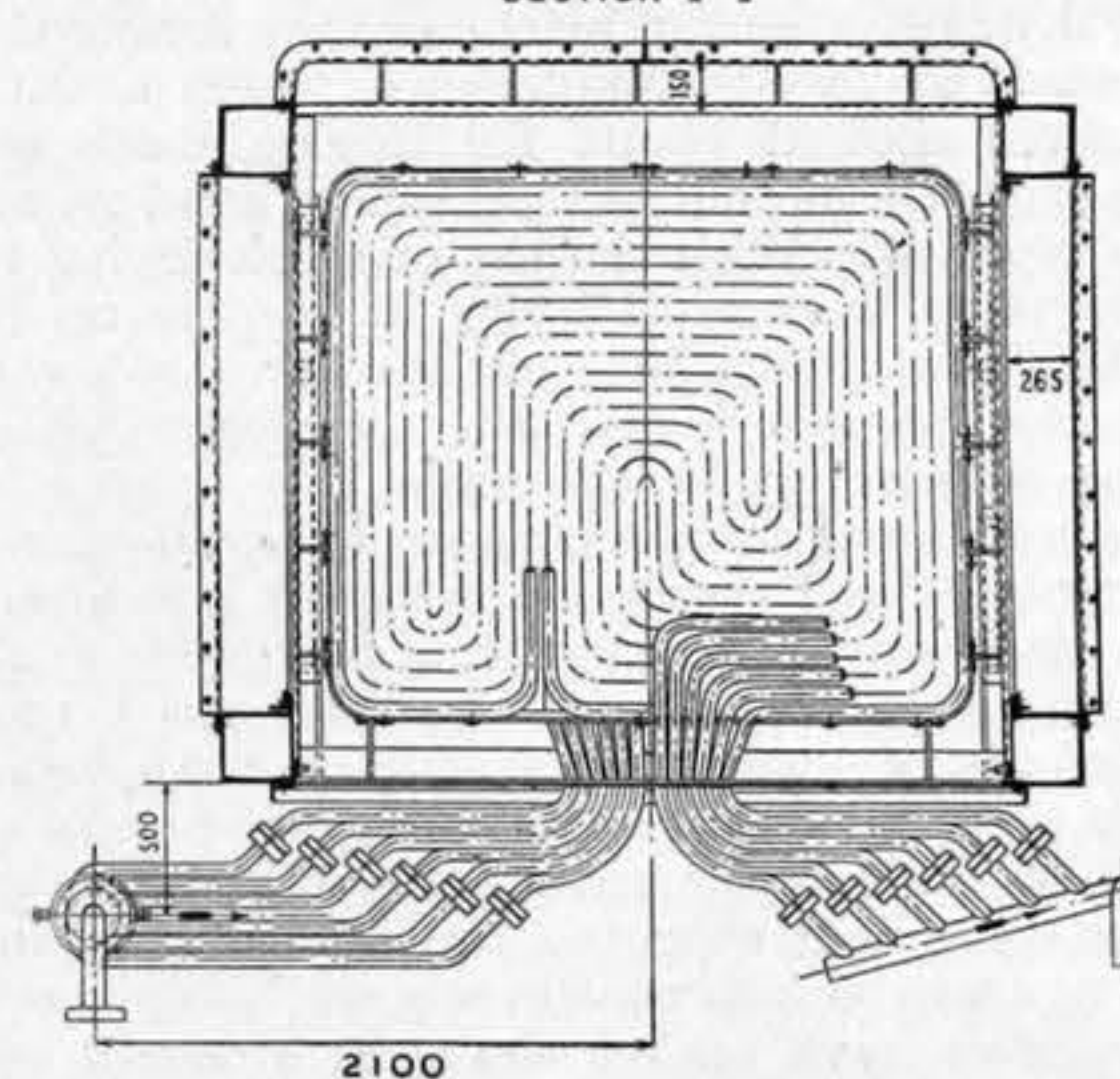
pipings, thus allowing the whole system to be easily controlled. The hand wheel serves only for adjusting to the minimum quantity of steam in the position "Ready for Service."

The air pressure at any moment, or the difference of air pressure in the burner, can be read from the indicator situated above the handwheel. With the handwheel to the left, on the turbine side of the manoeuvring platform, the whole plant is controlled, while the position of the indicator on the horizontal scale arranged above the hand wheel shows the conditions of working of the turbine at any moment. The instruments arranged above the indicator show the pressures before and after the high-pressure stage, the intermediate-pressure stage, and in the condenser.

In the unfilled space shown in the illustration, Fig. 8, a revolution indicator has been fitted, from which the speed of the propeller at any moment can be seen.



SECTION I-I



SECTION II-II

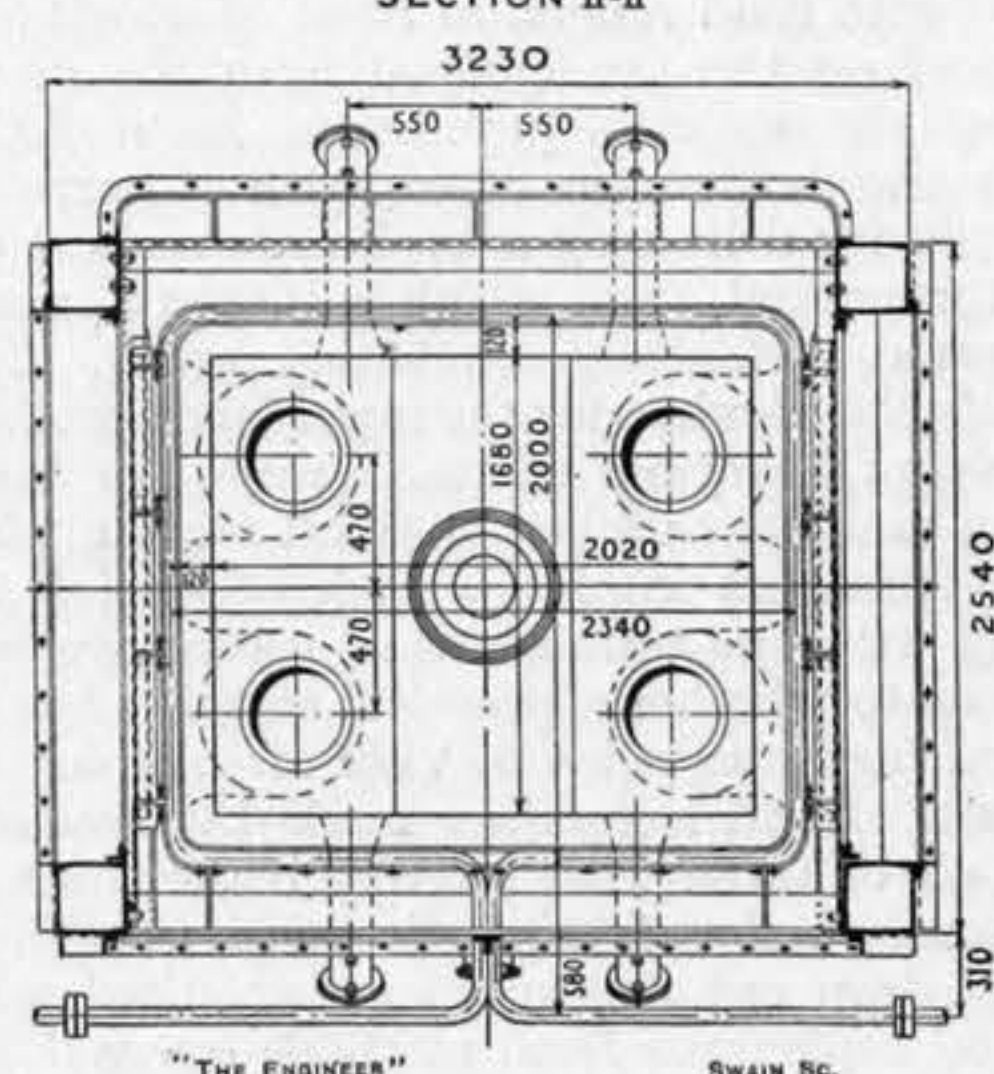


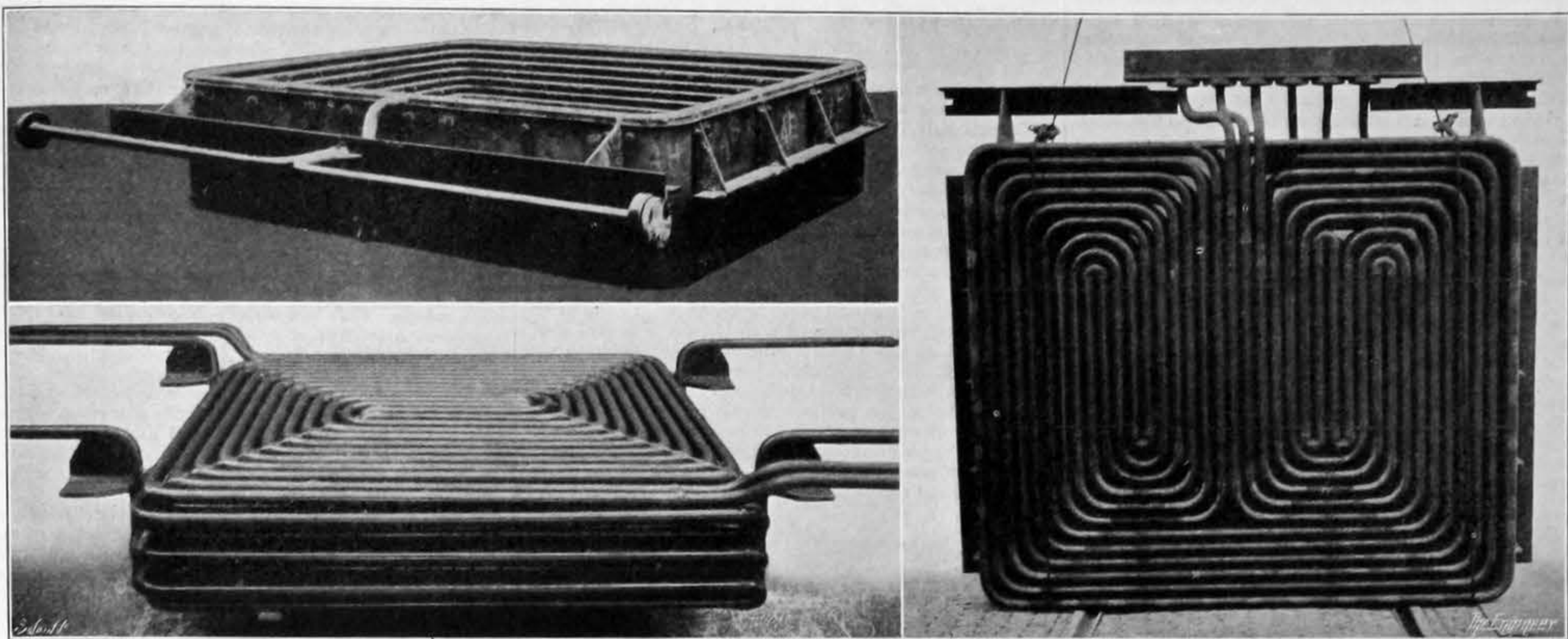
FIG. 4—CONSTRUCTION OF MONOTUBE BOILER

is arranged in such a way that the quantity of fuel and the quantity and pressure of the air going to the burners, on the one hand, and the control of the turbine valves and of the speed of the steam-driven feed-water pump, on the other hand, can be effected automatically from the

control panel on the starting platform. In this way the pressure and temperature of the steam can be kept practically constant, even when manœuvring quickly. This arrangement was only made possible by the provision,

ance was not only centralised and thereby simplified, but the total number of instruments and hand wheels requiring attention has been considerably reduced. The two adjusting handles shown to the right and to

guarantees given for the steam generator were easily fulfilled, and efficiencies up to 94 per cent. were measured. Between half and full load, and including the auxiliary machinery, an efficiency of over 90 per cent. was obtained.



FIGS. 5, 6 AND 7—COMBUSTION CHAMBER LINING, GENERATING COIL, AND ECONOMISER COIL

in addition to the positive parallel working of the feed water and fuel systems, of an additional automatic regulating device, which receives its impulse from thermostats and

the left of the boiler control hand wheel serve for adjusting the temperature and pressure of the steam. Consequently, the pressure and, what is of even greater importance, the

All the auxiliary machinery in connection with the high-pressure monotube steam generator was shown to be capable of fulfilling the stipulated requirements. The change-over to the standby units—for example to the standby feed pump—was carried out with the greatest ease, and the condition that any one of the four burners could be replaced with the boiler in full service, with the other three burners temporarily and automatically taking the full load, was easily met.

The new monotube boiler was designed so that any kind of oil fuel might be burnt. For the first voyage a special heavy oil with a specific gravity of 0.996

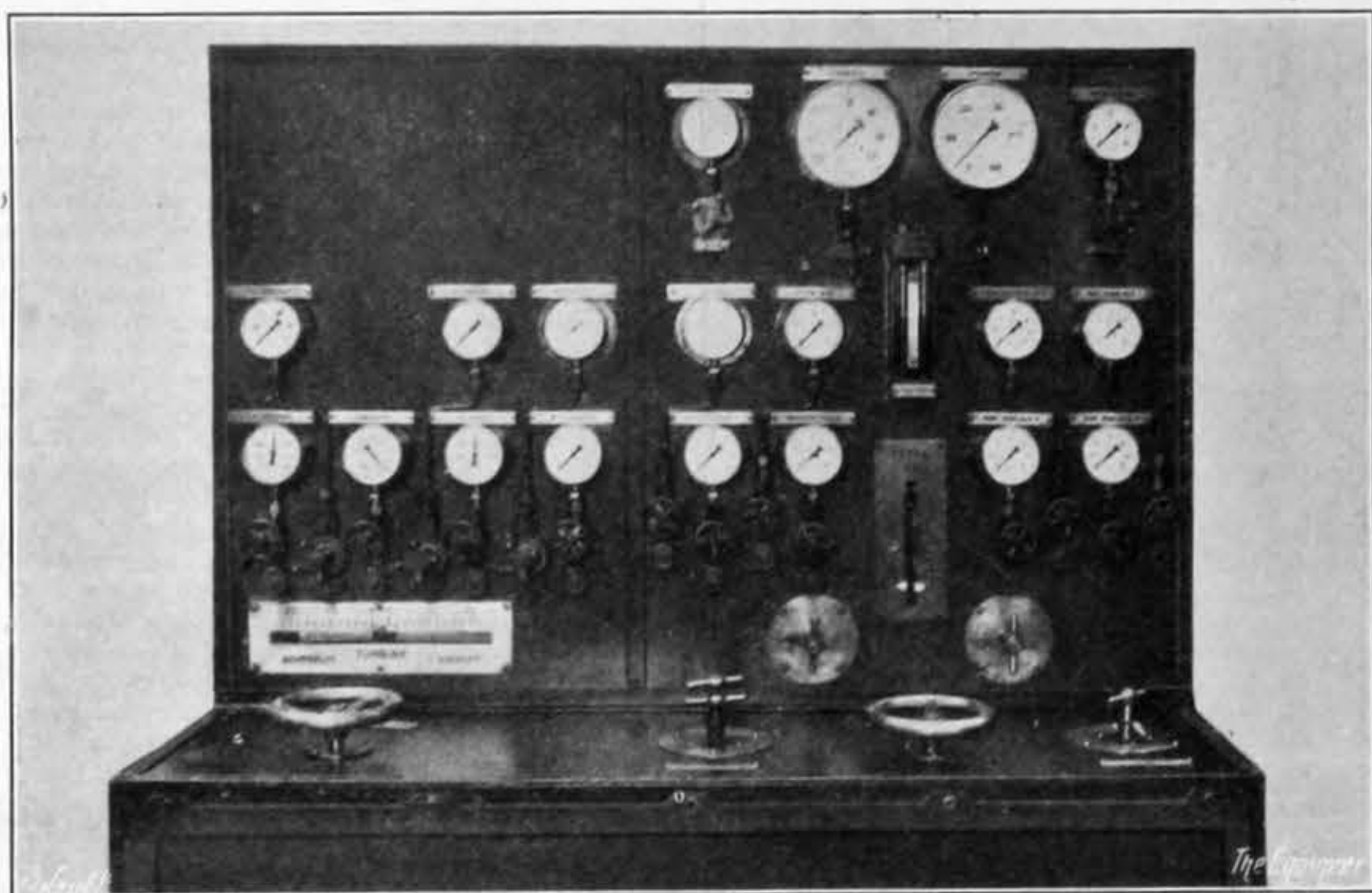


FIG. 8—BOILER AND TURBINE CONTROL PANEL

takes over the necessary fine regulation. The control panel contains all the instruments and hand wheels which are usually distributed among different parts of the engine-

temperature can be modified during service. This is of particular importance to a marine plant, since when manœuvring it is advantageous to work with a steam temperature which is not too high, to avoid overheating the blades of the turbine. When the vessel is proceeding normally at sea, the turbine works with a higher steam temperature in order to run under the most favourable conditions.

In Fig. 9 we illustrate the steam-driven feed-water, fuel oil, and operating oil pump for the installation. It has a designed feed output of 22 tons per hour, at a pressure of 75 atmospheres, and runs at a speed of 160 r.p.m., the inlet steam pressure is 12 atmospheres. The automatically controlled burner-adjusting devices at the bottom of the boiler unit are shown in Fig. 10.

SOME TRIAL RESULTS.

The conversion of the ship, apart from its technical interest, was particularly noteworthy in that very little time was available for installing the high-pressure steam plant and for changing over to high-pressure working. In consequence of bad weather, the "Kertosono" did not arrive at Flushing until February 16th, so that the whole work of conversion which was completed by March 6th, was carried out in the "De Schelde" yards in just under three weeks. Although the tests and trial runs which were intended to follow could not be carried out according to programme because of fog, the official trial run took place on March 11th. On March 14th the ship was ready to start for Rotterdam and to resume her regular service. From March 18th to 21st the "Kertosono" was at Antwerp to take in cargo, and the run from Rotterdam to Antwerp gave ample opportunity to demonstrate the ease with which the Sulzer high-pressure monotube steam generator could be handled. The plant, we learn, proved highly satisfactory in every respect.

The combined automatic regulating gear we have described, by which the regulation of the monotube steam generator and also of the turbine is controlled by means of a single hand wheel, facilitated manœuvring considerably. Each manœuvre was carried out without trouble, and manœuvring from "full speed ahead" to "full speed astern" was effected in 15-20 seconds.

At the basin trials in the shipyard at Flushing, the

was used. At all loads and under all conditions of load fluctuation the combustion was, we understand, smokeless. Marine engineers and naval architects will await with interest further operating results of this highly interesting and pioneer high-pressure steam plant.

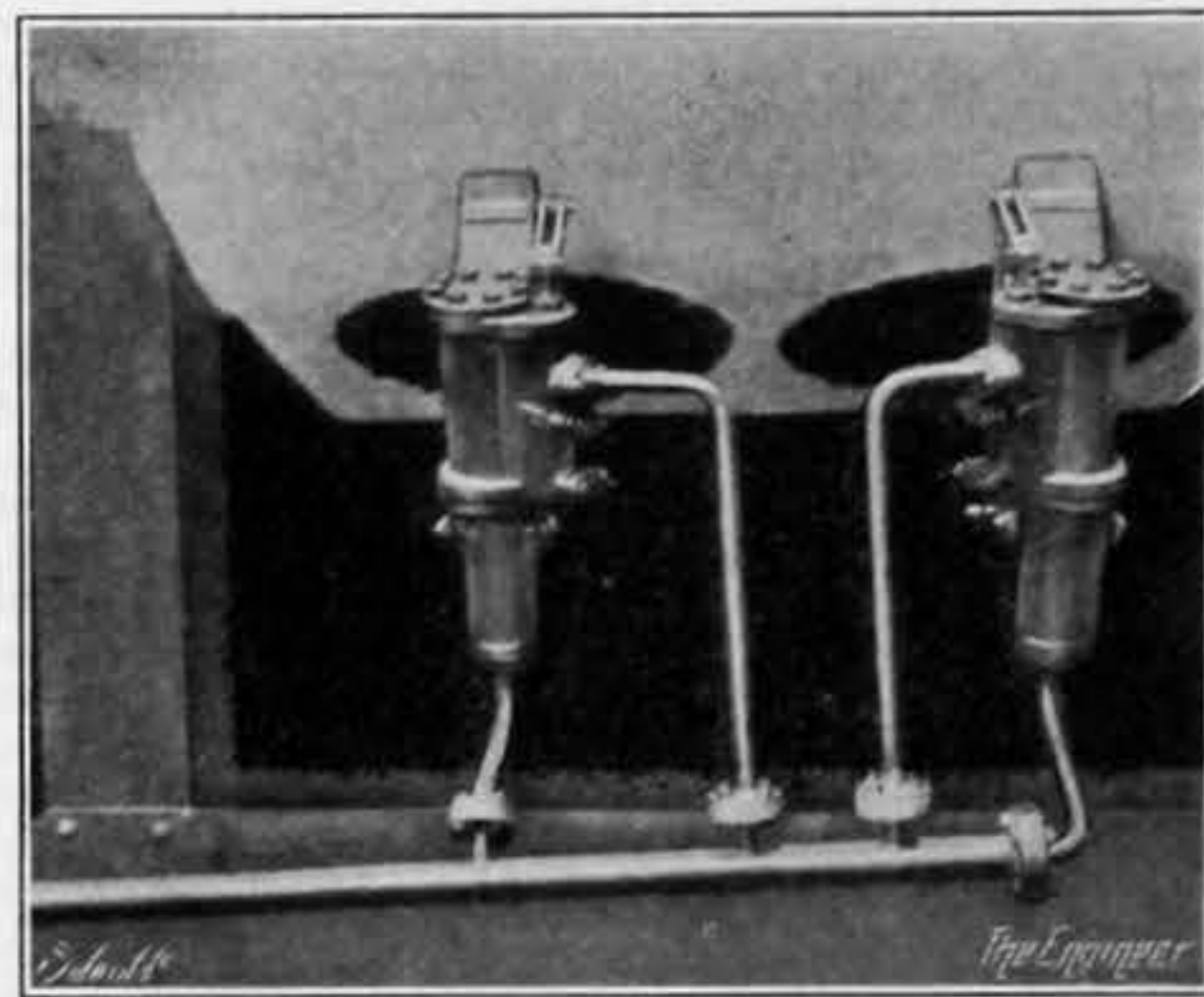


FIG. 10—AUTOMATIC BURNER CONTROLLERS

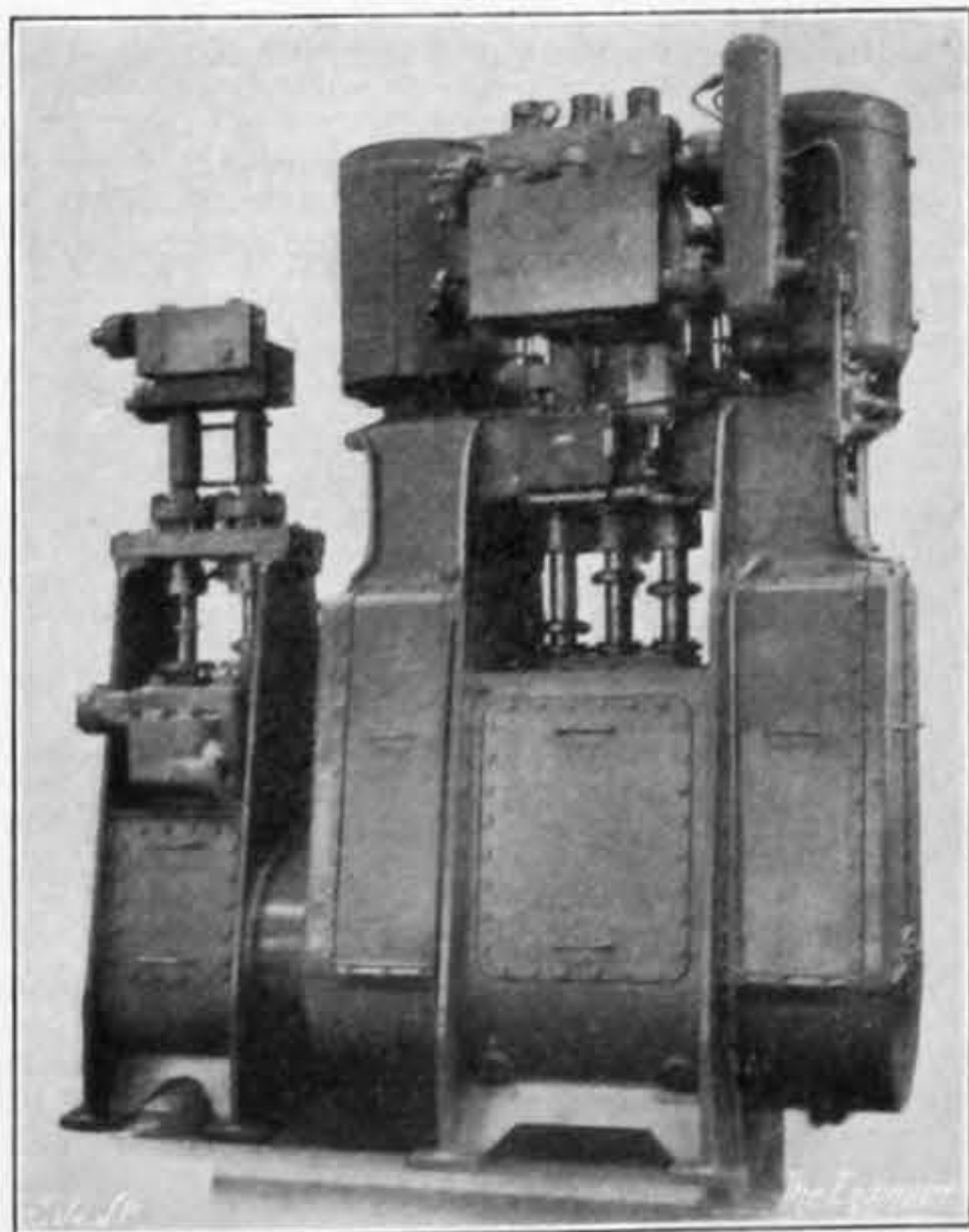


FIG. 9—FUEL AND FEED WATER PUMPS

room, such as the feed-water valve, the steam valve of the pumping set, and the other devices for controlling the burners and air pressure, &c. By the adoption of the oil pressure regulating system, the whole control and attend-

Metallurgy and Engineering.

In a lecture entitled "Recent Developments in Metallurgy and Their Influence on Engineering," Monsieur Charles-Eugène Schneider, governing director of Schneider et Cie., Le Creusot, discussed before the Institution of Civil Engineers, on Tuesday, May 26th, the important part which metallurgy has played in connection with advances in engineering practice. He pointed out that the present year 1936 was the hundredth anniversary of the taking over of Creusot works by his grandfather, who was responsible for their large and rapid development. Since that time those in charge of the works had never ceased to entertain friendly relations with the British iron and steel industry and to exchange ideas and results of experiments and discoveries with British metallurgists.

Monsieur Schneider said that in 1836 the metallurgy of iron was in a process of evolution, and many works still used old methods. France was then the second metallurgical country in Europe, the first place being occupied by England, whose output of pig iron and wrought iron was equal to that of the rest of the world. Of the 543 furnaces in blast in France, 502 were fired with charcoal and their output was restricted by the output of the forests. The old forges had to be located near forests and on the banks of rapid-flowing streams suitable for working the hearth bellows and small mechanical hammers by water wheels. The introduction of the use of coal in the manufacture of pig iron led to a complete change in methods of working and the location of plants. In 1836 Messrs. Schneider owned four coke blast-furnaces and produced 7000 tons of iron in bars and plate, whilst the total production of steel for making such things as tools and arms in France was about 6000 tons.

In the beginning those responsible for the introduction

of new ideas were limited by the facilities available, but during the last century new processes and new appliances had placed at the disposal of engineers facilities of the highest importance. The electric furnace, introduced in 1900, meant for the refined and special steel industry an advance similar to that afforded by the Bessemer converter in the manufacture of ordinary classes of steel. The era of electricity also radically transformed the rolling mills. Whilst in 1865 the Creusot works needed twenty-six rolling mill sets to roll 100,000 tons per annum, in a modern steel works of 1 million tons capacity to-day five graded sets would suffice for producing all the usual bar sections.

Quality improved at the same time as quantity. In 1885 two Creusot scientists, Osmond and Werth, established the proof of the cellular and crystalline structures of steel and alloys with the aid of photography, and the relations existing between the state of the constituents of steel and its mechanical properties, together with the influence of variations of temperature upon the state of the constituents of steel, formed the subject of researches by many other scientists. New methods of metallographic investigation were completed by resorting to oblique illumination, which enabled the identification of certain inclusions otherwise invisible.

Monsieur Schneider referred to the study being carried out in French laboratories of micro-analytical processes with a view to investigating micro-segregation. New testing machines due to Monsieur Chévenard enabled the determination of the mechanical characteristics of a small piece of metal and proved most useful in autogenous welding technique. Corrosion tests, mechanical tests in the hot state, and repeated torsion and bending tests supplied data which was absolutely essential to-day for the engineer. X-ray examination enabled information to be obtained concerning the homogeneity of steel, and was proving most useful for the verification of welds in plate work. He mentioned also the spectrographic analysis of an X-ray beam to determine with certainty the limits of solid solutions, to study definite compounds and their crystalline system, and to throw light upon the phenomenon of cold working or re-crystallisation. This exploring of the microscopic particles would procure data of the highest interest on special steels, on methods of forging, and also on the heat treatments which were most suitable for their different uses.

In connection with alloys, he said that nickel was the best alloy metal to act upon the critical range of quenching, since it increased hardness without making for brittleness and allowed of decreasing the percentage of carbon when an increase in hardness was not desired. The use of chromium, the addition of molybdenum and of titanium, the perfecting of thermal treatment and of pickling, and the smoothing of the surfaces, all combined, had enabled metallurgy to offer to the chemical industry a whole series of steels having notable mechanical properties, which could be worked up, machined, and welded, and were at the same time capable of resisting for long periods the strongest chemical reagents. Among these steels the best known and most commonly used was one having an austenitic structure containing 18 per cent. of chromium and 8 per cent. of nickel.

Monsieur Schneider referred also to the work carried out by metallurgists in the study of steel which showed satisfactory resistance at high temperatures both to mechanical stresses and to oxidation, and mentioned that chromium steels containing a certain proportion of nickel, tungsten, and vanadium would withstand temperatures of even 2000 deg. Fah. He mentioned the great increases in the pressures employed in tubular boilers, and the advance in the use of steel in railway carriage bodies, where there was even a tendency to replace the mild steel sheets now used by sheets of nickel-chromium-molybdenum steel, the elastic limit of which was almost double that of the former. Thanks to the improvements made, which were due in part to the manufacturer of steel, 1000-ton trains could now travel at a speed of over 80 m.p.h. more safely than the 100-ton trains in 1840 ran at 25 m.p.h.

The motor car and the aeroplane owed many of their recent advances to the results obtained by metallurgists. Recent military aviation engines weighed hardly 1.1 lb. per H.P., and there had been a corresponding decrease in the weight of the framework due to the manufacture of a whole series of light alloys having a specific gravity of 2 to 3 and a strength comparable to that of mild steel.

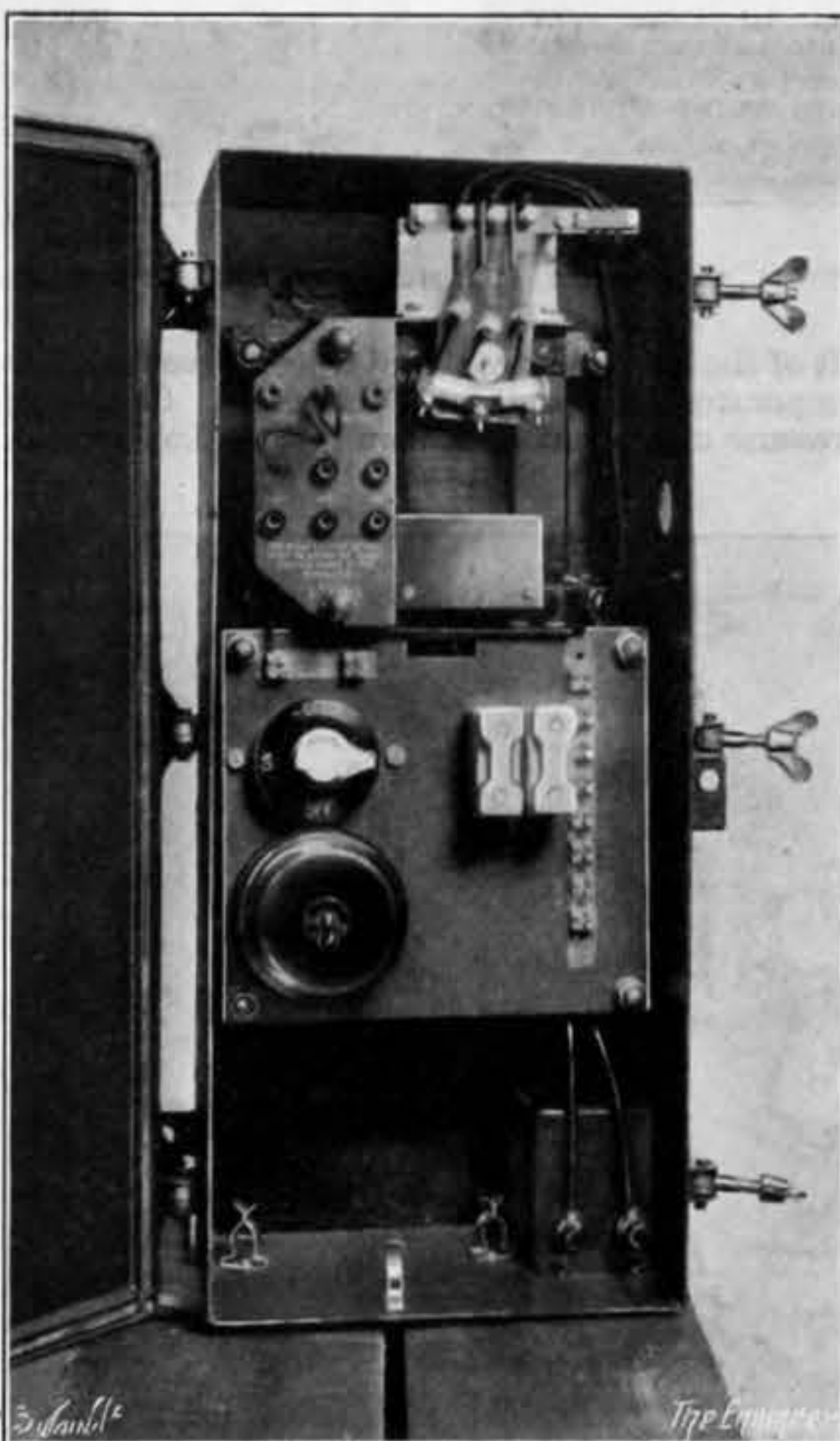
Monsieur Schneider quoted as an example of the improvements reached the fact that the length of round wire which could bear its own weight had increased from 2.5 miles for puddled iron wire and 3.3 miles for mild steel wire to about 15 miles for wire of special nickel chromium-tungsten steel. The use of special steels had also led to an increase in span in cantilever and suspension bridges, to making possible still deeper winding depths in collieries, and to improvements in the design of internal combustion engines and turbines. In connection with turbine shafts, he pointed out that one of the special conditions that had to be observed in their manufacture was to prevent any possibility of their undergoing deformation at their actual working temperatures. This meant that no residual stress should remain in them following thermal treatment. In France Messrs Messager and Jouguet discovered methods to arrive at the residual stress in question, but these were costly and took time. His firm had, however, perfected an approximate method called the "prism method," which consisted of measuring the deformation of a test prism in the course of machining. This permitted in every case the determination of the type of treatment required.

In conclusion, the lecturer mentioned some of the improvements which had been effected in the electrical and shipbuilding industries, and pointed out how tests carried out to meet the needs of military requirements had brought about results which were of the greatest value in peace. Researches made with a view to lightening submarines and aeroplane engines had thus led to improvements in agricultural tractors, motor lorries, and cars, while the experience gained in the manufacture of armour plates had been of use in the building of steam accumulators and of containers for the hydrogenation of coal and oils and in other branches of the chemical industry.

The Automatic Control of Voltage Regulators.

DURING a recent visit to the works of Ferranti, Ltd., of Hollinwood, Lancs., Mr. E. T. Norris, the company's chief designer, drew our attention to many voltage regulators in the course of construction. For the economic maintenance of voltage on distribution networks, these regulators are competing with no small measure of success with additional E.H.T. sub-stations and heavy cable sections. Fully automatic operation of this kind of apparatus is obviously essential, and simplification of the control gear for the purpose has been deemed to be needed. Until recently this gear was complicated and costly in relation to the regulator itself. Whilst a large supply authority with an extensive staff, including skilled relay and instrument experts, may not find the use and maintenance of this control gear a troublesome and expensive business, smaller undertakings and particularly those in rural areas, with scattered networks and a restricted technical staff, need something more simple and much less liable to call for attention. To make fully automatic voltage regulators suitable for general use throughout a distribution system has been the major problem with which designers and manufacturers of these regulators have had to deal.

Much of the complication and cost of fully automatic control gear has been eliminated by the development of the moving coil regulator and the mercury switch regulat-



NEW RELAY WITH SWITCH AND FUSES

ing transformer, both of which have been described in THE ENGINEER. Descriptions of the former are to be found in our issues of December 8th, 1933, and April 5th, 1935; whilst the latter was dealt with in our issue of December 1st, 1933. The elimination of components, such as automatic brakes, limit switches, auxiliary relays, and overload devices led to simplification, but the standard voltage relay or contact making voltmeter, which initiates operation of the regulator whenever voltage variation is required, remains a delicate instrument needing skilled adjustment and periodical maintenance.

A new device, known as the Astatic voltage relay, in which the most objectionable features of the ordinary relay have been eliminated, has been invented by Mr. E. T. Norris, and has recently been put upon the market by Ferranti, Ltd. The chief function of a regulator voltage relay or contact-making voltmeter is to close a motor circuit directly or indirectly whenever the voltage varies more than a prescribed amount (usually 1 per cent.) from the normal value, and so initiate operation of the regulator in the direction necessary for correcting the variation. In the ordinary standard relay the actuating forces at normal voltage are balanced by a spring suitably adjusted in tension. The small voltage variation permissible results in an operating force which is only sufficient to close a pair of light contacts, auxiliary relay circuits and starting contactors being necessary to control the regulator motor.

The new relay comprises an electromagnetic circuit of special design in which the force exerted on the moving element or armature at a given voltage is constant over a large range of movement and operates against the weight of the armature, due to gravity. If the circuit is arranged so that at normal voltage the force is exactly equal to the weight of the armature, then the effect of gravity is neutralised, and the armature tends to no particular position—hence the name "Astatic" relay. The mechanical forces on the armature are approximately proportional to the square of the voltage. If therefore the voltage rises, say, 1 per cent., the force on an armature of weight w lb. increases 2 per cent., or $0.02w$ lb., and since the weight of the armature is neutralised, this additional force of $0.02w$ lb. has nothing to do beyond overcoming the negligible friction of the armature, and can be utilised for external work. Owing to the astatic action, the extra forces, $0.02w$ will be constant for a considerable distance M , giving a work output of $\pm 0.02wM$. As both w and M can have any desired magnitude relatively large outputs can be obtained.

The actual values chosen for the standard model of the new relay are such that the energy available for operation due to a 1 per cent. change of voltage is 480 times greater on actual measurement than in the ordinary type of relay, with the result that it is possible to operate a mercury switch with ease instead of closing a pair of light and relatively delicate contacts. The use of mercury switches eliminates burning or wear of contacts, and there are no hold-on coils or other devices to prevent chattering. The rupturing capacity of the switch enables motor loads to be handled directly, thus making auxiliary relays and starting contactors unnecessary.

The accompanying illustration shows the new relay complete in case with the control switch and fuses. Usually the case is mounted on the side of the regulator, so that all control wiring and connections are completed before dispatch from the works. The regulator and its control gear then form a self-contained unit, ready for installation. Since there is no wear or arcing of open contacts and the mercury switch is capable of an unlimited number of operations, and since there are no spring tension adjustments, the "Astatic" relay does not require periodical attention or maintenance. The only adjustments necessary are those for operating voltage and sensitivity. In practice, the former is easily determined by a wander plug, and a terminal board marked directly in voltage values, whilst sensitivity for any given regulator can usually be set once and for all at the works before dispatch, although it can easily be changed in service by varying the pendulum action of the switch movement. No hold-on adjustment is necessary.

The new relay can replace existing Ferranti relays, and in most cases relays of other makes on all types of automatic voltage regulators, including existing or new on-load tap-changing gear and induction regulators. In some cases as, for example, the moving coil regulator, the operating gear consists of no more than the relay and driving motor. Simplification has not, however, been achieved at the expense of reliability or the facilities of the older forms of control, but mainly by the elimination of undesirable features. In rural and other sparsely populated areas in which inspection and maintenance costs must be reduced to a minimum, the new relay is particularly valuable for the control of small regulators.

An Automatic Clutch for Railcars.

THE installation of an internal combustion engine in a railway vehicle presents a series of problems of transmission design which were analysed at a conference held recently by the Société des Ingénieurs Civils de France by M. Fieux, an engineer of the Schneider Company. He pointed out that in a railcar the resistance to motion due to inertia is superimposed on the "passive" resistances to motion due to friction, oil drag in axle-boxes, &c.,

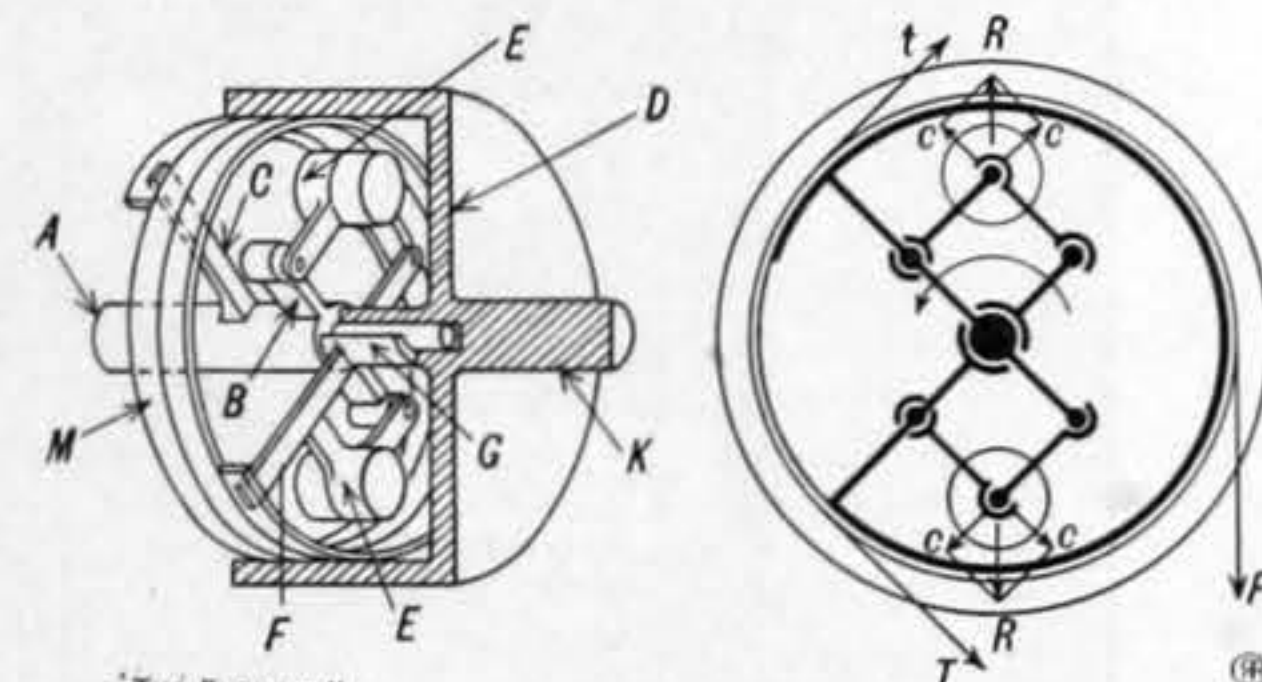


FIG. 1—DIAGRAM OF CENTRIFUGAL CLUTCH

and that the adhesion of the driving wheels was relatively low. Accordingly, the requirements of rail traction necessitate the use at starting of a couple approximately equivalent to the maximum horse-power output of the engine which is developed at high revolutions. It was therefore essential to provide, between the engine and the wheels, a coupling capable of transmitting horse-powers which nowadays vary between 150 and 4000, and allowing slip to take place in a manner which is controlled and automatic over a prolonged period of time. While in the case of the small railcar of 7 or 8 H.P. per ton the clutch

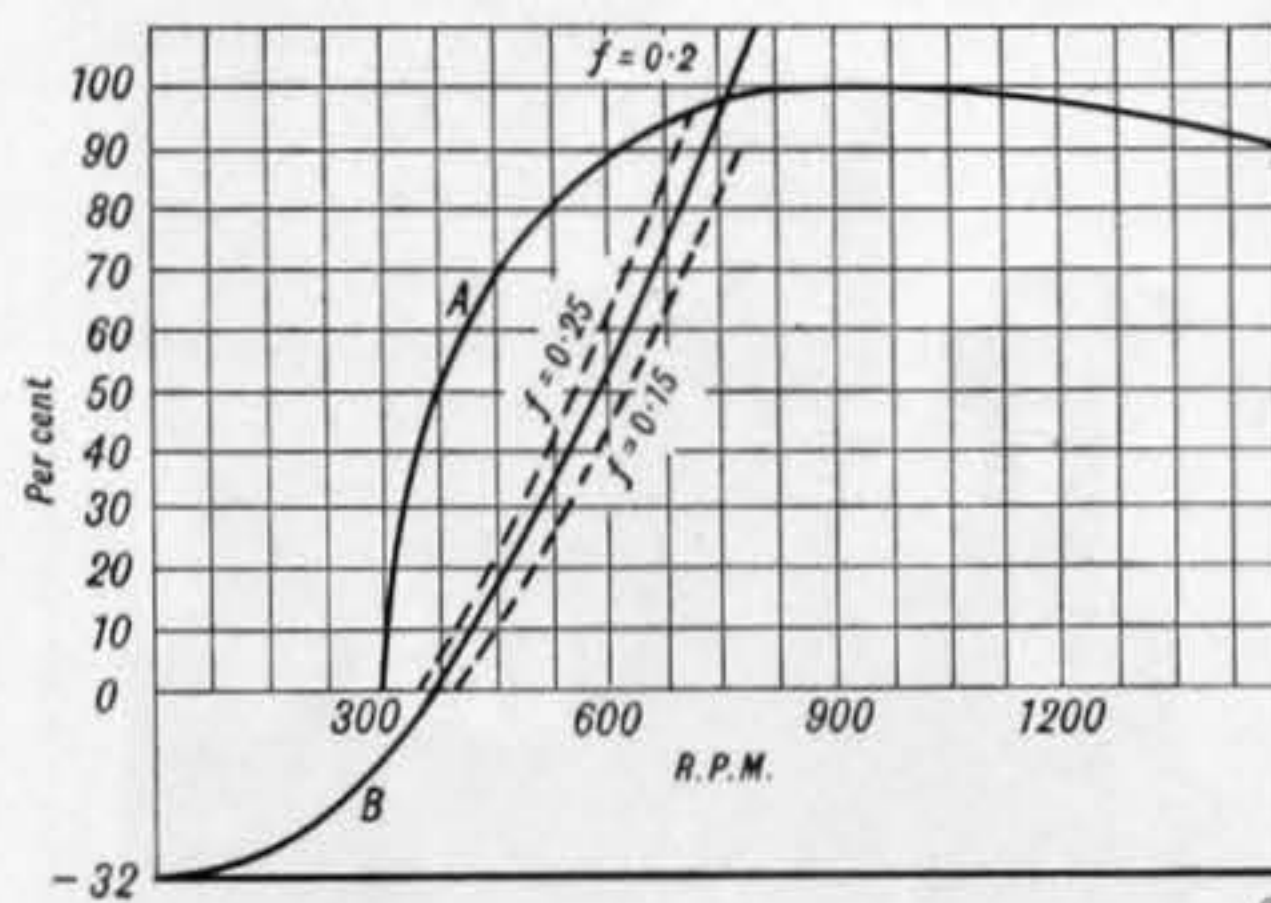


FIG. 2—A. ENGINE COUPLE
B. TRANSMITTED COUPLE

slip at starting took place for about four or five seconds between the first application of power and full engagement of the transmission, allowance must be made for slip lasting forty to fifty seconds in the case of cars of the Bugatti type capable of 150 kiloms. to 160 kiloms per hour.

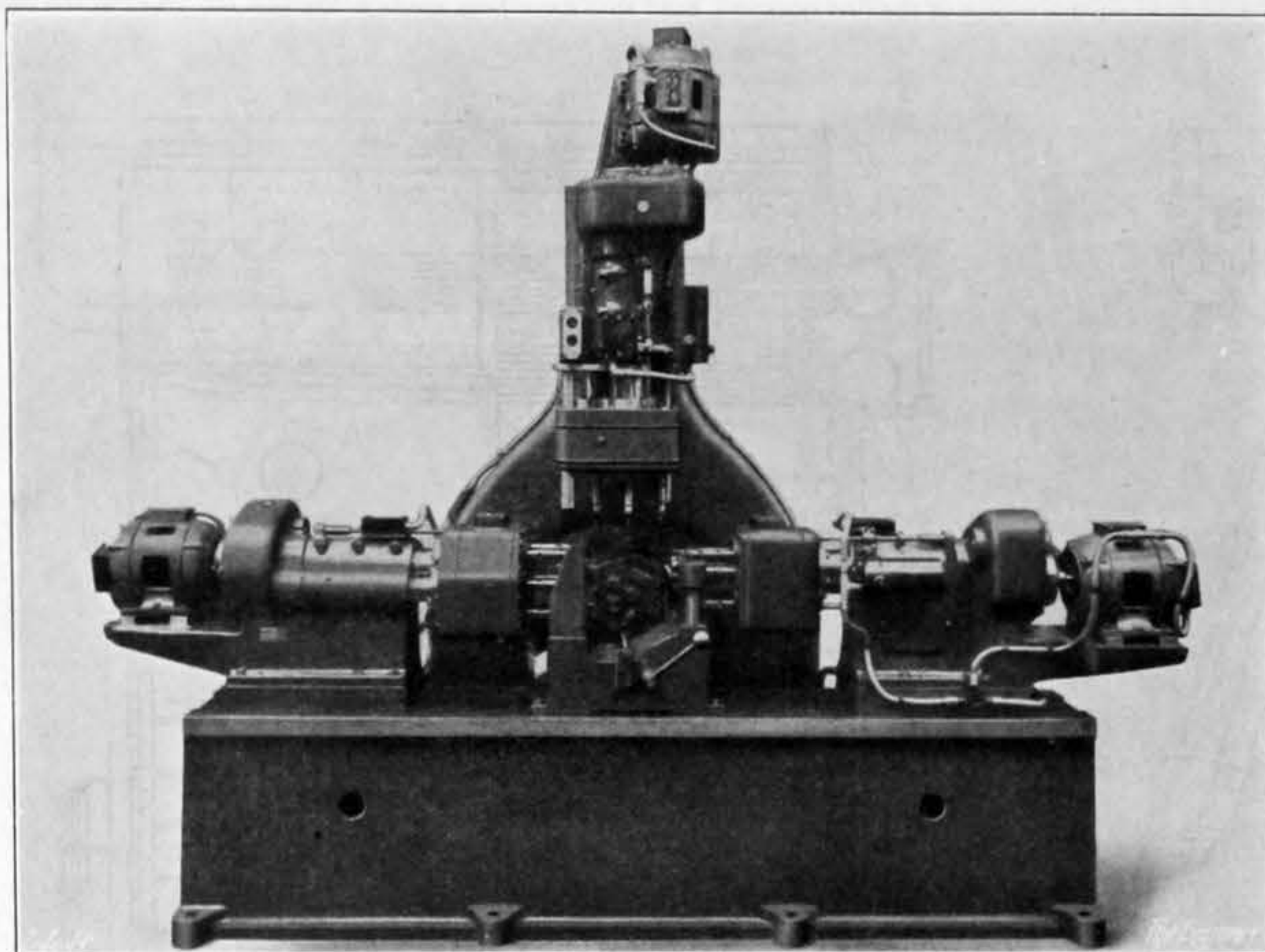
M. Fieux made a brief examination of electric, hydraulic, and mechanical systems of transmission before describing the Schneider-Fieux centrifugal clutch, a system which, he explained, has already been used for some time in connection with petrol engines, but which has recently been perfected and adapted as an automatic clutch for railcar use. The schematic drawing, Fig. 1, illustrates the method of operation. The engine shaft A carries a spider B, to the periphery of which masses E are articulated. The masses are also linked to another

spider F carried on a sleeve G, which is free to rotate, but rides on an extension of the shaft A. The spiral spring M has one end rigidly attached to the engine shaft A by the arm C, and the other end attached to the spider F and thus to the sleeve G. The outside of the spring M carries a friction-resisting lining, and during normal running engages with the casing D, which forms part of the driven shaft K. An auxiliary spiral spring attached to the arms carrying the masses E retains the spring in the "disengaged" position when the transmission is

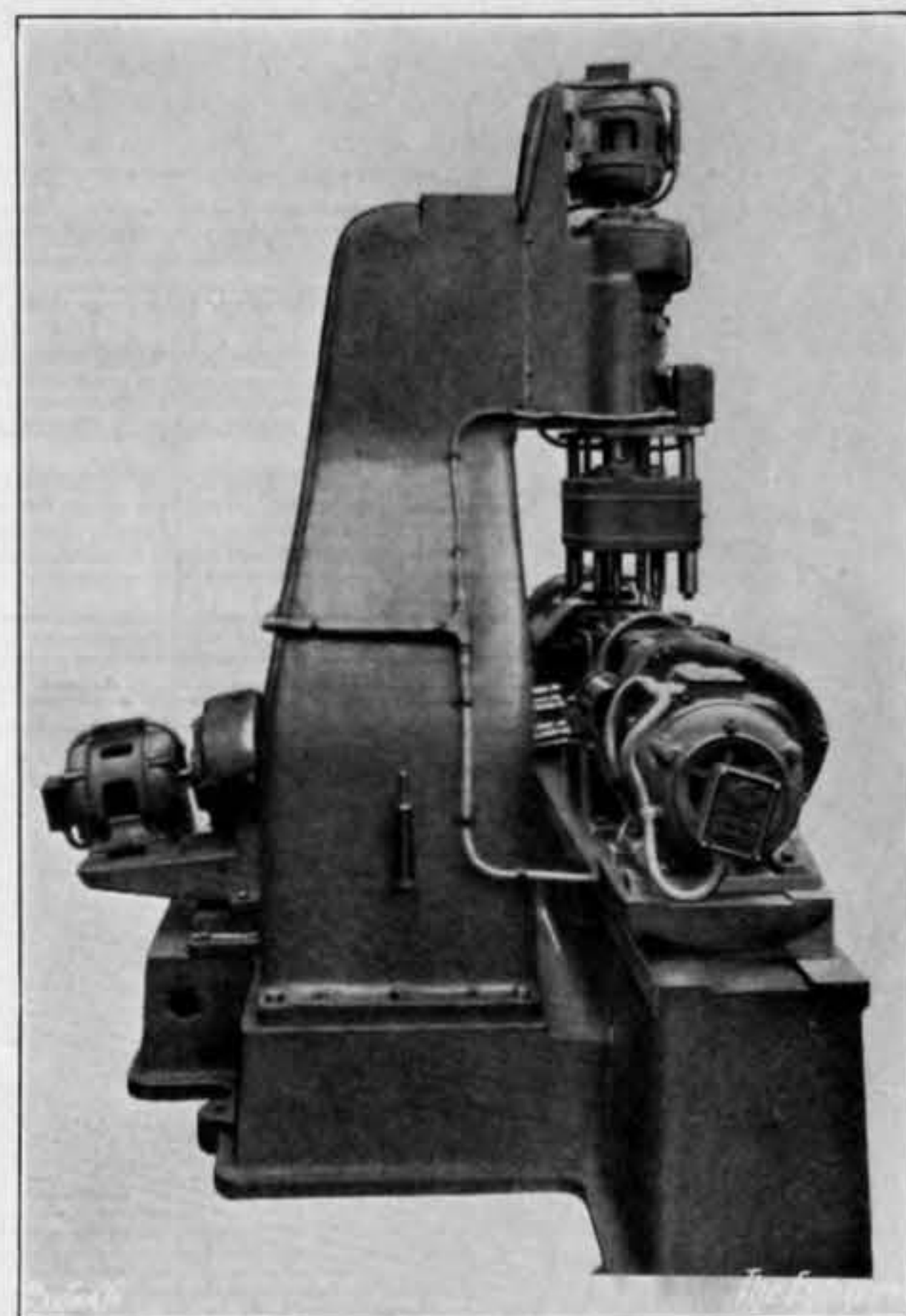
nators themselves are the largest of the kind so far built by British manufacturers. By reason of the stresses at runaway speed, the rotor rim is built up of segmental stampings, 1½ in. thick, assembled on a separate cast iron spider with special overlapping giving an effective section equivalent to three-quarters of the total section, instead of one-half as given by simple overlapping. The stampings are clamped between flame-cut rolled steel plates by means of a large number of bolts passing through closely fitting holes in the stampings. On the outer rim of the

provided to secure rigidity. The spur gears driving the spindles are lubricated by a siphon system, and all the spindles are accurately ground.

In operation an electric button on the vertical column is pressed, and starts up all four heads simultaneously, feeding the taps through the holes at the correct tapping rate. When through the work, the driving motors are automatically and independently reversed, and the heads returned to the first position, at which point each head stops, the sequence being repeated in exactly the same



FOUR-SIDED TAPPING MACHINE



stationary, and ensures that no engagement will take place before the correct engine torque is available. The couple exerted by the auxiliary spring corresponds to a reduction in the clutch engagement couple of about one-third the maximum engine couple, as shown by the curves of engine couple A and transmitted couple B in Fig. 2. The operation of the clutch is dependent on the centrifugal action of the masses which overcomes the action of the auxiliary spring, and then the torsion applied to the main spiral by the engine torque, thus expanding it to engage the casing D. In the balance of forces shown in Fig. 1, t represents the disengaging force acting at the free end of the spiral; T is the force applied by the engine to the opposite end of the spiral and directly proportional to the square of the speed of the engine; F is the useful effort due to friction. Thus $t = T - F$, and t is always very small relative to T and F , the coefficient of friction, and therefore t may vary greatly without affecting the useful effort F . The use of the clutch on a Somua vehicle, now in course of delivery, is expected to show that 50,000 starts can be carried out without change of linings, the figure being based on previous models which have accomplished 15,000 vehicle starts with a clutch of smaller dimensions.

core are T-shaped slots for dove-tailed fitting of the poles. The rim built up in this way forms a self-supporting ring, and as it is not attached to the spider, no centrifugal stresses of the core and poles are applied to the spider. Floating on the spider the rim is driven by rectangular-shaped keys, which allow a certain amount of expansion without the rim being able to run out of centre.

The thrust bearing and upper guide bearing of the umbrella rotor are placed immediately below the magnet wheel. Complete with its shaft and exciter, the rotor weighs about 95 tons, and together with the weight of the turbine runner and the water thrust, gives a total weight of 220 tons on the thrust bearing. The latter consists of a highly polished rotating steel collar running on white-metal faced stationary segments, each supported by a large number of strong steel springs to ensure uniform distribution of the load. The normal speed of both alternators is 214 r.p.m., and the rotors are being tested at the runaway speed of 395 r.p.m.

A Four-sided Tapping Machine.

A VERSATILE machine for tapping bolt holes in the gear-boxes of motor cars, which has just been produced by William Asquith, Ltd., of Halifax, is represented in the engravings above. It is capable of tapping twenty-nine holes simultaneously on four sides of a casting, but can be adapted for other combinations.

In the arrangement shown, the four heads have seven, ten, six, and six spindles respectively, and each is driven by a separate electric motor of 3 H.P. It will be noticed that the back head is slightly inclined to the horizontal, and that the top head is carried by a straddling standard. The multiple spindle tapping heads are bolted to a large barrel and take their feed from a screw fitted to the head, the nut being fixed in the unit head. A torque rod is also

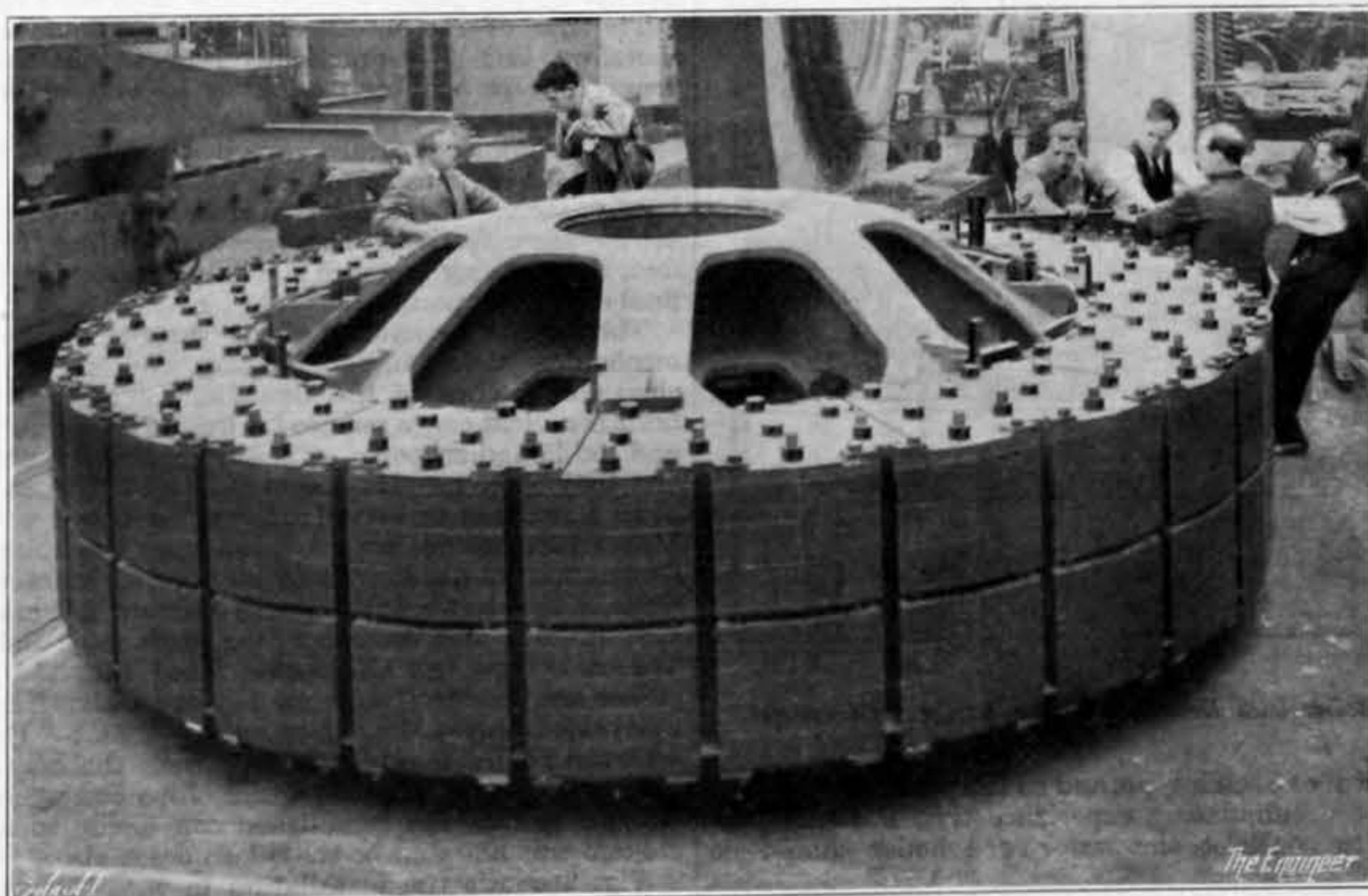
manner when the jig has been reloaded, and the push button again operated. Provision is made in the electrical system to prevent the machine being restarted unless all the heads have returned to the starting position.

SIXTY YEARS AGO.

"THE Coming War—England Without a Navy" was the title of an alarmist pamphlet which we reviewed in our issue of June 9th 1876. The pamphlet was anonymous but, with a freedom of speech characteristic of the times, we found in its jerky, disjointed chapters and the magniloquent and reckless manner in which the expenditure of millions of pounds was declared to be necessary, evidence which pointed to Mr. John Scott Russell as being the author. Whoever he was the author claimed to be a professional man practically acquainted with his subject for a period of thirty or forty years. He further claimed that his pamphlet echoed the opinions of eminent naval men. He asserted that since the close of the Crimean War, a conflict which had proved that a wooden navy was useless and which had set this country the task of building a new fleet, we had spent a hundred million pounds on naval defence. The money, he said, had been spent without settled purpose, plan or will. We had been experimenting with big guns, turrets and broadsides and armour plating and had failed to create the new navy which we required. We reminded the author that some twenty years previously the Emperor Napoleon with the aid of his naval architect, Dupuy de Lome, had completely reorganised the French Navy with the result that within a very few years France had found herself in possession of a fine fleet which was completely out of date. Had the author of the pamphlet had his way we would at this date, we asserted, possess a fleet of "Warriors" partially plated with 4½ in. armour and would have been at the mercy of any enemy which had done, as we had actually done, feeling their way and building enough ships at a time to keep up with the knowledge which they possessed. If fifty million pounds were to be expended immediately on the creation of an effective fleet, as the author demanded, it was most probable that in ten years' time a similar sum would be demanded because of the uselessness of the fleet which would now be constructed. We then proceeded to carry the attack into the author's own camp. If, we said, his views really represented the opinions of naval circles, then his pamphlet merely demonstrated the incapacity of naval officers to direct the Admiralty. And when we studied the training which naval officers received the reason for their incapacity became plain. At the age of 12½ to 13½ years boys were sent to the "Britannia" for two years' instruction and then packed off to sea. They might or might not be fortunate enough to be assigned to a ship carrying a naval instructor but even if they were the most they could hope to do was to keep up what little knowledge they had gained during their course on the "Britannia." It was not longer true, as it was in Nelson's time, that a thorough knowledge of seamanship was the most desirable qualification of a good officer. Recent deplorable accidents, however, which threatened to turn our navy into a national sinking fund, showed that even seamanship was wanting in our naval officers at present. The college at Greenwich might do some good in helping to improve the education of young naval officers but we regretted that Mr. Ward Hunt's proposal to build a new college at Dartmouth, to do away with the "Britannia" and to extend the naval cadet's training to three years had been dropped. A war, we concluded, would find us deficient not so much in ships as in officers to command them—not to mention seamen to man them.

Large Water-Wheel Alternators for New Zealand.

ROTORS for two 24,000-kVA water-wheel alternators, under construction at the works of the Metropolitan-Vickers Electrical Company, for Arapuni, New Zealand, possess unusual and interesting features. On account of the large fly-wheel effect required, the magnet wheel of each machine, even without its poles, is too large to be shipped in one piece, and it is believed that the alter-



ROTOR CORE ASSEMBLED ON SPIDER

The Coal-Fired Marine Boiler.*

By Engineer Rear-Admiral W. M. WHAYMAN.

SOME eight years ago the author was associated with a small, but influential, Committee which included such eminent individuals as the late Sir Charles Parsons, Sir John Biles, the present Lord Weir, and representatives of the coal industry, for the purpose of promoting the use of coal afloat in the form of powdered fuel. A machinery design proposal for a modern tramp steamer with turbine propelling machinery and water-tube boilers burning

to them in respect of first cost, weight, and space and will provide durability and reliability for the life of the ship and economic advantage in fuel and running costs.

There is also another very important aspect of the situation and that is the alternative now offered to the shipowner to use oil as fuel for raising steam in the vessel's boilers, and although it is not intended in this paper to discuss the change that has come about in the choice of fuel to be used, it is important to realise that the present tendency is for the price of boiler fuel oil to fall and the price of coal for bunkers to rise, certainly in this country and generally throughout the world. It is not desired to provoke discussion on this aspect of the fuel question, but

be most suitable for the vessel's particular service and the shipowner's pocket, but this advantage in choice of fuel and the ability to use either kind as availability and price of fuel demand, although most efficacious in controlling the price of fuels, is not alone sufficient to induce the shipowner to choose steam propelling machinery. The steam plant must be such that for a given type of vessel and trade it will show economic advantage in the shipowner's balance sheet of first cost, depreciation, maintenance and running costs for repairs, fuel, and staff.

It was therefore considered that it would be interesting in this paper to review some of the changes and progress that have been made in the last ten years in the direction

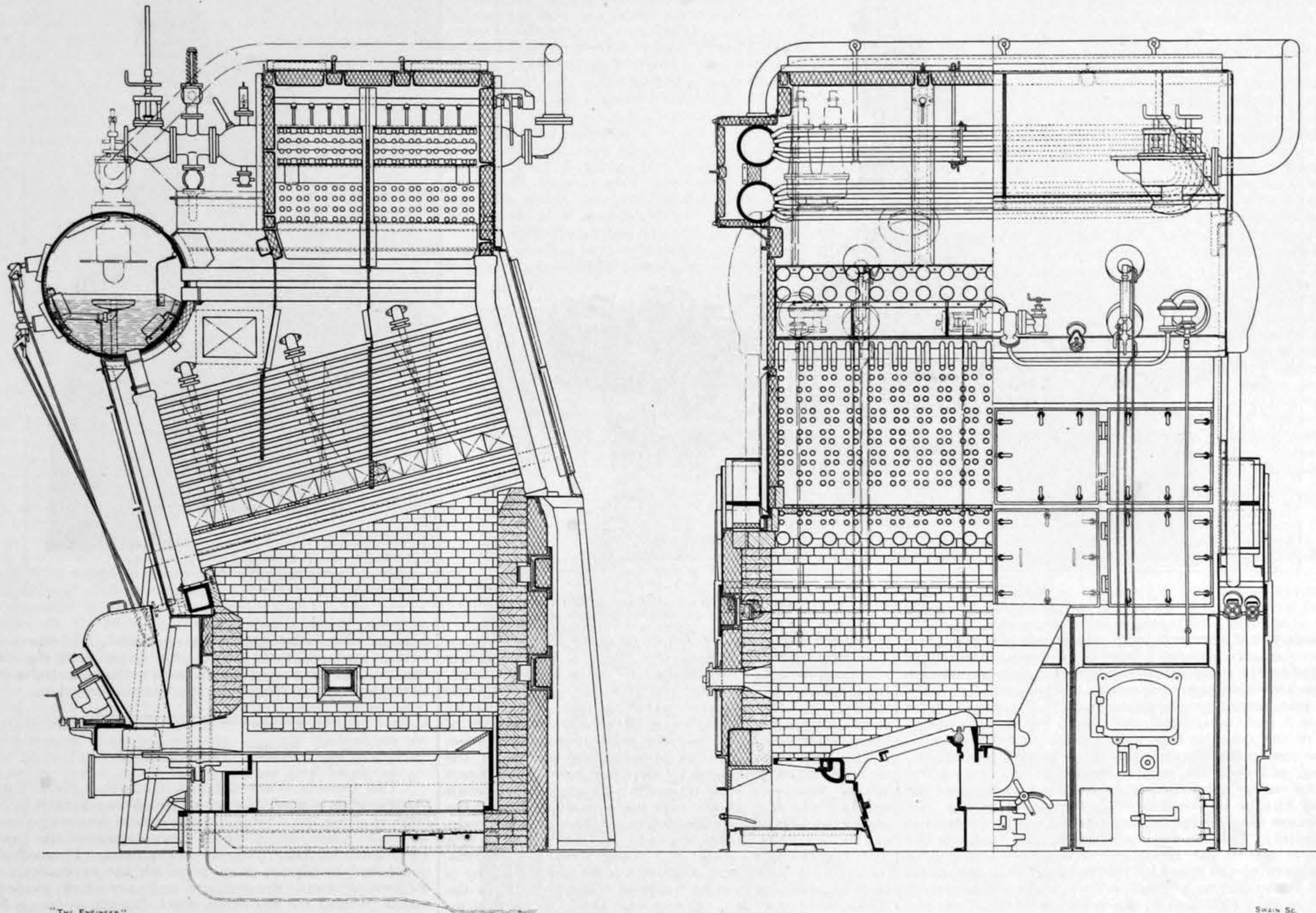


FIG. 1—Typical Boiler with Mechanical Stoker as used in Vessels of the Royal Packet Navigation Company of Holland for their Dutch East Indies Service.

pulverised coal and working at 550 lb. pressure with superheated steam was submitted for the consideration of two influential shipowning companies, but never reached the building stage. This was in 1928.

The pioneer in the use of coal in pulverised form afloat will probably go down to history as the United States collier "Mercer," which made her first voyage across the Atlantic to this country in 1927. The ship was thrown open to inspection at Rotterdam and the system shown and explained by Mr. Carl Jefferson, of the United States Shipping Board, who had superintended the experimental work and installation and continued to assist in the progress of pulverised fuel afloat for many years.

The system was tried in many English and foreign vessels and although it is still in use in a few vessels it has not yet been able to establish itself in competition with other methods of burning solid fuel, either by hand or mechanical stokers.

Both methods, *i.e.*, either by pulverising the coal by plant on board ready for use as required, or pulverising the coal on shore and shipping the fuel into bunkers as powdered coal, have been tried, but it is considered to be true to say to-day that the initial cost, weight, and space required for an installation to use pulverised fuel afloat makes it economically impossible, and the author can see no prospect of this method of fuel firing being introduced afloat in the near future.

Undoubtedly the use of pulverised coal is extending in large power stations on shore, where the limitations on weight and space placed on marine installations do not apply and where suitable coal is available at a competitive price, but the mechanical stoker is more extensively used.

Until within the last few years coal afloat has been hand fired to the boilers, generally of the Scotch or cylindrical type, into the completely water-cooled circular furnaces with fire-grates of almost standard type and with perhaps little incentive to improve combustion results with the South Wales bunker coals which had established their pre-eminence in the market in pre-war days. With the large-size coal available, easily burnt, with little ash and high calorific value and average draught, and the absence of competitive fuels, the comparatively low-priced Welsh coal had the market to itself.

The introduction of the internal combustion engine altered the outlook to the extent that a very serious rival to coal as a source of power supply had arrived, and the situation to-day as regards the use of coal is precarious unless shipowners can be offered improved steam propelling plant using coal as fuel such as will be attractive

it is desired to emphasise the importance of this fact on the choice of propelling machinery for ships and the continuance of the use of coal for power supply afloat.

Since retiring from H.M. Navy and entering commercial life, the author has been endeavouring to exploit the advantages of the water-tube boiler in comparison with

of the more scientific utilisation of coal for marine propulsion purposes.

It is proposed to undertake this review under two main headings, *viz.*—

- (a) The water-tube boiler and the mechanical stoker; and
- (b) Cylindrical and water-tube boilers and improved methods of firing, both hand and mechanical.

(A) THE WATER-TUBE BOILER AND MECHANICAL STOKER.

As long ago as 1919 the use of the retort type of mechanical stoker was tried in association with the Babcock and Wilcox water-tube boiler by the Royal Packet Navigation Company, of Holland, and subsequently adopted and used in some forty vessels in that company's fleet trading in the Dutch East Indies, where the company own coal mines producing a class of coal which can be used more effectively with a mechanical grate than with hand firing.

The use of the mechanical stoker afloat is not new therefore, but it is practically only within the last ten years that it has been adopted to any extent in this country.

Fig. 1 shows a typical two-boiler installation (*s.s.* "Van Swoll") as an illustration of the early use of the retort type stoker. The heating surface of the two boilers is 4986 square feet, the superheating surface 1496 square feet, the working pressure 206 lb. per square inch, and the final steam temperature 570 deg. Fah.

The first important use of the water-tube boiler and the mechanical stoker in this country was in the "Beaver" class cargo ships of the Canadian Steamship Company, built for a fast cargo service between this country, Europe, and the Canadian ports. There were five ships in the class and they came into service in 1927 and 1928, so that they have now been in actual service for about seven years. Steam turbines are used as propelling machinery and the service results are known to be very satisfactory. Three ships of the class are fitted with Yarrow boilers and Erith-Roe stokers, and the other two ships have Babcock and Wilcox boilers, one ship being fitted with the Erith-Roe stoker and the other with the Taylor stoker. The two last-mentioned ships, the "Beaverbrae" and "Beaverhill," were originally hand-fired, but when the success of the mechanical stokers in the other ships equipped with the Yarrow boilers was established conversion to mechanical stokers was adopted in these two cases also.

Fig. 2 shows the installation in the "Beaverbrae." Recent outstanding interest, however, in the use of mechanical stokers afloat has been directed to the cross-

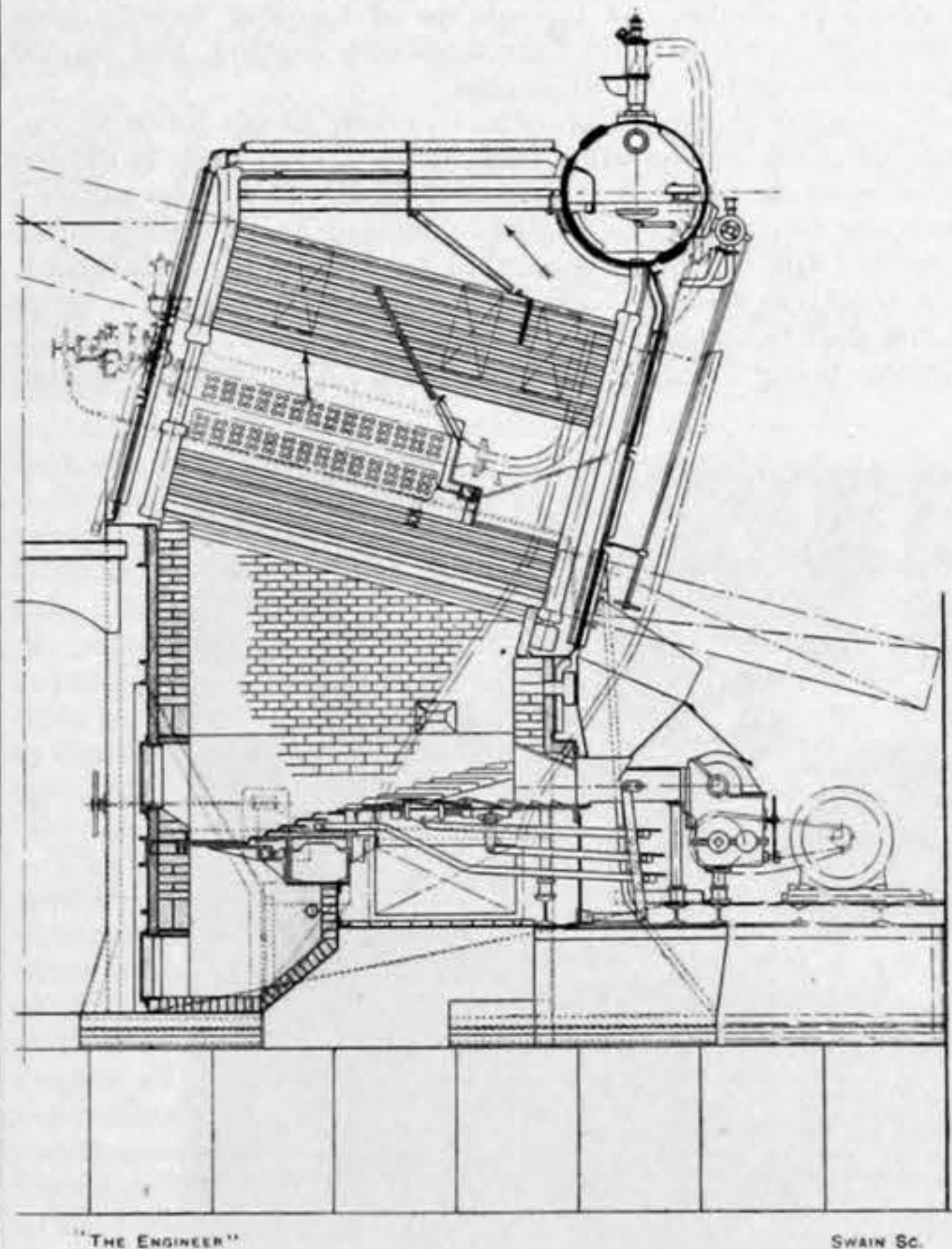


FIG. 2—Boiler with Erith-Roe Stoker in the "Beaverbrae."

the cylindrical or Scotch type, and as the years roll on there seems to be accumulating experience that if steam propulsion is to continue the water-tube boiler should be adopted.

With steam propelling machinery there is the choice in the use of either solid or liquid fuel at will and as may

* The Institute of Marine Engineers, March 6th, 1936, Swansea.

Channel steamers of the L.M.S. Railway Company for their Heysham-Belfast service, three ships of the "Duke of Lancaster" class. These vessels, which were put into service in 1928, have twin-screw turbine-driven machinery with Babcock and Wilcox water-tube boilers and were originally using hand-fired coal as fuel. Each vessel has

of the "Duke of Lancaster" to the Erith-Roe retort type stoker. It will be appreciated that a vessel already built was not the most suitable choice for a trial of a new type of improved firing, as the stokers had to be adapted to the limited space available, and alterations in air supply to the stoker grates presented special difficulties.

consequent on the conversion, permitted the steam output of these boilers to be increased beyond the originally designed normal output, thus allowing the hand-fired boilers in use to give more efficient results at a reduced rating and even in their case to use an inferior quality coal without detriment to the service of the vessel. It will therefore be recognised that two principal advantages are secured by the use of a mechanically fired grate over that of the hand-fired design, i.e., increased evaporative rating and ability to burn fuel of a lower grade and less costly variety; the increase in evaporative capacity per unit is approximately 30 per cent., the calorific value of the fuels used being of the order of 13,500 B.Th.U.

Another advantage obtained with the mechanical stoker is the absence of smoke emission usually associated with hand firing, except at low boiler ratings. There was, however, some emission of grit at the higher ratings of the boilers it was desired to use in the "Duke of Lancaster," but this has been successfully eliminated by the fitting of grit arresters in the boiler uptakes. Fig. 3 shows one of the two forward boilers of the T.S.S. "Duke of Lancaster" and gives details of the mechanical stoker.

The Erith-Roe design, which with its slicing bars is peculiarly suited to controlling the combustion on the short grate which obtains in marine practice, will successfully burn all types of bunker coal varying from South Wales slacks to coals of high volatile content. Naturally, being of the retorting type, i.e., distillation of volatiles forming part of its chain of functioning, it is not suitable for anthracites or for near-anthracites; that is, coal of, say, less than 15 per cent. total volatile.

Early in 1933 the L.M.S. Railway Company placed an order for a new steamer, the "Princess Maud," for the Stranraer-Larne route, and as a result of the experience gained with the mechanical stokers in the "Duke of Lancaster" that company was encouraged to equip the new vessel's boilers with the same type of mechanical stoker, i.e., the Erith-Roe. The boiler section of the machinery installation closely follows the installation fitted aboard the "Princess Margaret," built some two

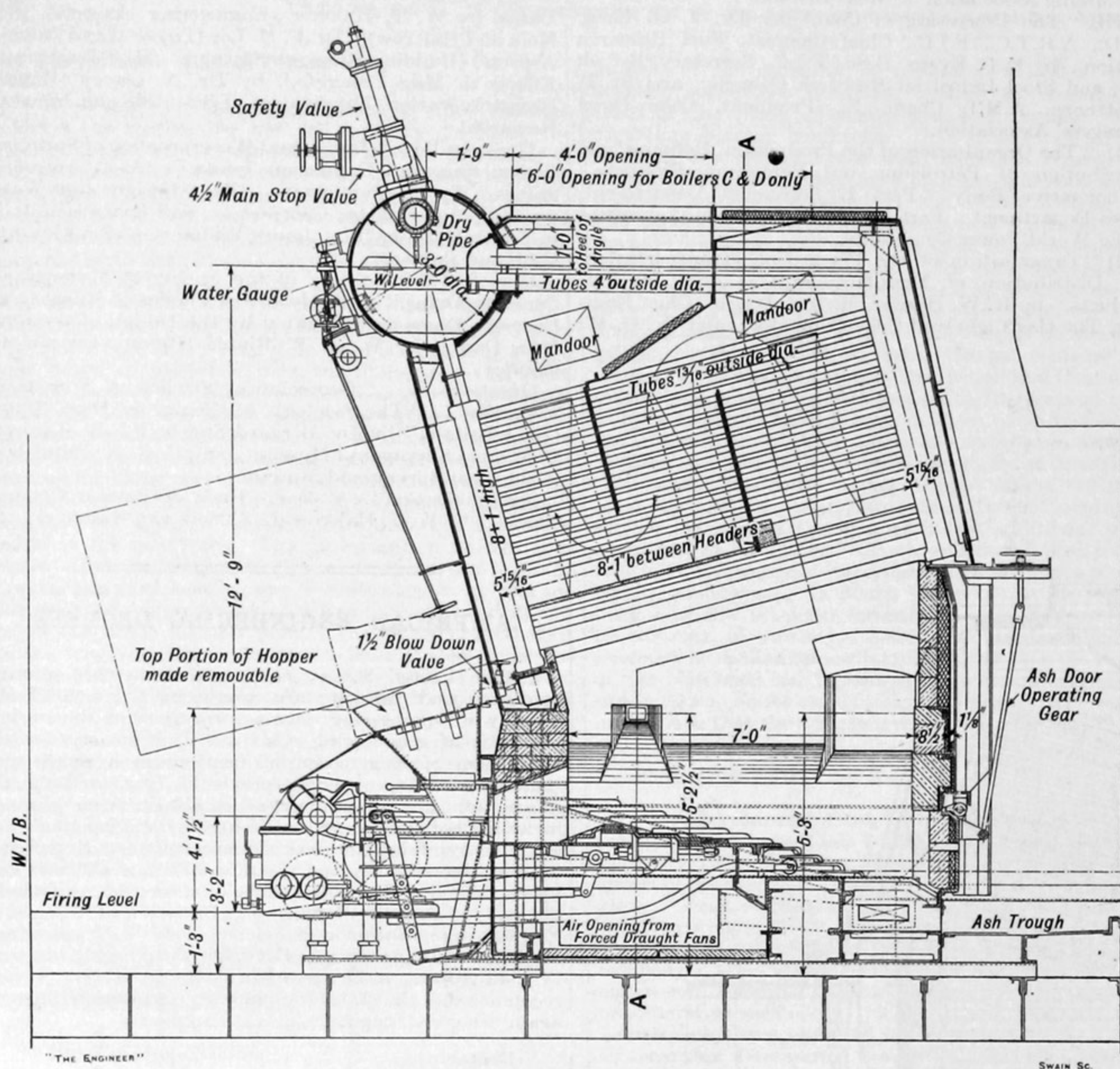


FIG. 3—Cross Sectional View of Boiler with Mechanical Stoker in "Duke of Lancaster."

six boilers with a total boiler heating surface of 19,770 square feet and 600 square feet grate area.

In the latter half of 1931, after all three vessels had done considerable service using steam coal under hand-fired conditions, and following a full inquiry into all the

It took some time to get through what may be called the teething troubles of the new installation and to determine the best method of using the two mechanically fired boilers in association with two, three, or four of the other hand-fired boilers as the steam requirements demanded.

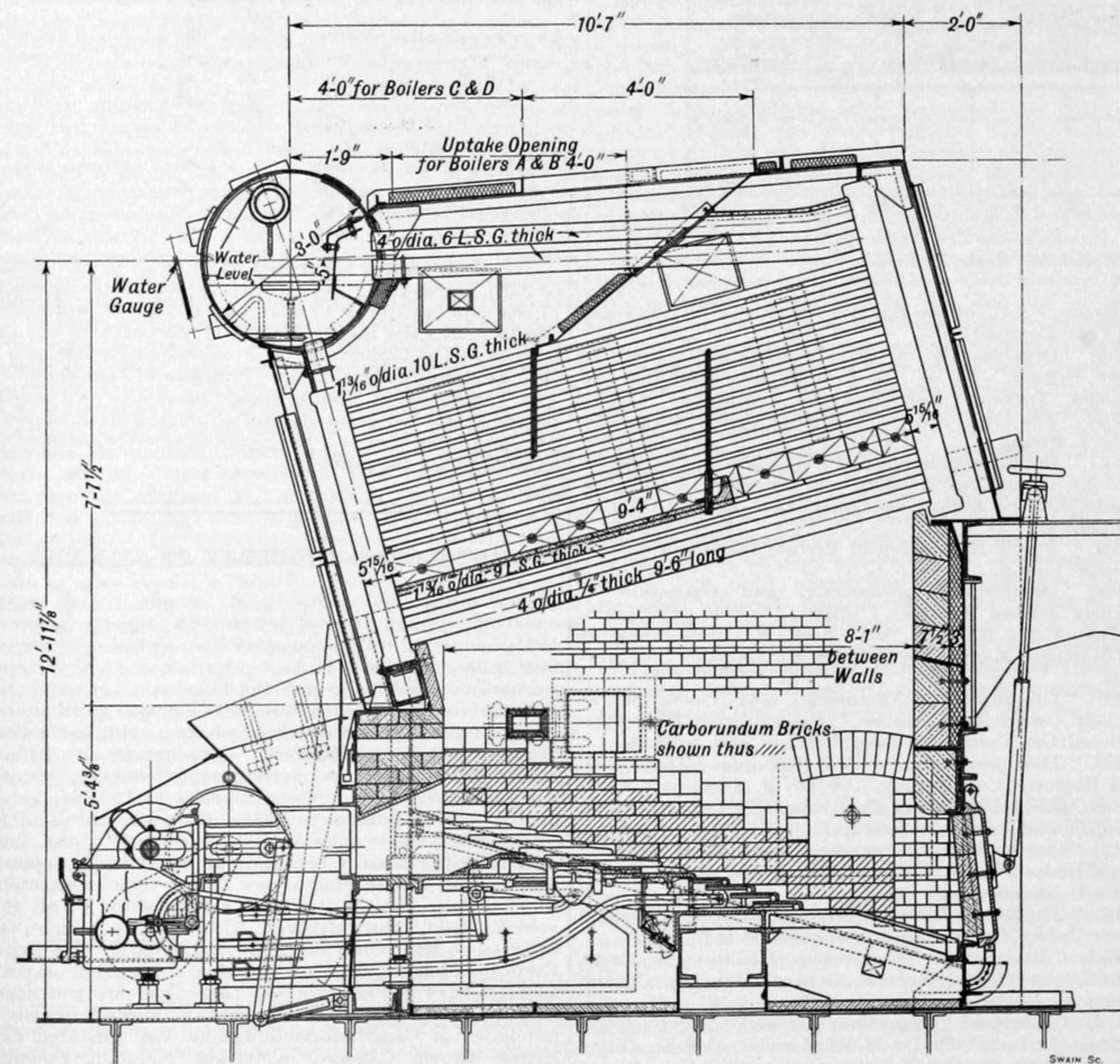


FIG. 4—Cross Section of Boiler and Stoker in "Princess Maud."

attendant factors by the responsible official, it was considered that there were substantial reasons for anticipating the realisation of satisfactory economies by a conversion to a mechanical firing device capable of burning low-grade fuels; hence it was decided to experiment in the first instance with the conversion of the two forward boilers

Time and experience, however, demonstrated that the two mechanically fired boilers had fulfilled expectations from an economical standpoint, for trials extending over a considerable period showed that low-grade fuels covering a wide range could be efficiently utilised.

The more efficient operation of the two forward boilers,

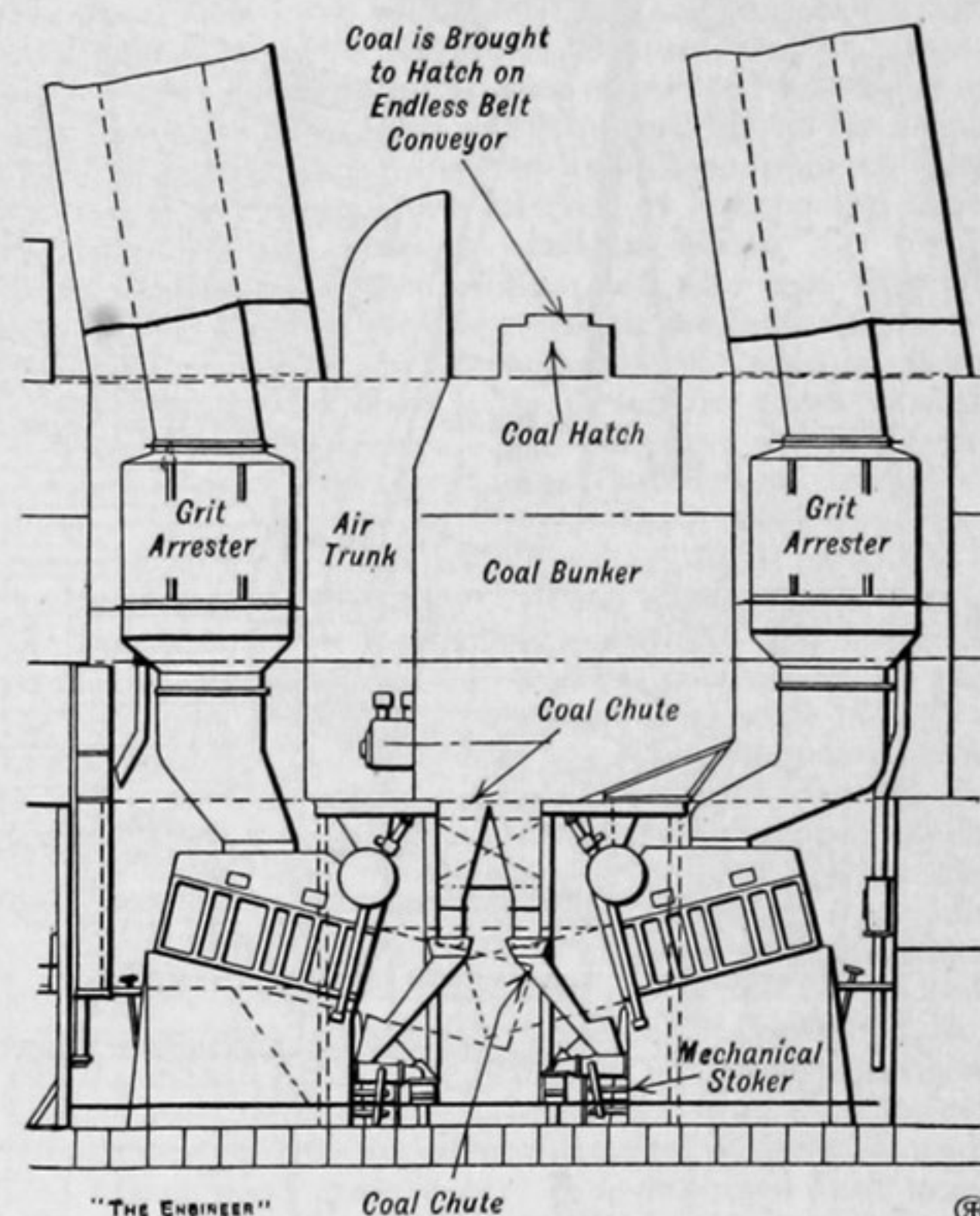


FIG. 5—Fore and Aft Section Showing Arrangement of Boilers, Stokers and Self-Feeding Hoppers and Bunkers in the "Duke of York."

years previously, with the exception that the new ship is fitted with mechanical stokers instead of hand firing. The four boilers are arranged in pairs, back to back, in a single boiler room, with a total tube heating surface of 15,400 square feet.

Fig. 4 shows the arrangement of the boilers in the ship with the mechanical stokers.

The boilers were designed to give 95,000 lb. of steam per hour, converting feed water at 180 deg. Fah. into saturated steam at 225 lb. pressure, under normal service conditions, with coal of 11,500 B.Th.U. per pound calorific value. Each boiler has an eight-retort stoker arranged with rear ashing doors. The total grate area is 448 square feet and the total combustion chamber volume 2400 cubic feet. The closed stokehold system of air supply for ventilation and for air for combustion is used, and in this vessel the coal is man-handled from the athwartship bunkers into the coal hoppers. Steam control is regulated with the same ease and certainty as with an oil-fired boiler and with the same degree of flexibility in a clean and dust-free stokehold. The coal used is an Ayrshire slack and service conditions have been regularly maintained with three boilers out of four in use.

The "Princess Maud" commenced service early in 1934 and about the middle of that year the L.M.S. Railway Company decided to order another vessel for the Heysham-Belfast service to run in conjunction with the three vessels of the "Duke" class.

With the continued experience in the "Duke of Lancaster" and the "Princess Maud" this new vessel was designed to give sensibly equivalent performance on service to the three early ships of the "Duke" class, with four water-tube boilers instead of six, the new ship being of practically the same tonnage and speed. Each of the four boilers, however, was fitted with a seven-retort Erith-Roe stoker operated under the closed stokehold system of air supply as in the earlier vessels.

The boilers were designed to produce under service conditions 120,000 lb. of steam per hour at 225 lb. pressure per square inch from feed water at 215 deg. Fah., using a slack coal of 12,500 B.Th.U. value. As is usual in vessels of this class with very limited boiler room space and headroom, no superheaters are fitted, saturated steam being used.

A further distinct advance was made in this ship by arranging the position of the bunkers in the ship so that

the coal is self-trimming into the stoker hoppers. In this vessel, therefore, using coal as fuel, we have the whole boiler room operation performed mechanically as in an oil-fired ship, and it is not an exaggeration to say with the same degree of flexibility and cleanliness as in an oil-fired ship. Incidentally it may be mentioned, as a matter of interest, that mechanical coaling plant is used at Heysham for bunkering the "Duke" class steamers. Fig. 5 shows the arrangement of boilers and mechanical stokers and the coal supply from the bunkers to the stoker hoppers.

The mechanical stoker equipment of the boilers in the "Duke of York," though essentially the same in principle as in the earlier ships, has an improved method of air supply to the stoker grate and fuel bed. In the early installations the air supply to the retort portion of the grate was fed to the front and rear ends of the retort through one supply and damper control between the air boxes under each portion of the grate. It has been found beneficial to arrange for entirely separate and individual control to these two portions of the retort section of the grate. This improvement and difference in design of air control can be seen by reference to Figs. 3 and 6, showing

Statistics with Particular Reference to International Use : Electricity," by Hugh Quigley, Chief Economist and Statistician, Central Electricity Board ; A. S. Windett, Statistician, Economic Section, Central Electricity Board.

(4A) "Organisation of the Production and Distribution of Coal," Authoritative Bodies, Mines Department and Mining Association of Great Britain.

(4B) "The Processing of Coal," by Dr. J. G. King, Ph.D., A.R.T.C., F.I.C., Chief Chemist, Fuel Research Station ; by E. C. Evans, B.Sc., F.I.C., Secretary, British Iron and Steel Industrial Research Council ; and by T. Westthorp, A.M.I. Chem. E., President, Coke Oven Managers' Association.

(5) "The Organisation of the Production, Refining, and Distribution of Petroleum and Petroleum Products," Authoritative Body : Part I, Petroleum Department, Mines Department ; Part II, British National Committee of the World Power Conference.

(6) "Organisation of the Production, Transportation, and Distribution of Manufactured Gas and Gas By-products," by R. W. Hunter, M. Inst. Gas E., Chief Engineer, The Gas Light and Coke Company ; and Dr. G. W.

Britton, M.I.E.E., M.I. Mech. E., Engineer and Manager, Chester Electricity Department.

SECOND INTERNATIONAL CONGRESS ON LARGE DAMS.

Question III : "Special Cement." (A) Report of the Joint Sub-Committee on Special Cements of the Institution of Civil Engineers and the British Committee on Large Dams, by W. T. Halcrow (Engineering Aspects) (C. S. Meik and Halcrow) ; Dr. F. M. Lea (Physical and Chemical Aspects) (Building Research Station). (B) "Temperature Effects in Mass Concrete," by Dr. N. Davey (Building Research Station, Department of Scientific and Industrial Research).

Question IV : "Design and Waterproofing of Shrinkage, Contraction, and Expansion Joints." (A) "Contraction Joints," by E. Sandeman. (B) "Design and Waterproofing of Shrinkage, Contraction, and Expansion Joints in Concrete Dams," by James Williamson (Sir Alexander Gibb and Partners).

Question V : "Study of the Facing of Masonry and Concrete Dams." "Study of the Facing of Masonry and Concrete Dams as Illustrated by the Design of the Shing Mun Dam," by W. J. E. Binnie (Binnie, Deacon and Gourley).

Question VI : "Geotechnical Studies of Foundation Materials." "The Geology of Reservoir Dam Sites—Great Britain," by Dr. Bernard Smith, F.R.S. (Director, Geological Survey and Museum), and C. E. N. Bromehead (Geological Survey and Museum).

"Communication" : "Dams Built of Precast Concrete Blocks," by W. T. Halcrow (C. S. Meik and Halcrow).

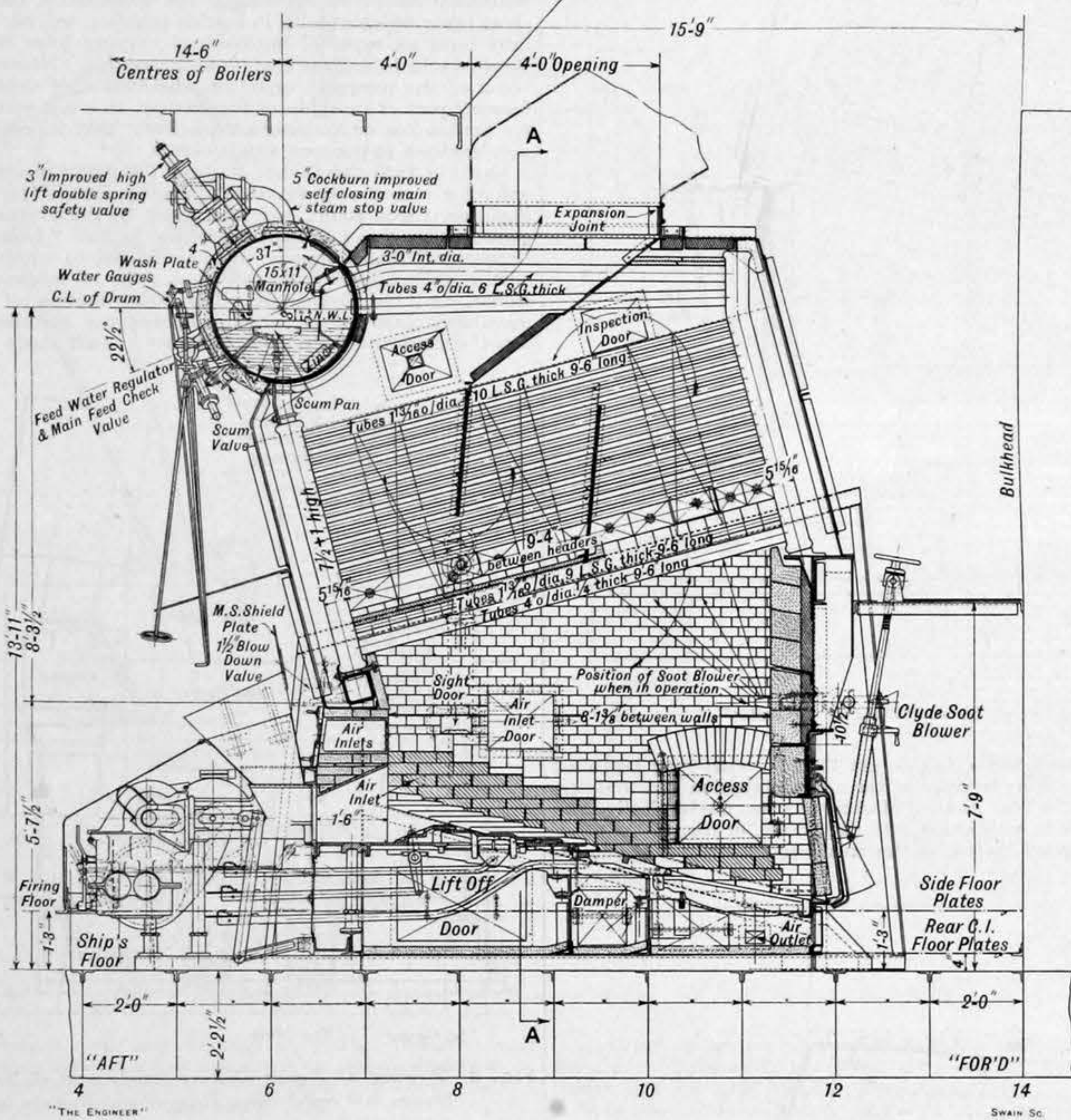


FIG. 6—Cross Section of Boiler and Stoker in "Duke of York."

the section through mechanical grate in the "Duke of Lancaster" and "Duke of York" respectively.

At the same time as this alteration was made the design of grate parts at the rear end of the retort portion and the dump bars at the rear end of the grate has been improved in order to ensure improvement in air supply and durability of the grate parts.

(To be continued.)

World Power Conference and Congress on Large Dams.

WE give below a list of the twenty-three papers which are being presented by the British National Committee of the World Power Conference at the Third World Power Conference to be held in Washington between September 7th and 12th, 1936, and of six papers and one "Communication" which are being presented by the British Committee of the Commission at the Second Congress, International Commission on Large Dams of the World Power Conference, which is being held in Washington concurrently with the Power Conference, by invitation of the Government of the United States.

There will be a large and influential British delegation at Washington, including several official representatives of His Majesty's Government. The total British participation is likely to exceed 100 persons, the majority of whom will travel on the "Queen Mary," sailing from Southampton on September 2nd.

(1) "Power Resources, Development, and Utilisation," by Frederick Brown, Editor, "Statistical Year Book of the World Power Conference"; Lecturer, Departments of Statistics and Business Administration, London School of Economics and Political Science.

(2) "Significant Trends in the Development and Utilisation of Power Resources," by Frederick Brown.

(3A) "Collection, Compilation, and Publication of Statistics with Particular Reference to International Use : Coal and Coal Products and Petroleum," Authoritative Body, Mines Department.

(3B) "Collection, Compilation, and Publication of

Anderson, F.I.C., of the Engineering Staff, The Gas Light and Coke Company.

(7A) "Organisation of Private Electric Utilities in Great Britain," by W. B. Woodhouse, Engineer and Manager, Yorkshire Electric Power Company.

(7B) "The Organisation of Private Gas Utilities," by Leslie F. Stemp.

(8A) "Public Regulation of Private Electric Utilities," by John C. Dalton, Manager and Secretary, County of London Electric Supply Company, Ltd., and Association Companies.

(8B) "Public Regulation of Private Gas Utilities," by Leslie F. Stemp.

(9A) "Organisation, Financing, and Operation of Publicly Owned Electric Utilities," by H. C. Lamb, M. Inst. C.E., M.I.E.E., M.I. Mech. E., Chief Engineer and Manager, Manchester Corporation Electricity Department.

(9B) "Organisation, Financing, and Operation of Publicly Owned Gas Utilities," Authoritative Body, The National Gas Council of Great Britain and Ireland.

(11) "The Conservation of Coal Resources—The British Fuel Research Coal Survey," by Dr. F. S. Sinnatt, C.B., M.B.E., D.Sc., Director of Fuel Research, Department of Scientific and Industrial Research.

(12) "Conservation of Petroleum," suggested Authoritative Body, British National Committee of the World Power Conference.

(13) "The Scope, Duties, and Possibilities of a National Water Board," by Sir Alexander Gibb, G.B.E., C.B.

(15A) "Integration of Electric Utilities in Great Britain," by Harold Hobson, General Manager, Central Electricity Board.

(15B) "Regional Integration of Gas Utility Facilities in Great Britain," by Dr. C. H. Lander, C.B.E., D.Sc., Vice-Chairman, British National Committee of the World Power Conference, Professor of Mechanical Engineering, City and Guilds (Engineering) College.

(16A) "Rationalisation of the Distribution of Electric Energy," by James R. Beard, M.Sc., M.I.E.E., partner in Merz and McLellan.

(16B) "Rationalisation of Distribution of Gas in Great Britain," by George Evetts, M. Inst. C.E., M.I. Mech. E., M.I. Gas E., M. Cons. E.

(17) "Rural Electrification in Great Britain," by S. E.

AMERICAN ENGINEERING DEGREES.

IN the United States, no less than in this country, confusion and difficulty are caused by the lack of uniformity in engineering degrees arising from the various practices of engineering schools. The Society for the Promotion of Engineering Education, in a report presented in 1934, outlined provisions for unifying the names of, and requirements for, engineering degrees, including honorary degrees. Using civil engineering as an example typifying the lack of uniformity and confusion in all engineering degrees, the Society found the following forms of the first, or bachelor's, degree:—Bachelor of Arts; Bachelor of Science; Bachelor of Science in Engineering; Bachelor of Science in Civil Engineering; Bachelor of Engineering; Bachelor of Civil Engineering; Civil Engineer. In contrast to this diversity, the Society recommended the following plan for engineering degrees, again using civil engineers as an example:—

Degree.	Type.
Bachelor's ..	Bachelor of Civil Engineering (B.C.E.)
Master's ..	Master of Civil Engineering (M.C.E.)
Doctor's ..	Doctor of Civil Engineering (D.C.E.)
Honorary ..	Master of Engineering (M.Eng.)
Honorary ..	Doctor of Engineering (D.Eng.)
Professional ..	Civil Engineer (abandon, either earned or honorary)

The Society subsequently submitted the recommendations to letter ballot, with the following results:—

Degrees earned in course.	Votes in favour.	Per cent.	Votes opposed.
B.C.E. ..	657 ..	81 ..	152
M.C.E. ..	650 ..	81 ..	150
D.C.E. ..	639 ..	80 ..	156
Honorary degrees.			
M.Eng. ..	666 ..	85 ..	116
D.Eng. ..	702 ..	90 ..	78
Discontinue professional C.E. ..	474 ..	61 ..	304

The total ballots numbered 813 out of a membership of 2325, representing 160 institutions. With the exception of the vote favourable to abandonment of the professional degree (C.E.) the results are also in accord with the preference of the Committee on Professional Recognition of the Engineers' Council for Professional Development. That organisation had proposed that the professional degree might be granted only to experienced engineers who had otherwise met the requirements for certification as members of the profession.

MOTOR CAR INDUSTRY IN CANADA.

THE automobile industry in Canada added nearly 6,000,000 dollars to the Dominion's export figures in 1935, increasing its foreign sales from eighteen to twenty-four million dollars. These figures, although they represent only a small portion of the Dominion's export trade, indicate to a marked extent the increasing purchasing power of the different countries of the world, particularly those of the British Empire. Correspondingly, sales of motor vehicles in Canada increased from 73,358 cars, valued at 75,785,461 dollars, in 1934 to 100,961, valued at 101,285,655 dollars, in 1935. Over two-thirds of the new motor vehicle sales in 1935 were cash transactions, indicating the healthy condition of the Canadian market. The amount of financing of new motor vehicles amounted to 22.1 per cent. of the total selling value of all such vehicles sold, and involved 31,950 units which were financed to the extent of 22,410,656 dollars. The British Empire absorbed most of Canada's automobile exports, namely, 92.4 per cent. of the passenger cars and nearly 99 per cent. of the freight trucks. A marked increase in purchases of Canadian-made trucks was indicated from British Crown Colonies in Africa, including Southern Rhodesia, East Africa, Cambia, Gold Coast, Nigeria, Sierra Leone, and Aden.

It is announced by the U.S.S.R. Commissariat of Railways that 3500 miles of railway line and 2500 miles of double track will be built in that country during the current year.

Markets, Notes and News.

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quotations are f.o.b. steamer. A comprehensive list of the prices of materials mentioned below will be found on the next page.

The Advance in Steel Prices.

Owing to the interruption of the Whitsun holidays the market has not yet had time to digest the effect of the advance in the prices of many descriptions of iron and steel notified to come into immediate effect on May 28th. The price of basic iron was advanced by 2s. 6d., hematite by 3s. 6d., soft basic billets and hard basic billets were raised 5s., whilst the quotations for small bars, hoop and strip were increased by 6s. Sections, joists, and plates, $\frac{1}{2}$ in. and up, including chequer and boiler plates, were raised by 12s. 6d., and medium plates (under $\frac{1}{2}$ in. down to and including 3 mm.) by 10s. Export prices were left unaltered. It is a long time since the prices of such a wide range of materials were simultaneously increased, and the market, which had not anticipated any movement until June 30th, was taken by surprise at the extent of the movement and at the decision to put the new prices into immediate operation. It is said that most consumers are covered for a long period ahead, and that the steel industry will not feel the full benefit of the higher values for several months; but all fresh contracts, of course, will have to be made at the new rates. The movement in British steel prices created some speculation as to the attitude of the Continental steel makers, who by their agreement with the British have to keep their quotations at not more than 10s. below the home makers' price. The British raised their prices, however, just as the June release of steel under the Continental quota was being made, and it has been decided that this tonnage will be sold at the prices which have ruled for some weeks past. On the July and following releases it is anticipated that an advance corresponding to the British increases will be made in the prices of Continental material. In the meantime negotiations are proceeding between the British and Continental steel makers with regard to export markets, and last week it became known that the international tin-plate agreement had been renewed for a period of two years. Difficulties had arisen between the members as a result of a demand by the Germans for a higher export quota. The trouble, however, was smoothed over by the other members of the international association surrendering a certain percentage of their shares and eventually the Germans accepted the increased tonnage made up in this way.

The Pig Iron Market.

Although price changes were expected to take place in the pig iron market at the end of June, the announcement of an immediate increase of 2s. 6d. in the price of basic and of 3s. 6d. in hematite came as a surprise to most buyers. The producers argue that the higher cost of production due to increases in the prices of ore, coke, and scrap, warrants the movement. It is possible that in the case of basic it will lead to more iron becoming available for the market, although there are few signs that any large quantity has been held up in the hope of obtaining higher prices since the last advance at the end of April. In fact, the position with regard to basic is causing some anxiety, and it is suggested that a real scarcity is likely to make itself felt before the end of this year unless production is substantially augmented. As it is this description forms the bulk of the British production of pig iron, and it would be impossible to alter the present proportion without creating considerable inconvenience to users of other kinds. The price of basic is now 75s. less a rebate of 5s. Imports of Russian basic iron are beginning to arrive here, and it is reported that substantial quantities have been contracted for. Considerable interest is being aroused as to the quality of this iron and reports are eagerly awaited. The demand for hematite iron also has been sufficient to absorb the make, and lately there has been practically no iron available for export. Heavy quantities continue to pass into consumption, and for some time consumers have not found it easy to place orders for near delivery. The increase in hematite prices makes the quotation for No. 1 80s. 6d. Some surprise has been expressed that no increase has occurred in the price of foundry qualities, but it is anticipated that an advance will be made at the end of June. The situation in this market is still acute, and although on the North-East Coast rather more foundry iron is now available there is practically no surplus to meet fresh demands. The requirements of the foundries are well in excess of production. Cleveland makers report that they will have little iron to offer for delivery this year, and that their production will be barely sufficient to meet existing commitments. The Midland ironmasters are not accepting orders for delivery before June 30th. They are sending fair quantities to the North-East Coast to relieve the shortage of Cleveland iron, and also to Scotland, whilst Midland consumers absorb a considerable tonnage. The position in Scotland is tight, but users do not appear so hard-pressed for supplies as in some other districts. The Scottish steel works are understood to have covered their requirements of basic until the end of the year.

The Midlands and South Wales.

The steel works in the Midlands curtailed the holidays as much as possible, as in practically every case they are gradually losing ground in the matter of deliveries. Specifications in most departments are reaching the mills at a record rate, and the time required for the execution of an order is steadily growing. For plates, $\frac{1}{2}$ in. and less, six to eight weeks are generally needed, and for most other descriptions of steel from five to six weeks seems to be the average. The increase in prices announced at the end of last week will benefit the industry to only a small extent, as most of the works have already sold the greater part of their output until well into the third quarter of the year. In these circumstances, the volume of new business has been negligible this week, partly

because of the difficulty of placing new orders, partly because consumers naturally wished to consider the effect of the price advances, and also because of the prevailing holiday conditions. The constructional engineers in the Midlands are well placed as regards contracts, and their requirements of joists and sections will be heavy for some months to come. Most of these firms also expect to tender for important new contracts during the next few weeks, and, of course, upon these the enhanced steel prices will have to be paid. The plate makers have a large tonnage of orders in hand, and a fair proportion of these are for boiler plates. In the sheet department the home demand absorbs most of the output of black and galvanised sheets, but overseas business remains spasmodic. Negotiations between the British and Continental makers are proceeding with regard to the division of the world's markets, but progress is slow. The re-rollers in the Midlands are working practically at capacity and some of them are said to have built up stocks of British and Continental billets which they bought at the old prices. It is reported, however, that after the end of July no further supplies of Continental billets additional to the quota will be obtainable. The re-rollers will then have to rely upon the material imported under the quota plus the British production. In South Wales the works continue busy and the tin-plate industry is operating at about 60 per cent. of capacity. Sales, however, have shown a tendency to decline somewhat of late, but with the renewal of the international agreement overseas business may expand, as no doubt some foreign buyers withheld business in the hope that the arrangement would collapse.

Current Business.

Malcolm and Allan, Ltd., Glasgow, are to supply auxiliary switchgear and cable for the new generating station of the Fulham Borough Council, and James Howden and Co., Ltd., will supply boiler house auxiliary plant. Head, Wrightson and Co., Ltd., Thornaby-on-Tees, have agreed with the Aetna Standard Engineering Company, of Youngstown, Ohio, to manufacture the latter company's steel works plant, including sheet and tube equipment, seamless tube and pipe mill equipment, and miscellaneous machinery. Glenfield and Kennedy, Ltd., Kilmarnock, have obtained a contract from the Chinese Government Purchasing Commission for the supply of mechanical equipment for a control weir. The contract includes the supply and erection of sixty sets of free roller sluice gates. The London, Midland and Scottish Railway Company has placed a contract with works in the Birmingham district for the supply of fifty-seven coaches required for the electrification of the Wirral section of the railway. The London and North-Eastern Railway Company's Redheugh Wharf on the Tyne has been acquired by C. W. Dorkin and Co., shipbreakers, of North Dock, Sunderland, who have commenced shipbreaking operations there. The Fairfield Shipbuilding and Engineering Company, Ltd., has obtained a contract for an 11,000-ton twin-screw Diesel passenger and cargo vessel from the Anchor Line. The Hughes Bolckow Shipbreaking Company, Ltd., of Blyth, have purchased the "Armada Castle" (13,000 tons gross) from the Union-Castle Mail Steamship Company, Ltd. A number of Tyneside local authorities have decided to support the application to Parliament by the River Tyne Commissioners for the purchase of Tyne Dock from the L.N.E.R., as part of a river development scheme, which will cost £750,000. The Department of Overseas Trade announces that the following contracts are open for tender:—New Zealand Public Works Department: Supply and delivery c. and f. Dunedin or Bluff of one deep-well pump, complete with electric motor-driven power head, automatic float starter, all tubing, including working barrel and pump rods, strainer and any other equipment necessary to complete the installation (Supplies and Tenders Committee, Public Works Department, Wellington, July 7th); New Plymouth Harbour Board: Supply, delivery, and erection at Newton King Wharf of one 2-ton electric, level luffing, portal, travelling jib crane and spares (Moturoa, New Plymouth, New Zealand, August 27th). Cape Town Electricity Department: 1000 tubular steel electric light poles; street lighting number plates and fittings (Cape Town, July 1st). Argentine State Railways Administration: Shovels, spades, picks, &c. (Buenos Aires, June 30th). South African Railways and Harbours Administration: Steelwork required for the proposed footbridge at Mossel Bay; extension of Bramfontein footbridge and of subway at Driehoek (Chief Stores Superintendent, Park Station Chambers, Johannesburg, July 6th).

Copper and Tin.

In spite of the interruption of the Whitsun holidays there has been a fair amount of activity in the electrolytic copper market. Probably optimistic reports of the market situation in the United States have led consumers in Europe to revise their view of the future of the trade, with the result that they have shown a greater inclination to replenish stocks. After the heavy buying by American consumers during April it was anticipated that business in that country would be slow until at least August. There has been, however, a steady demand, and although this has been principally for small parcels, it has been sufficient to enable the producers to stiffen their quotations. Consumers in Europe were inclined to mark time and had allowed their stocks to fall below the normal level, probably in the expectation that the price would be somewhat easier for a time. In this they were disappointed and during the past few days there has been brisk buying by users in France, Germany, and Poland. They may have been encouraged to some extent by the announcement that the arrangement between the world's copper producers to limit production permits the Americans to sell their stocks for export when the price is over 9c. The

producers, however, do not appear to have taken advantage of this provision to any extent, and they probably take the view that they will get better prices by holding the metal for a time. In the standard market prices have fluctuated and before the holiday break dropped to the lowest level recorded for some months. Further shipments of rough copper have taken place but these are becoming less frequent as the remaining stocks are in strong hands. . . . In the tin market prices have steadily receded since the announcement by the International Tin Committee that the four signatory countries were prepared to renew the agreement if Siam, the Belgian Congo, and other tin-producing countries would participate upon satisfactory terms. Apparently this has been regarded by the market as an indication that the agreement due to expire on December 31st will not be renewed. Rumours that differences exist between the members of the Committee have also been current, whilst another view is that support has been withdrawn from the market in order to indicate to the outside tin-producing industries what may happen if the present control breaks down. According to statistics issued by the International Tin Research and Development Council, the consumption of tin in March was 13,424 tons, the highest figure reached since September, 1935, when consumption totalled 13,693 tons.

Lead and Spelter.

The lead market seems to have suffered of late from alternate waves of optimism and depression, although the general tendency of prices has been disappointing. The producers have sold freely and a considerable amount of forward business has been transacted. At times this has created an impression that more lead has been available for the market than was required, but so far as can be seen the consuming industries have been able to take all the metal which has been offered. It is expected that the tightness in the prompt position which has obtained during the greater part of May will also rule throughout the present month. This scarcity arises from the fact that running contracts absorb most of the lead arriving in this country, and that little is left to meet consumers needing prompt parcels. The demand in this country continues at a high level, but Continental business has been quiet. Russian purchases which gave considerable strength to the market at the end of April have not been renewed, and that country is not expected to come into the market for substantial quantities for some time. American figures give the world's production of refined lead in April as 140,367 tons, compared with 128,747 tons in March. . . . Conditions in the spelter market have not materially changed for some weeks, and whilst the industrial demand was only moderate there seemed no likelihood of any speculative movement developing. Immediately before and after the holidays, however, speculators showed a mild interest in the market, probably because prices had fallen to a level that made the metal look an attractive investment. The movement, however, did not go far and had little influence upon prices. There has been a fairly good demand from the brass manufacturers, whilst the battery makers and manufacturers of die castings have also taken good quantities. It is reported that negotiations are proceeding amongst the spelter manufacturers in Belgium with the intention of forming a national comptoir to regulate production and prices. This would be a big step towards the re-establishment of the International Zinc Cartel, as one of the obstacles has been the difficulty of controlling the Belgian producers.

Non-ferrous Metal Prices.

The reactionary tendency of the non-ferrous metal markets during May is shown by reductions in the average prices over the month for all the principal metals dealt in on the London Metal Exchange. This is the more disappointing as the averages for April, with the exception of copper, also showed a fall upon the previous month. The average for cash copper for May was 5s. 8d. down compared with April, and for three months' copper it was 5s. 9d. less. The electrolytic copper price fell by 6s. and that for wire bars by 6s. 2d. below the April average. For cash and three months tin the May average showed a substantial reduction of £6 16s. 11d., and this, of course, reflected the wide fluctuations in price in this market during the month. The uncertain conditions ruling in the lead market during May were responsible for a drop in the average price for shipment during the current month of 11s. 4d., whilst for shipment in the third following month it dropped 12s. 8d., the mean average being 12s. down on the April figure. In the case of spelter the average for shipment during the current month disclosed a decline of 12s. 11d., and for shipment in the third following month of 11s. 2d., whilst the mean was 12s. lower than in April. The following are the official London Metal Exchange average quotations for May:—

STANDARD COPPER ..	Cash (mean) ..	£36 14 6 $\frac{1}{2}$
	3 Months (mean) ..	£37 0 2 $\frac{1}{2}$
	Settlement ..	£36 14 6 $\frac{1}{2}$
ELECTROLYTIC COPPER (mean) ..	..	£41 0 8 $\frac{1}{2}$
	..	£41 4 7 $\frac{1}{2}$
	..	£40 9 2
BEST SELECTED COPPER (mean) ..	..	£202 12 1 $\frac{1}{2}$
	..	£197 4 4 $\frac{1}{2}$
	..	£202 12 4 $\frac{1}{2}$
STANDARD TIN ..	Cash (mean) ..	£15 10 7 $\frac{1}{2}$
	3 Months (mean) ..	£15 12 0 $\frac{1}{2}$
	Settlement ..	£15 11 3 $\frac{1}{2}$
LEAD {	For shipment the current month ..	£14 10 8 $\frac{1}{2}$
	For shipment the third following month ..	£14 15 6 $\frac{1}{2}$
	Mean ..	£14 13 1 $\frac{1}{2}$
SPELTER {	For shipment the current month ..	£14 10 8 $\frac{1}{2}$
	For shipment the third following month ..	£14 15 6 $\frac{1}{2}$
	Mean ..	£14 13 1 $\frac{1}{2}$

Current Prices for Metals and Fuels.

Makers' official home trade prices per ton, delivered buyers' stations. Sections, joists and plates are subject to a rebate to home users purchasing only from associated British Steelmakers: joists, 22s. 6d.; plates and sections, 15s. *For Markets other than Canada, India, South Africa, Australia and New Zealand, 5s. per ton must be added.

PIG IRON.

	Home.	Export.
	(D/d Teesside Area)	
N.E. COAST—	£ s. d.	£ s. d.
Hematite Mixed Nos.	4 0 0	3 2 0
No. 1	4 0 6	3 3 6
Cleveland—	(D/d Teesside Area)	
No. 1	3 12 6	3 4 0
No. 3 G.M.B.	3 10 0	3 1 6
No. 4 Forge	3 9 0	3 0 6
Basic (Less 5/- rebate)	3 15 0	—
MIDLANDS—		
Staffs.— (Delivered to Black Country Station)		
North Staffs. Foundry	3 15 0	—
„ „ Forge	3 10 0	—
Basic (Less 5/- rebate)	3 15 0	—
Northampton—		
Foundry No. 3	3 12 6	—
Forge	3 7 6	—
Derbyshire—		
No. 3 Foundry	3 15 0	—
Forge	3 10 0	—
SCOTLAND—		
Hematite, f.o.t. furnaces	4 0 6	—
No. 1 Foundry, ditto	4 1 6	—
No. 3 Foundry, ditto	3 19 0	—
Basic, d/d (Less 5/- rebate)	3 15 0	—
N.W. COAST—	4 0 6 d/d Glasgow	
Hematite Mixed Nos.	4 6 0 „ Sheffield	
	4 12 0 „ Birmingham	

MANUFACTURED IRON.

	Home.	Export.
	£ s. d.	£ s. d.
LANCS.—		
Crown Bars	10 2 6	9 5 0
Best Bars	10 12 6	9 12 6
S. YORKS.—		
Crown Bars	10 2 6	9 5 0
Best Bars	10 12 6	9 12 6
MIDLANDS—		
Crown Bars	10 2 6	9 5 0
Marked Bars (Staffs.)	12 10 0	12 0 0
No. 3 quality	8 10 0	—
No. 4 „	9 0 0	—
SCOTLAND—		
Crown Bars	10 2 6	9 5 0
Best	10 12 6	9 15 0
N.E. COAST—		
Common Bars	10 2 6	9 2 6
Best Bars	10 12 6	9 12 6
Double Best Bars	11 2 6	10 12 6

STEEL.

	Home.	Export.
	£ s. d.	£ s. d.
LONDON AND THE SOUTH—		
Angles	9 2 6	*7 10 0
Tees	10 2 6	*8 10 0
Joists	9 10 0	*7 10 0
Channels	9 7 6	*7 15 0
Rounds, 3in. and up	10 2 6	*8 10 0
„ under 3in.	9 9 6	7 10 0
Flats, 5in. and under	9 9 6	7 10 0
Plates, 3/4in. (basis)	9 12 6	7 15 0
„ 1/2in.	9 17 6	8 0 0
„ 1/4in.	10 2 6	8 5 0
„ 3/16in.	10 7 6	8 10 0
„ 1/8in.	10 0 0	9 0 0
NORTH-EAST COAST—		
Angles	9 0 0	*7 10 0
Tees	10 0 0	*8 10 0
Joists	9 7 6	*7 10 0
Channels	9 5 0	*7 15 0
Rounds, 3in. and up	10 0 0	*8 10 0
„ under 3in.	9 7 0	7 10 0
Plates, 3/4in.	9 7 6	7 15 0
„ 1/2in.	9 12 6	8 0 0
„ 1/4in.	9 17 6	8 5 0
„ 3/16in.	10 2 6	8 10 0
„ 1/8in.	9 15 0	9 0 0
Boiler Plates, 3/4in.	9 17 6	—
MIDLANDS, AND LEEDS AND DISTRICT—		
	£ s. d.	£ s. d.
Angles	9 0 0	*7 10 0
Tees	10 0 0	*8 10 0
Joists	9 7 6	*7 10 0
Channels	9 5 0	*7 15 0
Rounds, 3in. and up	10 0 0	*8 10 0
„ under 3in.	9 7 0	7 10 0
Flats, 5in. and under	9 7 0	8 17 6
Plates, 3/4in. (basis)	9 10 0	7 15 0
„ 1/2in.	9 15 0	8 0 0
„ 1/4in.	10 0 0	8 5 0
„ 3/16in.	10 5 0	8 10 0
„ 1/8in.	9 15 0	9 0 0
Boiler Plates, 3/4in.	10 0 0	7 15 0

STEEL (continued).

	Home.	Export.
	£ s. d.	£ s. d.
GLASGOW AND DISTRICT—		
Angles	9 0 0	*7 10 0
Tees	10 0 0	8 10 0
Joists	9 7 6	*7 10 0
Channels	9 5 0	*7 15 0
Rounds, 3in. and up	10 0 0	*8 10 0
„ under 3in.	9 7 0	7 10 0
Flats, 5in. and under	9 7 0	8 17 6
Plates, 3/4in. (basis)	9 7 6	7 15 0
„ 1/2in.	9 12 6	8 0 0
„ 1/4in.	9 17 6	8 5 0
„ 3/16in.	10 2 6	8 10 0
„ 1/8in.	9 15 0	9 0 0
Boiler Plates	9 17 6	—
SOUTH WALES AREA—		
Angles	9 0 0	*7 10 0
Tees	10 0 0	*8 10 0
Joists	9 7 6	*7 10 0
Channels	9 5 0	*7 15 0
Rounds, 3in. and up	10 0 0	*8 10 0
„ under 3in.	9 7 0	7 10 0
Flats, 5in. and under	9 7 0	8 17 6
Plates, 3/4in. (basis)	9 10 0	7 15 0
„ 1/2in.	9 15 0	8 0 0
„ 1/4in.	10 0 0	8 5 0
„ 3/16in.	10 5 0	8 10 0
„ 1/8in.	10 0 0	9 0 0
IRELAND—		
	BELFAST.	REST OF IRELAND.
	£ s. d.	£ s. d.
Angles	9 5 0	9 7 6
Tees	10 5 0	10 7 6
Joists	9 12 6	9 15 0
Channels	9 10 0	9 12 6
Rounds, 3in. and up	10 5 0	10 7 6
„ under 3in.	9 8 0	9 10 6
Plates, 3/4in. (basis)	9 12 6	9 15 0
„ 1/2in.	9 17 6	10 0 0
„ 1/4in.	10 2 6	10 5 0
„ 3/16in.	10 7 6	10 10 0
„ 1/8in.	10 2 6	10 5 0

OTHER STEEL MATERIALS.

	Home.	Export.
	£ s. d.	£ s. d.
Sheets.		
10-G. to 13-G., f.o.t.	9 15 0	9 0 0
14-G. to 20-G., d/d	11 5 0	9 10 0
21-G. to 24-G., d/d	11 10 0	9 15 0
25-G. to 27-G., d/d	12 2 6	10 7 6
The above home trade prices are for 4-ton lots and over; 2-ton and 4-ton lots, 10s. per ton extra; and under 2-ton lots 30s. per ton extra.		
Galvanised Corrugated Sheets, Basis 24—		
Home.	£ s. d.	
4-ton lots and up	13 10 0	
2-ton to 4-ton lots	13 17 6	
Under 2 tons	15 10 0	
Export : £12 17s. 6d. to £13 2s. 6d., c.i.f. India.		
„ £11 15s. 0d., f.o.b. other markets.		
„ Scandinavia : £10 10s. 0d. to £10 15s. 0d. f.o.b.		
Tin-plates.		
20 by 14 basis, f.o.b. Bristol Channel Ports, 18s. 9d.		
Tin-plate Bars, d/d Welsh Works, £5 15s. 0d. to £6 0s. 0d.		
Billets.		
Basic (0.33% to 0.41% C.)	7 5 0	
„ Medium (0.42% to 0.60% C.)	7 15 0	
„ Hard (0.61% to 0.85% C.)	8 5 0	
„ „ (0.86% to 0.99% C.)	8 15 0	
„ „ (1% C. and up)	9 5 0	
Soft (up to 0.25% C.), 500 tons and up	6 2 6	
Rails, Heavy, 500-ton lots, f.o.t.	8 10 0	
„ Light, f.o.t.	7 10 0	

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/3 per lb.	
Ferro Tungsten	3/- per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 10 0	7/-
„ „ 6 p.c. to 8 p.c.	£21 0 0	7/-
„ „ 8 p.c. to 10 p.c.	£21 0 0	7/-
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£33 10 0	11/-
„ „ 1 p.c. carbon	£36 5 0	11/-
„ „ 0.50 p.c. carbon	£37 5 0	12/-
„ „ carbon-free	9 1/2 d. per lb.	
Metallic Chromium	2/5 per lb.	
Ferro Manganese (loose), 76 p.c.	£11 5 0 home	
„ Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- p.u.	
„ „ 75 p.c.	£17 17 6 scale 6/- p.u.	
„ Vanadium	12/8 per lb.	
„ Molybdenum	4/6 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£200 to £205	
Cobalt	6/3 to 6/9 per lb.	

NON-FERROUS METALS.

Official Prices, June 3rd.

COPPER—		
Cash	£36 5 0 to £36 6 3	
Three months	£36 11 3 to £36 12 6	
Electrolytic	£40 5 0 to £40 15 0	
Best Selected Ingots, d/d Birmingham	£40 0 0	
Sheets, Hot Rolled	£68 0 0	
	Home.	Export.
Tubes, Solid Drawn (basis)	10 1/2 d.	10 1/2 d.
„ Brazed (basis)	10 1/2 d.	10 1/2 d.
BRASS—		
Ingots, 70/30, d/d Birmingham	£32 0 0 to £33 0 0	
	Home.	Export.
Tubes, Solid Drawn, 2/1 Alloy	9 1/2 d.	9 1/2 d.
„ Brazed	11 1/2 d.	11 1/2 d.
TIN—		
Cash	£187 0 0 to £187 10 0	
Three months	£185 0 0 to £185 10 0	
LEAD :	£15 3 9 to £15 5 0	
SPELTER :	£14 2 6 to £14 7 6	
Aluminium Ingots (British)	£100	

FUELS.

SCOTLAND.

LANARKSHIRE—		Export.
(f.o.b. Grangemouth)—Navigation Unscreened	14/-	to 14/6
Hamilton Ell	16/-	to 17/-
Splints	18/6	to 19/-
AYRSHIRE—		
(f.o.b. Ports)—Steam	13/-	to 13/6
FIFESHIRE—		
(f.o.b. Methil or Burntisland)—		
Prime Steam	14/9	to 15/-
Unscreened Navigation	13/-	to 13/6
LOTHIANS—		
(f.o.b. Leith)—Hartley Prime	14/-	to 14/6
Secondary Steam	13/6	to 13/9
ENGLAND.		
YORKSHIRE, MANCHESTER—		
B.S.Y. Hard Steams	19/6	to 23/-
Furnace Coke	14/6	to 20/-
NORTHUMBERLAND, NEWCASTLE—		
Blyth Best	14/9	to 15/-
„ Second	14/-	to 14/6
„ Best Small	12/-	
Unscreened	13/6	to 15/-
DURHAM—		
Best Gas	14/8	
Foundry Coke	24/6	to 26/6
SHEFFIELD—		Inland.
Best Hand-picked Branch	26/-	to 29/-
South Yorkshire Best	23/-	to 25/-
South Yorkshire Seconds	20/-	to 21/-
Rough Slacks	11/-	to 12/-
Nutty Slacks	10/-	to 11/-

CARDIFF— SOUTH WALES.

Steam Coals :	
Best Admiralty Large	19/6
Best Seconds	19/- to 19/4 1/2
Best Dry Large	18/9 to 19/3
Ordinaries	18/3 to 18/6
Bunker Smalls	13/6 to 14/6
Cargo Smalls	12/6 to 13/-
Dry Nuts	24/- to 25/-
Foundry Coke	28/- to 47/6
Furnace Coke	24/- to 25/-
Patent Fuel	21/-

SWANSEA—

Anthracite Coals :	
Best Large	36/- to 40/-
Machine-made Cobbles	41/- to 48/6
Nuts	40/- to 48/6
Beans	25/- to 35/-
Peas	19/- to 23/6
Rubbly Culm	11/6 to 12/-
Steam Coals :	
Large Ordinary	18/- to 20/6

FUEL OIL.

Inland consumption ; contracts in bulk.	
Exclusive of Government tax of 1d. per gallon.	
Ex Ocean Installation.	Per Gallon.
Furnace Oil (0.950 gravity)	3 1/2 d.
Diesel Oil	4d.

French Engineering Notes.

(From our own Correspondent in Paris.)

Strike Developments.

WHEN the men employed at the Breguet aircraft factory at Havre installed themselves in the works until their demands were agreed to, and similar strikes followed in half a dozen other works, it was supposed that the movement was impelled by force of example and had no political significance. But when strikes of an identical character broke out in aircraft factories, engineering works, the Renault factory where more than 32,000 men ceased work, and spread to practically all firms engaged more or less on Government contracts, there could be no doubt that the movement was being carried out according to plan. It may be that the execution of the plan was precipitated by the success of the first strikes. It was certainly not opportunely timed. A notable thing about the strikes is the quiet and orderly way in which everything is done. The men content themselves with staying in the works and being supplied with what they need by friends and families outside. In some cases they take possession of offices and paralyse administrative services. Care is taken of the machinery and plant, so as to be ready for work when the strike is declared off. They receive instructions from their Union delegates. At least two Communist municipalities in the Paris suburbs supply strikers with meals. All the demands are for the acceptance by employers of a "collective contract" comprising similar clauses, including a rise in wages with a minimum for all workers according to categories, a fortnight's holiday with full pay each year, a recognition of shop delegates, and a forty hours' week. The minimum basis for wages submitted to Renault is 7f. an hour for mechanics, 6.25f. for automatic machine tool operators, and 5f. for women. At the present rate of exchange, 7f. is equivalent to about 1s. 10d.

Trade Union Control.

At the beginning of the movement strikes were settled by employers accepting some of the demands and undertaking to consider others, but when it became apparent that the men's action was nothing less than a Socialist labour revolution, employers declined to enter into negotiation with them until they had vacated the shops, while in the metallurgical and allied industries employers informed the Government that the demand for a forty hours' working week and some other questions were outside the range of private discussion. They could only be settled by the State. Therefore the onus of providing a solution devolves upon the Government at the precise moment when the nation's affairs are passing into the hands of Monsieur Léon Blum, leader of the new Socialist Government. As the strike movement began in industries working for the State, such as aircraft manufacture, aero engine building, war material, and munitions, the situation is grave, because the new Government will have the means of imposing an acceptance of the men's claims. Whether it will exercise such powers remains to be seen. Meanwhile, the men have retreated from their strategic positions at the Renault and Gnome et Rhône works on the understanding that some of their claims will be favourably considered. The situation appears to indicate that factories working for the State tend to pass more closely under State control, and must therefore adhere to the Socialist programme which is now presented to them. The additional financial burdens imposed on these manufacturers must inevitably be made good by the State consenting to an adjustment of contract prices to the higher wages. Unfortunately, if compensation can be obtained at the country's expense by firms working wholly or partly for the State, there is no such help for industry as a whole, which threatens to be swept by the Socialist movement. Passive strikes are extending in the engineering and allied industries, and if the "collective contract," with a high minimum wage basis, a forty-hours' working week, and trade union control, with Government support, is accepted by firms executing State orders, it can hardly be supposed that the movement will be arrested until it has obtained a complete hold on the country's industrial production.

Wage Fallacies.

At a time when industry was passing through a particularly active period, and there was a shortage of skilled labour, wages repeatedly rose, and were invariably followed by advances in commodity prices. There may have been reasons special to this country for a partial concordance of wage and price curves, the latter with a decided lag, and it is inevitable in a country which is both agricultural and industrial, but there is always some concordance which lessens the margin between the two, and thereby reduces the wage-earner's increase of purchasing power. The minimum wage basis has taken into account the shorter working week, so that there shall be no reduction in the weekly wages, but the men fix conditions for working overtime, thereby implying that the forty hours' week is conventional, and need not prevent employers from carrying on overtime on payment of an extra 33 to 100 per cent. The idea that a forty hours' week would reduce unemployment is not seriously entertained, for the reason that there is practically no unemployment amongst skilled hands, and it has been ascertained that only about 1 per cent. of those out of work are capable of being trained as mechanics. The minimum wage basis "according to the category of workers" approaches the ideal levelling of wages which is responsible for the shortage of skilled mechanics. When an operator of an automatic machine, who is incapable of setting his own tools, earns nearly as much as a skilled turner, there is little inducement for youths to undergo a long apprenticeship. There can be no progress in a workshop when employers are deprived of the right to encourage capable men. While workers have every reason to improve their situation compatibly with what intelligence and skill they may possess, their opportunity for doing so appears to be restricted by the mass organisation undertaken by trade unions, whose activities are particularly serious at a time when the country is trying to find a way out of its difficulties by reducing costs all round and recovering the foreign trade it has lost in consequence of high production costs.

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., 1s. each.

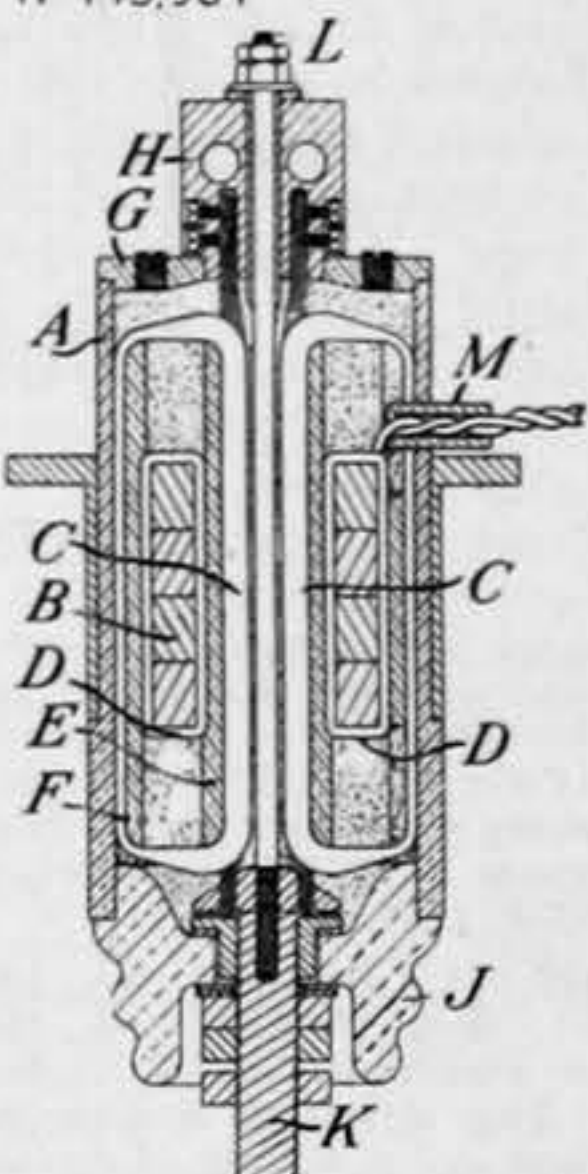
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

TRANSFORMERS AND CONVERTERS.

445,964. December 24th, 1934.—CURRENT TRANSFORMERS, The Harland Engineering Company, Ltd., 196, Greengate, Manchester; and G. Caton, "B.E.P." Works, Alloa, Clackmannanshire.

This current transformer is housed within a cylindrical terminal bushing A of a circuit breaker head (not shown). The construction comprises an annular core B, through and around which are wound a primary winding C and a secondary winding D located within the primary winding. The core and the secondary winding are accommodated between inner and outer annular shells E F respectively of insulating material, the primary winding being wound through and around the annulus formed by the shells. A cover G fitted to the top of the bushing A carries a terminal head H. An arcing shield J fitted to the bottom of the bushing carries a contact stem K, which is mechanically connected to the terminal head H by a bolt L extending axially of the transformer. The cavities within the bushing A are filled with insulating compound. The secondary is led into the casing through a small insulating tube M penetrating the bushing and extending through a gap between turns of the primary.—April 22nd, 1936.

N°445,964



446,227. July 8th, 1935.—IRON CORES FOR INDUCTION COILS, C. Lorenz Aktiengesellschaft, Lorenzweg 1, Berlin-Tempelhof, Germany.

This invention relates to methods of producing cores of self-induction coils intended for high-frequency circuits. Iron powder is mixed with a solution of amber which is not too viscous. After mixing, which must be made very carefully in order to obtain a substance as homogeneous as possible, the powder is dried. Each iron particle has thus been coated with a thin layer of amber. The powder when dry is, before being compressed to form the core, moistened with a small amount of turpentine oil in order that the compressed material may be given a greater mechanical solidity. The usual pressures are employed in accomplishing the compressing action.—April 27th, 1936.

ELECTRICAL APPLIANCES.

445,738. April 4th, 1935.—ELECTRON DISCHARGE DEVICES, Rogers Radio Tubes, Ltd., 100, Sterling-road, Toronto, Ontario.

In this valve there is the cathode A with its heating connections to the plugs B and C. The anodes D D are interconnected at E and connected with the plug F. A pair of standards G G is connected with the plug H and serves to support the control grid J. The grid has the form shown in Fig. 2, so that it partially embraces the anodes. It has been found that the distance d, Fig. 2, is quite important in determining the amplification constant of the tube and its other electrical characteristics. With the structure shown, a great many of the electrons in their journey from the cathode to the anode rods must pass through the control grid twice. That is, they pass through the grid

N°445,738

Fig 1

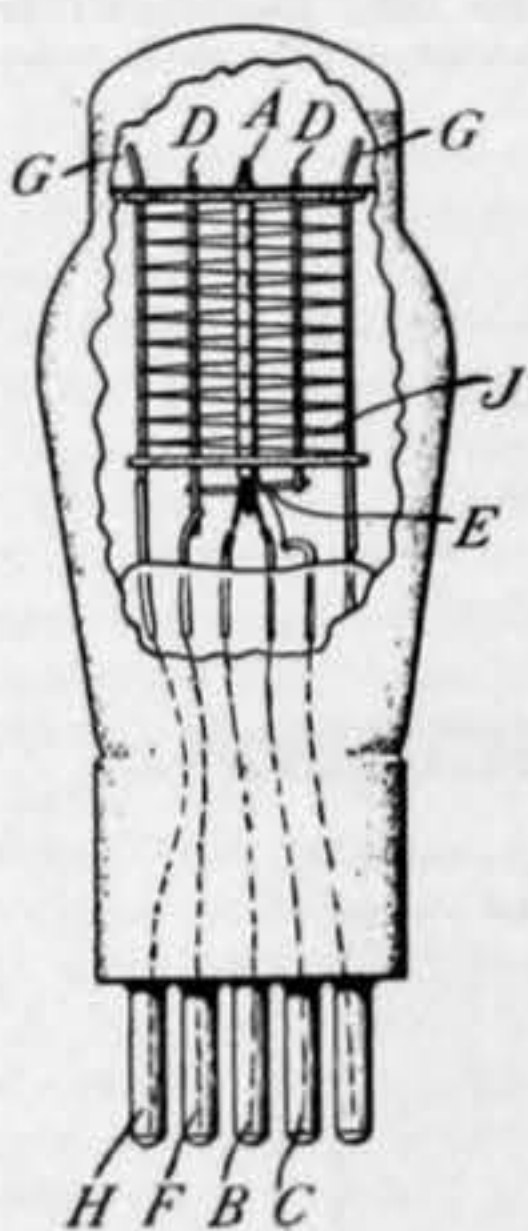


Fig 2



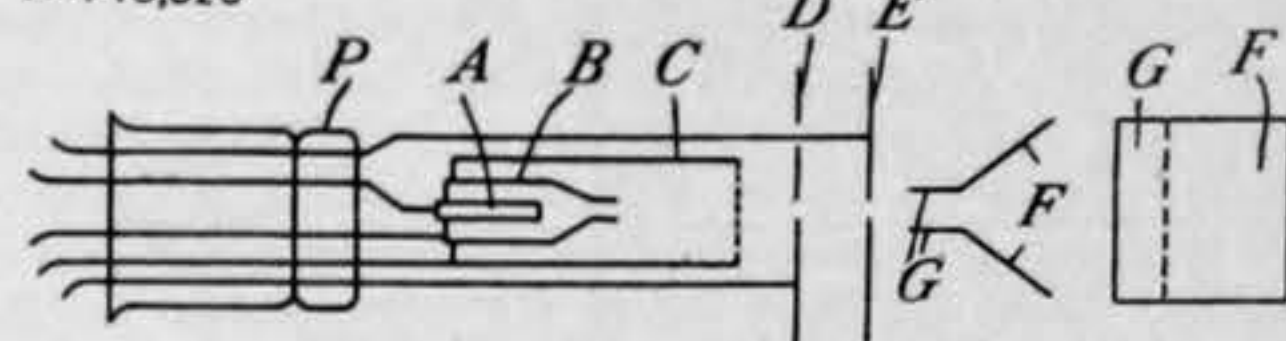
from the cathode outward and from outside of the grid inward to the anode rods. This weaving of the electrons through the grid causes a multiplication of the amplification factor and renders possible the attainment of a high trans-conductance triode. For example, when the distance d has a value of approximately 0.045in., an amplification factor is obtained of 3, and when this constricted portion is reduced only slightly, as, for instance, to 0.020in., an amplification factor of 9 is obtained. In tubes constructed with the distance d having a value of 0.025in., it has been possible to duplicate the commercial triode Type 227 in an electrical manner, even though the anode instead of having a large surface consists of only a wire twenty-five thousandths of an inch in diameter. This will serve to illustrate the degree of simplification and economy attained.—April 17th, 1936.

445,820. July 10th, 1935.—CATHODE RAY TUBES, F. J. Gerard van den Bosch, 14, Normans'-buildings, Central-street, London, E.C.1.

This invention has for an object an improved assembly of the

various parts of a cathode ray tube in conjunction with an improved form of each of these individual parts. The figure shows first the foot or pinch P which supports the assembled parts and is such as to allow these parts to be easily sealed within the tube. The cathode A consists of a single pole of thoriated tungsten which can be covered with a highly emissive oxide or not, as desired. This is made to glow at the required temperature by applying a suitable potential between A and B. The potential to be applied is governed by the distance between both electrodes and the use it is intended to make of B. If B

N°445,820



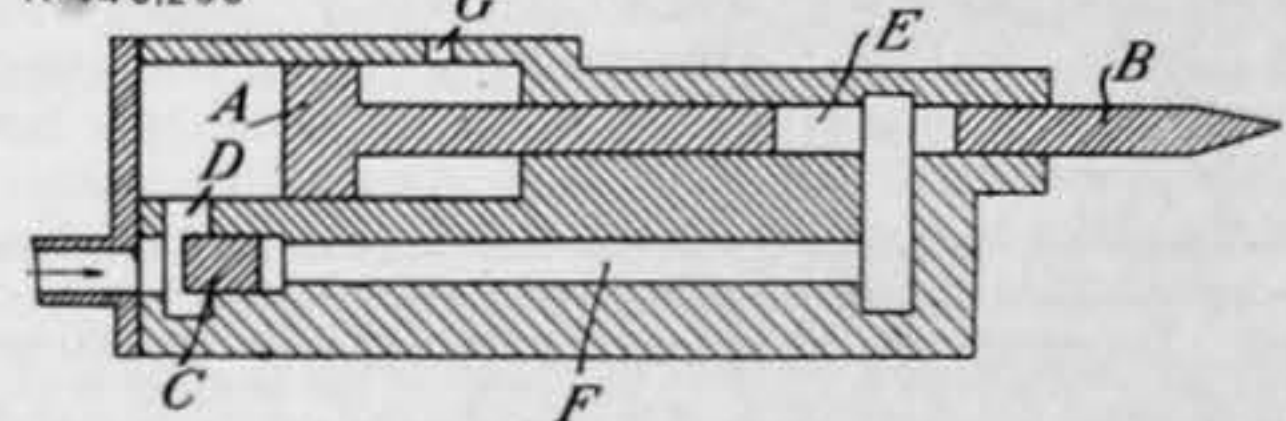
is to be used as a negative pole of the cathode, it does not much matter, provided one bears in mind that the potentials applied to the anodes and shields are corresponding for the regular operation of the tube. In cases, however, in which B is to be used as shield (i.e., in gas-filled tubes) then the applied potential is governed by characteristics of the tube. C is an additional shield which might be used in conjunction with B or separately. D and E are the first and second anodes. F is the deflector plates which are so constructed that, of each plate, part G represents one-third of the total length, the remaining two-thirds being coated with an emissive material.—April 20th, 1936.

MACHINE TOOLS AND SHOP APPLIANCES.

446,208. January 23rd, 1935.—PNEUMATIC TOOLS, Société D'Etudes et D'Exploitation du Générateur à Piston Libre, 167, Boulevard Voltaire, Paris, and 33, Rue Liogier, Saint-Etienne (Loire), France.

It is claimed that this pneumatic tool gives a blow from five to ten times greater than that of the usual type of tool. Its operation is shown diagrammatically in the drawing. A is the working piston, B the tool, and C a sliding block. The space comprised between the piston, the tool, and the block is filled with oil; the face of the block opposite that which is in contact with the oil is subjected to the pressure of the compressed air. The operation is as follows:—When the piston is at the left-hand end of its stroke and the admission orifices D are open the piston accelerates in a forward direction. As long as the plunger has not passed beyond the chamber E the oil will be displaced

N°446,208



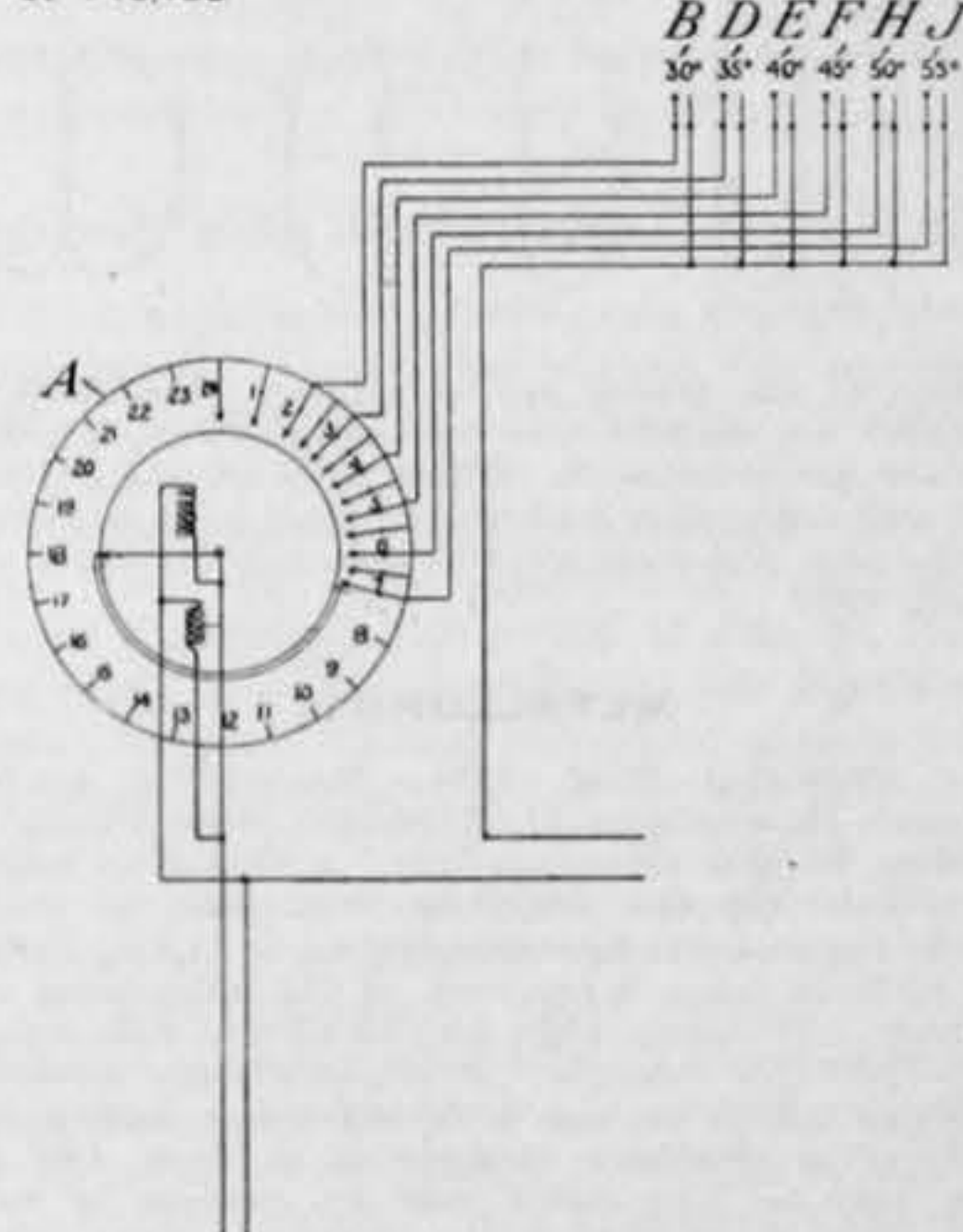
in the duct F and move the block C against the pressure of the compressed air. At the end of a certain travel the plunger, travelling at full speed, passes beyond the chamber E. The oil interposed between its end and the tool is violently compressed, while the speed of the piston slackens and the tool receives the impulse. In the meantime the admission orifices have closed and the exhaust orifices G opened. When the piston has come to rest it is driven backwards (the returning means are not shown in the drawing) and the operation continues as before. The movement of the block C controls the distribution of the compressed air. For this purpose the orifices D are covered by the block when the forward stroke of the piston has reached a suitable value and are uncovered in the opposite direction during the backward stroke, when the piston is sufficiently close to the end of the cylinder.—April 27th, 1936.

LIGHTING AND HEATING.

446,168. September 19th, 1934.—THERMOSTATIC CONTROL, S. C. Mount, 43, Bloomsbury-square, London, W.C.1; R. Grierson, 4, Bloomsbury-place, London, W.C.1; and Richard Crittall and Co., Ltd., 43, Bloomsbury-square, London, W.C.1.

This arrangement is for the control of the temperature of, for instance, office buildings, where it is unnecessary that they should be heated during the night, but must be brought up to a definite temperature when working time arrives. It depends

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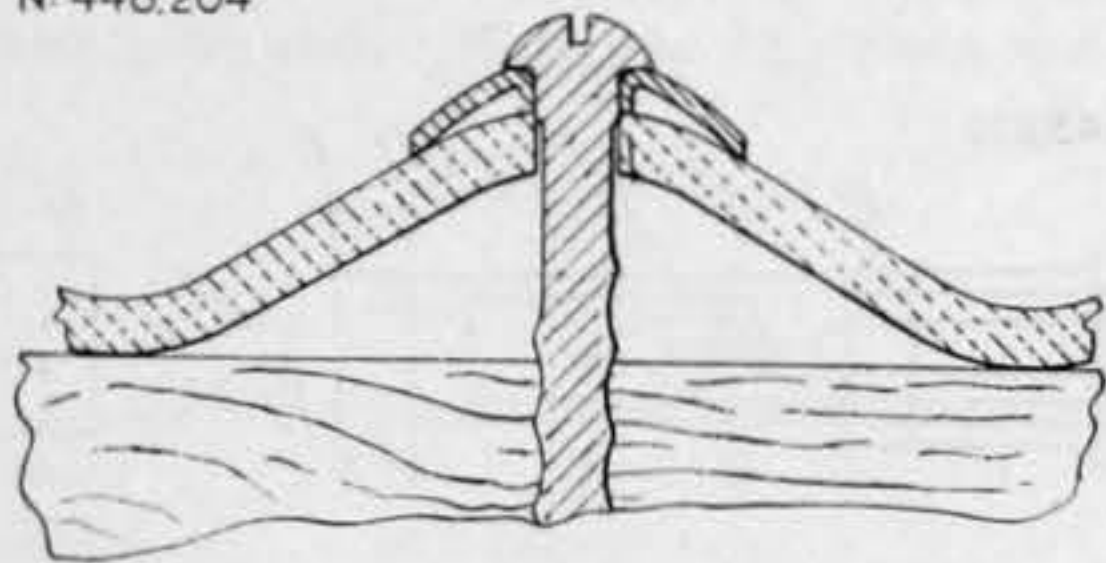
on an electrically operated clock A and a series of outdoor thermostats, B to J. These thermostats are set to operate at intervals of five degrees of temperature, and are connected with contacts on the clock as shown. Should the outdoor temperature be low, say, 30 deg., then as soon as the clock hand arrives at 2 o'clock a circuit is completed and the heating apparatus is set in action. If the temperature is higher the clock hand has to pass on to a further contact before a circuit is completed.—April 20th, 1936.

BUILDING.

446,204. January 10th, 1935.—DRIVE SCREW-NAILS, S. Roberts, Pound, Toll End, Tipton, near Birmingham.

This invention concerns drive screw-nails used for fixing corrugated roofing sheets. These screw-nails are used in conjunction with washers, and as the process of rolling the thread

N° 446,204



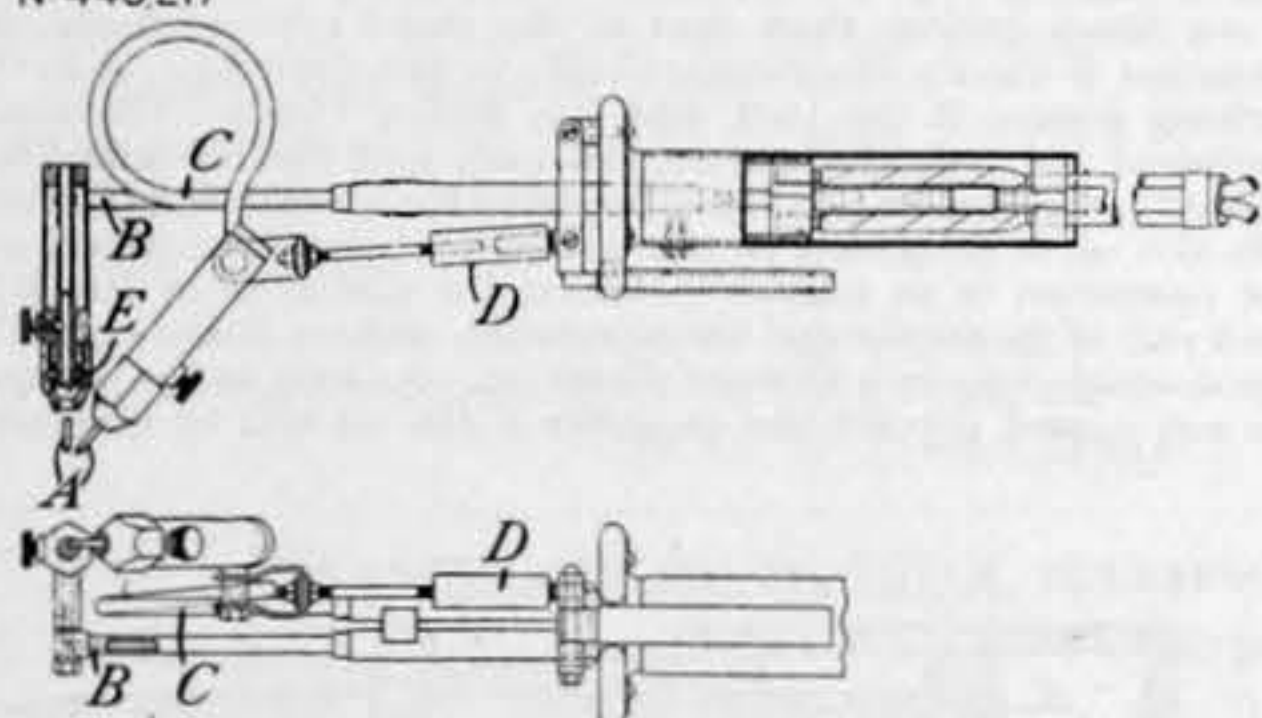
increases the overall diameter of the nail the hole in the washer must be large enough to pass the thread. In the screw-nail specified the shank is upset immediately beneath the head to a diameter equal to that of the thread, and the washer has an intumed flange. In this way a strong and weather-tight joint is made between the nail and the washer.—April 27th, 1936.

WELDING.

446,217. March 5th, 1935.—ELECTRIC ARC HEATING TORCHES, D. A. Pearson, 12, Bramley-avenue, Stretford, Manchester, and Metropolitan-Vickers Electrical Company, Ltd., Number One, Kingsway, London, W.C.2.

This is a torch of the atomic hydrogen type. Its construction is described in great detail. The arc is struck between the

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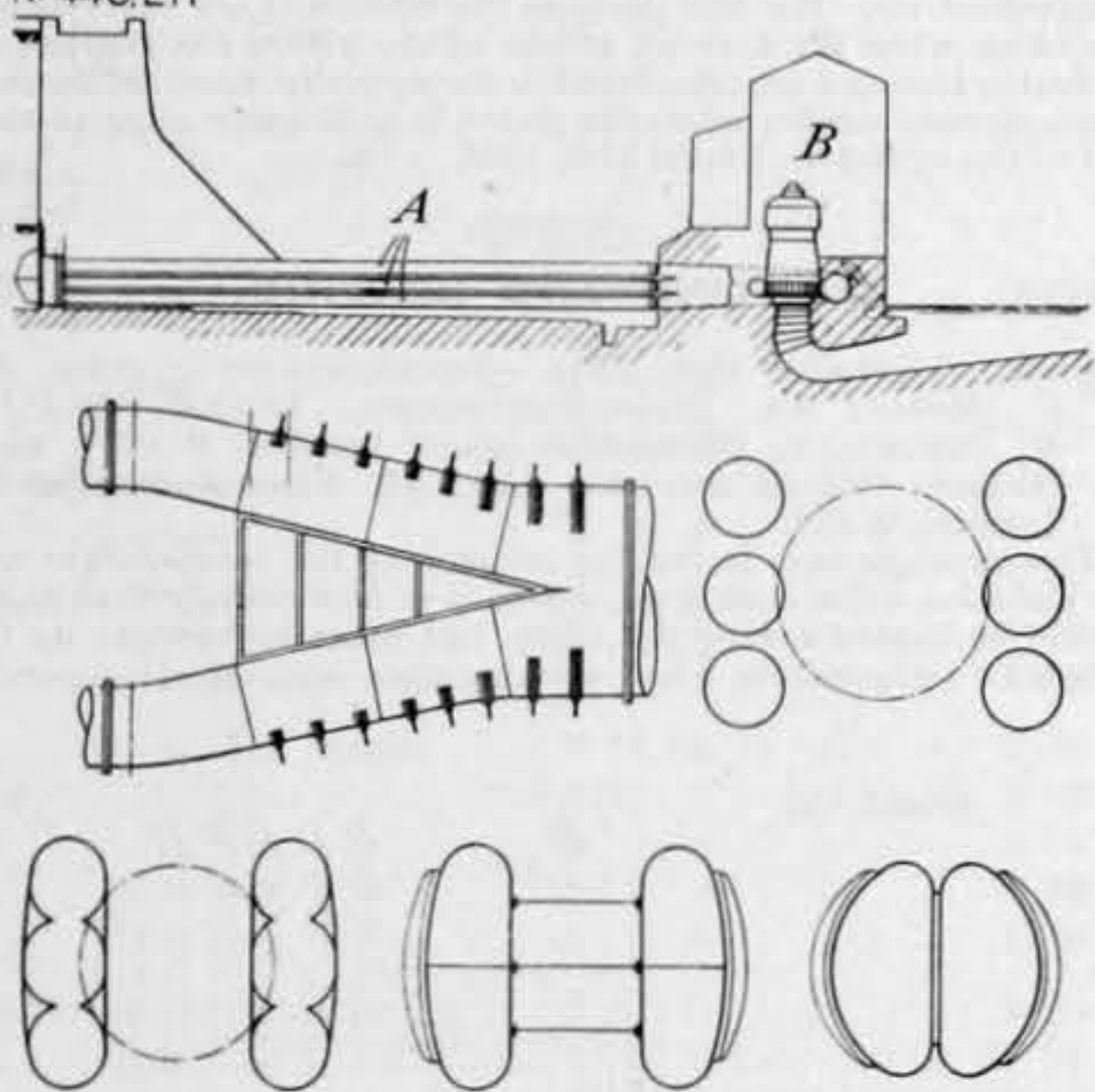
two refractory electrodes A, and electric current and hydrogen gas are supplied by the pipes B and C, which are preferably of steel. The length of the arc can be regulated by the adjustment D. Emphasis is given to the value of the annular cavity E in securing an even distribution of gas in the arc.—April 27th, 1936.

WATER POWER.

446,211. January 28th, 1935.—HYDRAULIC POWER INSTALLATIONS, The English Electric Company, Ltd., Queen's House, 28, Kingsway, London, W.C.2.

This is a scheme for utilising an existing irrigation dam for providing power from some of its sluices. In the case illus-

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trated two of the sluices are so utilised. Into each of the sluices there are sealed three circular pipes A, which reach towards the power-house B. There they are merged together to make one connection with the turbine, by a breeches piece having the plan and cross sections shown in the lower views.—April 27th, 1936.

METALLURGY.

446,200. December 22nd, 1934.—MAGNESIUM ALLOYS, E. Strasser, Hauptstrasse 11, Rorschach, Switzerland.

According to this invention there is added to magnesium or magnesium alloys a compound composed of aluminium and zinc in the proportions corresponding to Al_2Zn_3 , the amount of such addition being 6 per cent. of the magnesium or magnesium alloy. The magnesium may be alloyed with manganese, iron, or cobalt, for example. It is particularly advantageous to expose the alloys to high temperatures or submit them to artificial ageing processes (tempering at from 100 deg. to 160 deg. Cent.). The result was an increase in hardness, elasticity, and an increase in the elongation limit. An alloy cast with 94 per cent. magnesium and 6 per cent. of the composition Al_2Zn_3 —that is, 4.7 per cent. zinc and 1.3 per cent. aluminium—possesses at first a Brinell hardness of 50, but after heat treatment one of from 89 to 99, or practically double the original hardness. Since an extraordinarily long period of heat treatment is required in the systems of magnesium-aluminium and particularly of magnesium-zinc or magnesium-zinc-aluminium, on account of their small penetrability, these alloys are attended by the great disadvantage that the prolonged heat treatment renders their structure coarser, which, in its turn, reduces their mechanical properties so as to render the

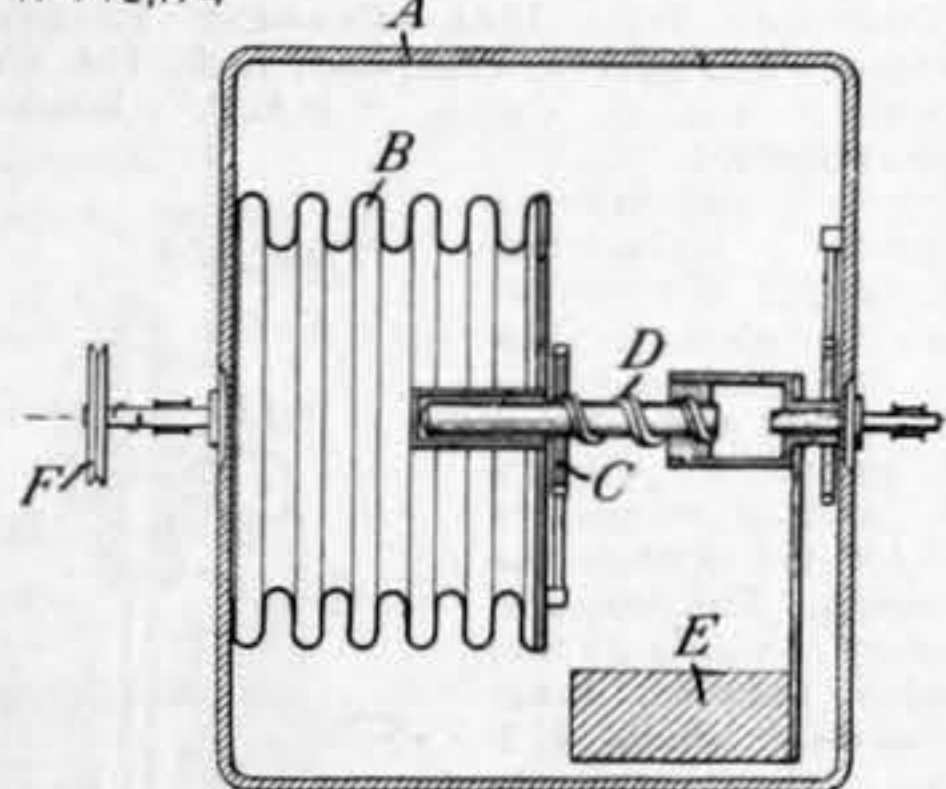
alloys unserviceable. Therefore, the alloy in question is raised temporarily to higher temperatures; for example, if the heat treatment lasts from thirty to sixty minutes, from 420 deg. to 480–520 deg. Cent., which gives rise to very rapid homogenisation and prevents the grain from coarsening.—April 27th, 1936.

MISCELLANEOUS.

446,174. October 22nd, 1934.—THERMAL MOTORS, J. L. Reutter, 9, Rue du Sommerard, Paris, France.

This is a device for winding clocks, or similar purposes, which is operated by changes in the atmospheric temperature. A hermetically sealed cylinder A contains a bellows B. The bellows is filled with a saturated vapour and the intervening

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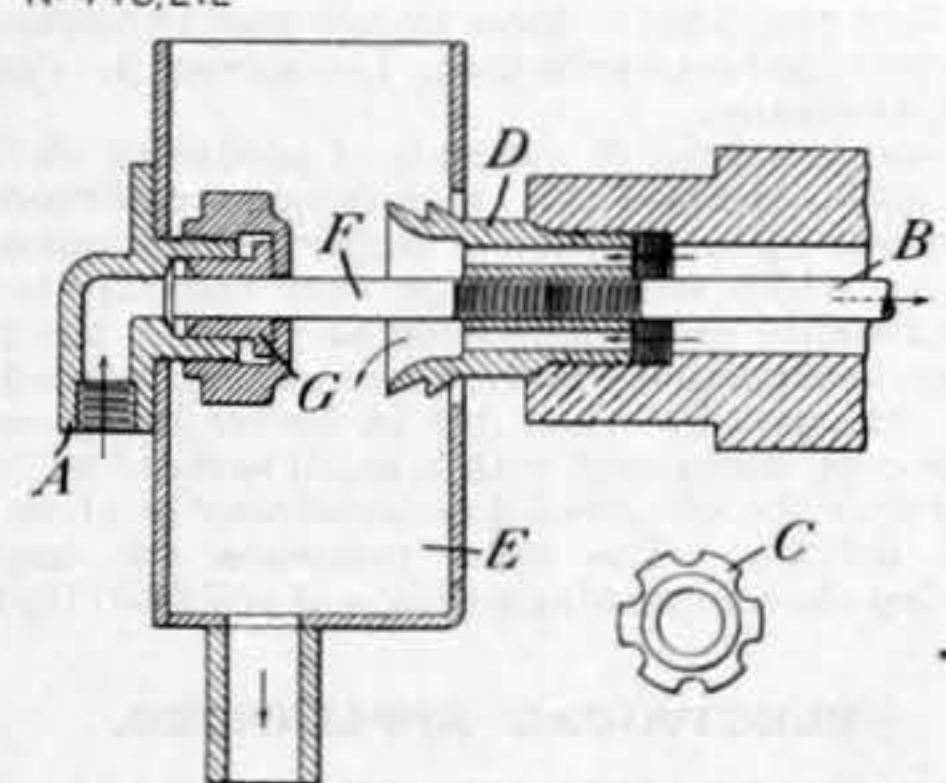


space with a gas. The bellows will, consequently, expand and contract with changes of temperature. The linear movement thus obtained is converted into a rotary one, in one direction, by the ratchet C and screw D. Acting against the opposition of the pendulum weight E this rotates the cylinder A, and, by means of a band on the pulley F, the clock is wound.—April 22nd, 1936.

446,212. February 1st, 1935.—ROLLER MILLS FOR CEREALS, Henry Simon, Ltd., Bird Hall-lane, Cheadle Heath, near Stockport, and J. H. Scott.

This invention is concerned with the water cooling of rolls used in the milling of cereals. It is said that trouble has been experienced through the sagging of the tube used to introduce the water to the interior of the roll and its consequent wear.

N° 446,212

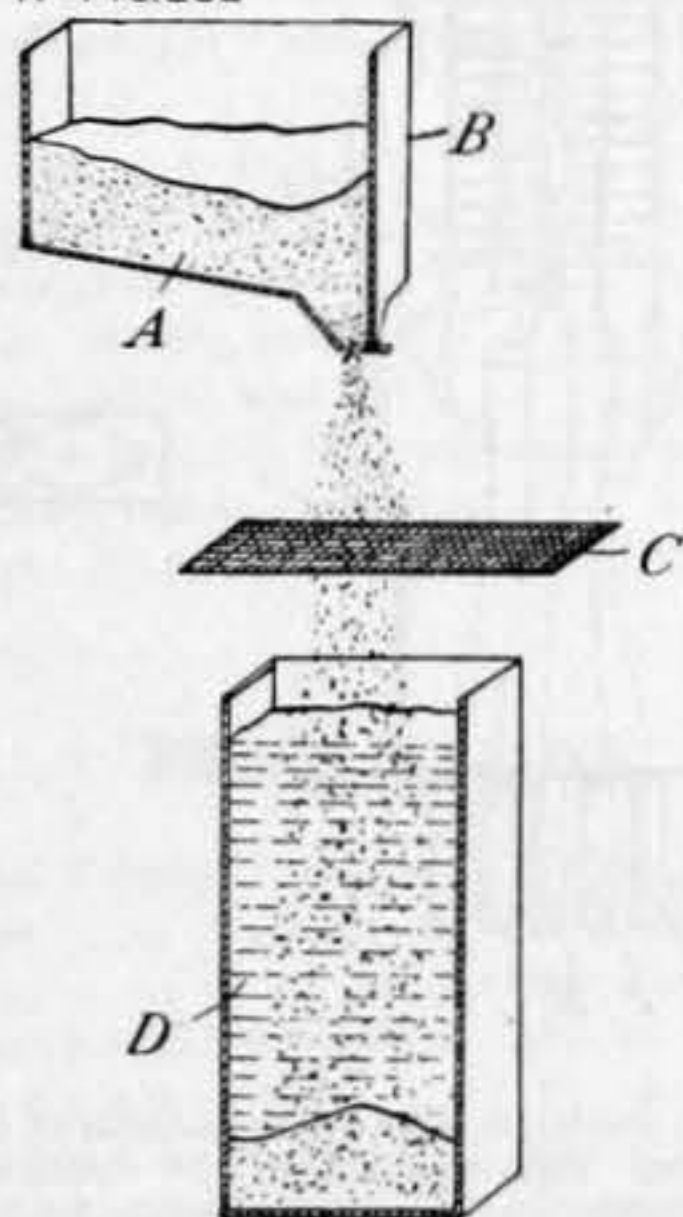


According to the new arrangement the water, supplied at A, is led to the distant end of the roll by the tube B. This tube is held in position by spiders C, and is screwed into the bell-mouth piece D through which the water escapes into the water box E. A short length of pipe F is also screwed into the piece D, and rotates therewith. It connects with the water inlet by means of the stuffing-box G.—April 27th, 1936.

446,232. September 16th, 1935.—MAGNET CORES, The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C.2.

The object of this invention is to provide a process for completely coating the single iron particles of magnet cores for high-frequency purposes with an insulating layer, and it consists in this, that the magnetic powder is first passed through a distributing device—for instance, a sieve—and directly thereafter through an insulating liquid—for instance, a phenol formaldehyde resin, such as that used in the manufacture of the substance known under the Registered Trade Mark "Bakelite"—dissolved in acetone, so that on its passage through

N° 446,232



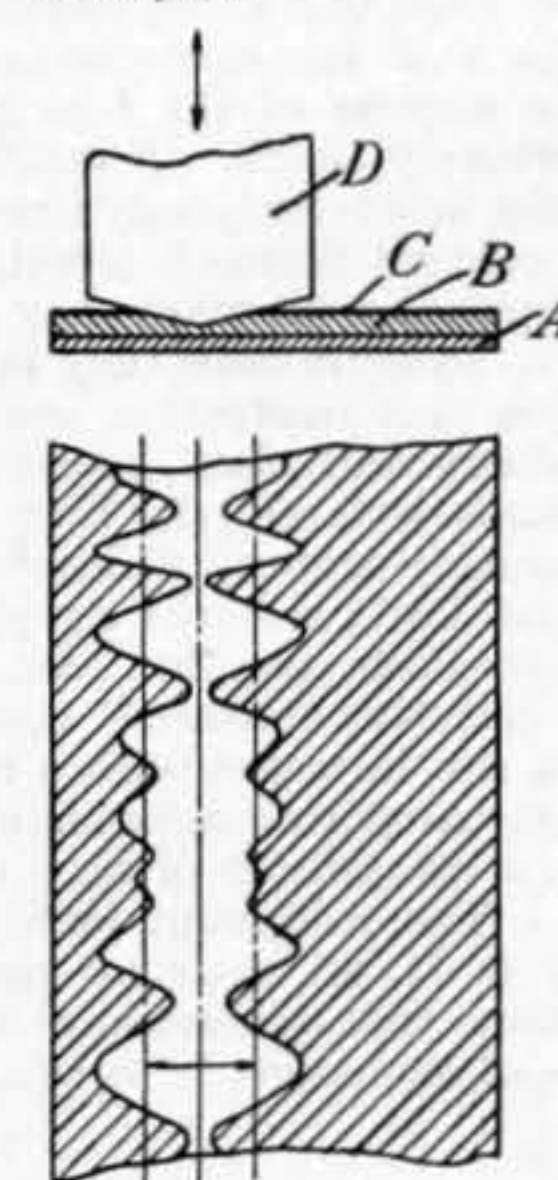
this fluid, each single particle is actually provided with a complete coating. The iron powder A passes from the receptacle B on to the sieve C, which is shaken. This sieve is of such a mesh that the single grains of the iron powder, after passing through this sieve, are completely separated from each other, and in this state are immersed in the liquid D, which may be, for instance, a solution of a phenol formaldehyde resin in acetone. On sinking through the insulating liquid each single particle of the iron powder receives a complete coating of insulating material, since each particle is separated spatially from the others. The path through the insulating liquid is made sufficiently great to ensure that each particle receives the insulating covering, with certainty, before the particles are finally deposited on the bottom. The iron particles, thus completely insulated and accumulated on the bottom, can then be passed on for

further working. By adding properly selected amounts of the dissolving medium, the viscosity of the insulating liquid can be varied according to requirement. It will generally be selected lower for the iron powder of finer grain than for the coarser particles. If the powder contains grains of very different sizes, instead of being stationary, the liquid can be employed in circulation, and thus it can simultaneously serve to separate further the particles.—April 27th, 1936.

445,658. June 17th, 1935.—THE MECHANICAL RECORDING OF SOUNDS, N. V. Philips' Gloeilampenfabrieken, Emmasingel, Eindhoven, Province of North-Brabant, Kingdom of the Netherlands.

This specification deals with the mechanical recording of sounds on films, so that they may be reproduced by optical methods, and goes very fully into the subject. A compound film is used comprised of a backing A, a transparent layer B, and

N° 445,658



an opaque covering C. A chisel D, with an obtuse angle, is vibrated by the sound waves in a direction normal to the surface of the passing film, and cuts a track through the opaque covering, as indicated in the lower figure, which serves for reproduction purposes. It is explained that such films are not made with a constant thickness, which, naturally, interferes with the record, and means of overcoming this difficulty are described.—April 16th, 1936.

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 Monday 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.

TUESDAY TO FRIDAY, JUNE 9TH TO 12TH.

INST. OF BRITISH FOUNDRYMEN.—Annual Conference in Scotland.

INST. OF MECHANICAL ENGINEERS.—Summer meeting at York.

TUESDAY TO SATURDAY, JUNE 9TH TO 13TH.

INST. OF AUTOMOBILE ENGINEERS.—Summer meeting in Scotland.

THURSDAY, JUNE 11TH.

RAILWAY CLUB.—Royal Scottish Corp'n. Hall, Fetter-lane, E.C.4. "Life in a Booking Office," Mr. C. E. Codd. 7.30 p.m.

MONDAY, JUNE 15TH, TO SATURDAY, JUNE 20TH.

INSTITUTION OF ELECTRICAL ENGINEERS.—Summer Meeting in Scotland.

THURSDAY TO SATURDAY, JUNE 18TH TO 20TH.

NEWCOMEN SOCIETY.—Summer Meeting in London. For programme, see page 579, May 29th issue.

FRIDAY, JUNE 26TH.

GLASGOW UNIVERSITY CLUB, LONDON.—Annual Summer Dinner, Trocadero Restaurant, W.1. Chairman, Mr. J. Ramsay MacDonald, M.P. 7.15 p.m. for 7.30 p.m.—dinner postponed from May 29th.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

LAURENCE, SCOTT AND ELECTROMOTORS, Ltd., ask us to state that some exaggerated reports have appeared concerning the damage caused by a fire at their Manchester works on May 27th. The fire was confined to a section of the offices, and the factory was unaffected. The works are in full production, and the staff of the offices affected has been accommodated in other parts of the building.

CONTRACTS AND ORDERS.

The Editor is always happy to print short announcements of contracts and orders in this column provided they are sent to him in time to have news value and that they are likely to interest readers.

THE LIVERPOOL REFRIGERATION COMPANY, Ltd., has received an order for supplying the refrigerating plant required for the new extension at Chambers' Wharf and Cold Storage Company, London. The equipment includes a four-cylinder "Polar" sleeve valve compressor, direct coupled to an electric motor.

CATALOGUES.

SYDNEY ROSE, 111, Gray's Inn-road, W.C.1.—Folders giving details of various types of indicators for liquid level indicating and controlling.

DIAGRID STRUCTURES, Ltd., Horseferry House, Page-street, London, S.W.1.—Pamphlets describing the "Diagrid" system of construction.

THOS. BOLTON AND SONS, Ltd., Widnes, Lanes.—Particulars of the firm's products in phosphor bronze, which include strip, sheets, wire, rods, bars, &c.