

layers of different thicknesses or material that is partly insulated. No heat marks are left on the surface between the two spot welds.

The double transformer twin spot welder has two 25-kVA transformers, each with primary tappings, giving twenty-five variations in the secondary voltage, and as the casing of each transformer forms the secondary, flux losses are reduced to a minimum. All manually operated controls and switchgear are operated at the low potential of 25 volts. Oil-immersed contactors, with contacts claimed to have a long life, are provided. While the welding tips of the lower transformer are stationary, those of the upper transformer are moved downwards by pneumatic pressure, and are balanced to give a pressure which is independent of the length of the individual welding tips. A foot-operated pneumatic valve is used for controlling the machine, and when the pre-determined pressure has been applied by the welding tips the primary circuits of the transformers are automatically closed. Various types of gear can be provided for controlling the duration of the weld, such as the maker's "N.P.C." patented automatic current controller or a special time switch.

J. AND H. McLAREN, LTD.

The principal exhibit on the stand of J. and H. McLaren, Ltd., of Midland Engine Works, Leeds, consists of a ship's emergency generating set, com-

with a designed output of 30 b.h.p. at 800 r.p.m. The firm is also exhibiting a McLaren-S.L.M. four-cylinder marine engine with Parsons reverse gear and hand and electric starting equipment. This unit has an output of 25 b.h.p. at 1250 r.p.m. and a bore of 95 mm. and a stroke of 125 mm. The gear is designed to give equal speeds ahead and astern. A twin-cylinder L.M. unit of similar design has a designed output of 20 b.h.p. at 1250 r.p.m., with a bore of 105 mm. and a stroke of 150 mm. All the engines above referred to are equipped with C.A.V.-Bosch fuel pumps and atomisers, and several of the units are demonstrated in actual operation.

THE RAPID MAGNETTING MACHINE COMPANY, LTD.

One of the exhibits of the Rapid Magnetting Machine Company, Ltd., of Lombard-street, Birmingham, is the separator illustrated in Fig. 33. This device is especially intended for the enamelling, china and earthenware trades. If the material from which enamelled ironware, pottery, or sanitary ware is made contains small particles of iron, a speckled appearance is found in the product. This separator is designed to remove these particles of iron. The material, in its liquid form, is caused to run down the chute. Strong magnetic bars are stretched across the chute and are not only serrated in the direction of their length, but are also provided with vertical diverters also serrated. It is found that fine particles

of iron are particularly attracted by the edges of a magnet and the serrations create a number of such edges and thereby increase the magnetic effect. The diverters, of course, by obstructing the flow, bring each part of the liquid into contact with the magnetic surfaces, so that it shall be thoroughly "searched." At the bottom of the chute there is a "collapsible bridge," which, when the current actuating the

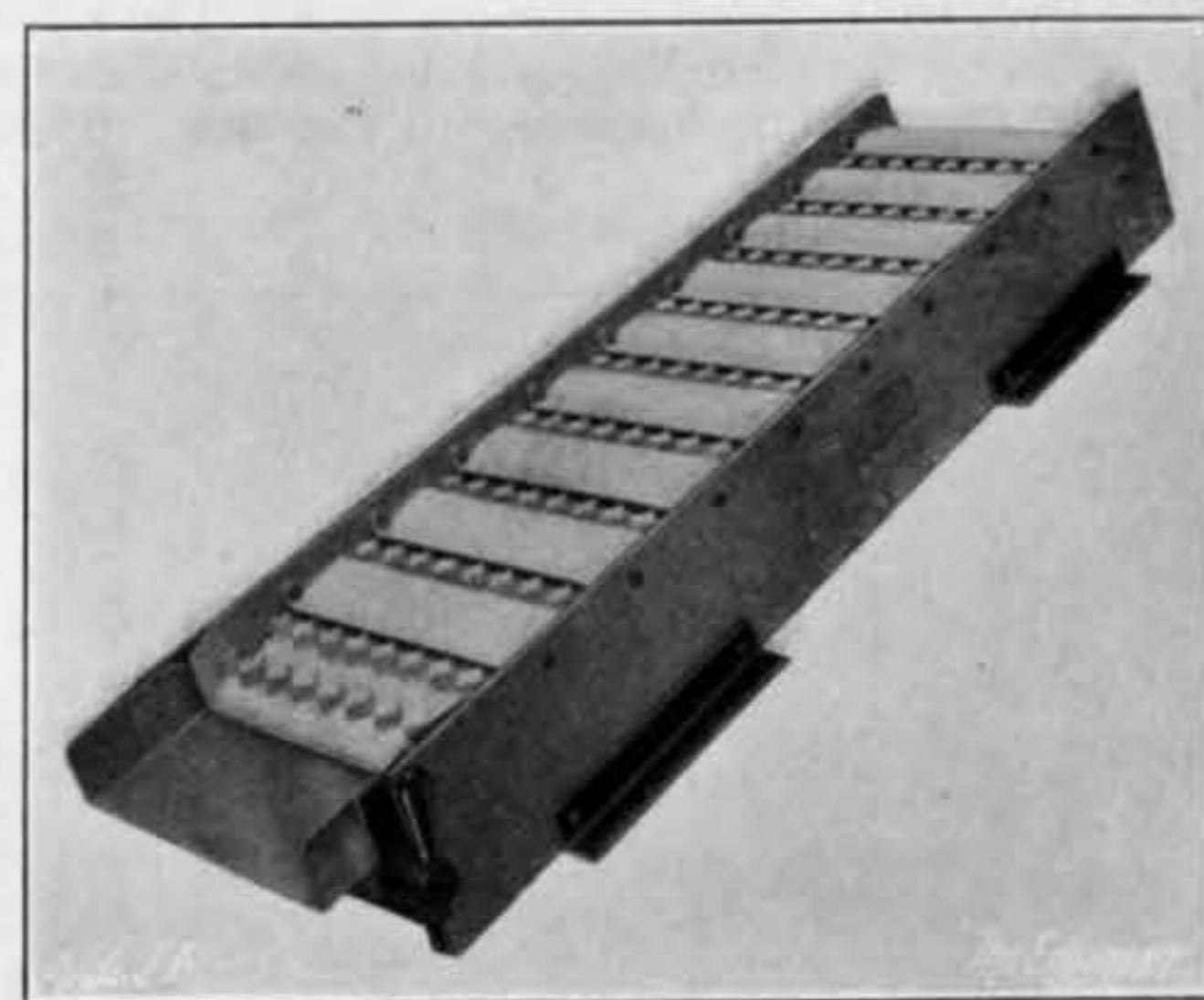


FIG. 33—MAGNETIC SEPARATOR—RAPID MAGNETTING

current is turned off in this manner for "washing down" and the automatic action of the collapsible bridge makes the device practically foolproof. The magnet illustrated in Fig. 34 is also exhibited by the firm. It is used especially for the testing of brass scrap and other materials, among which there may be certain quantities of ferrous materials. The

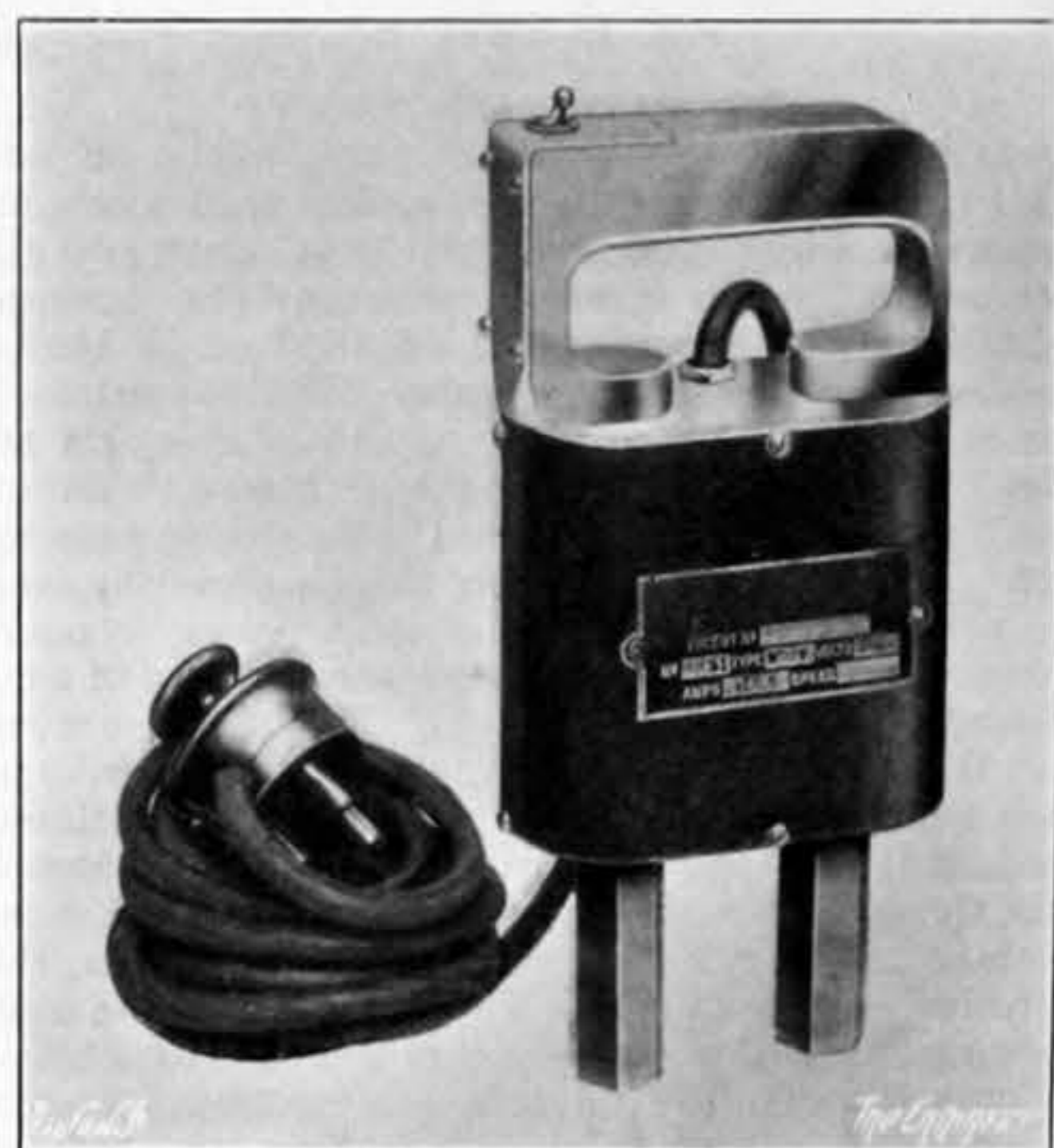


FIG. 34—TESTING MAGNET—RAPID MAGNETTING

presence of these materials, of course, alters the value of the scrap to an extent dependent on its amount. The magnet is supplied with a length of flex and has a switch mounted on the hand grip.

(To be continued.)

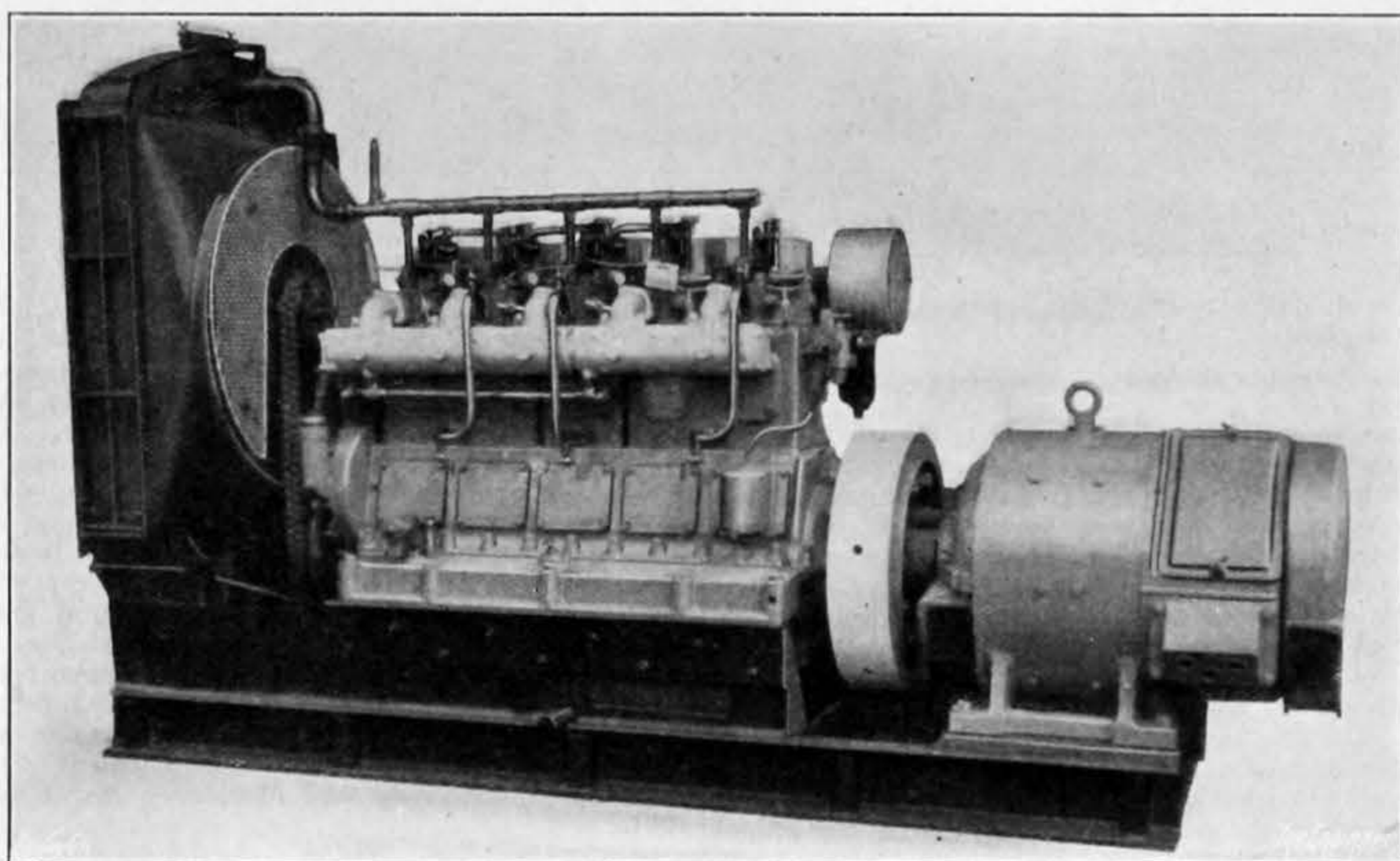


FIG. 31—87 B.H.P. MARINE EMERGENCY GENERATING SET—MCLAREN

prising a McLaren M.D.B.M. type five-cylinder engine with a designed output of 87 b.h.p. at 1000 r.p.m., which is coupled directly to a Laurence Scott and Electromotors, Ltd., 50-kW, 220-volt, enclosed ventilated type D.C. generator. As Fig. 31 shows, the set is mounted on a fabricated steel bed-plate, and it is complete with air starting gear. The normal output above mentioned refers to a sea level performance at a temperature of 62 deg. Fah., but the provision of a large radiator and fan makes the set

of iron are particularly attracted by the edges of a magnet and the serrations create a number of such edges and thereby increase the magnetic effect. The diverters, of course, by obstructing the flow, bring each part of the liquid into contact with the magnetic surfaces, so that it shall be thoroughly "searched." At the bottom of the chute there is a "collapsible bridge," which, when the current actuating the

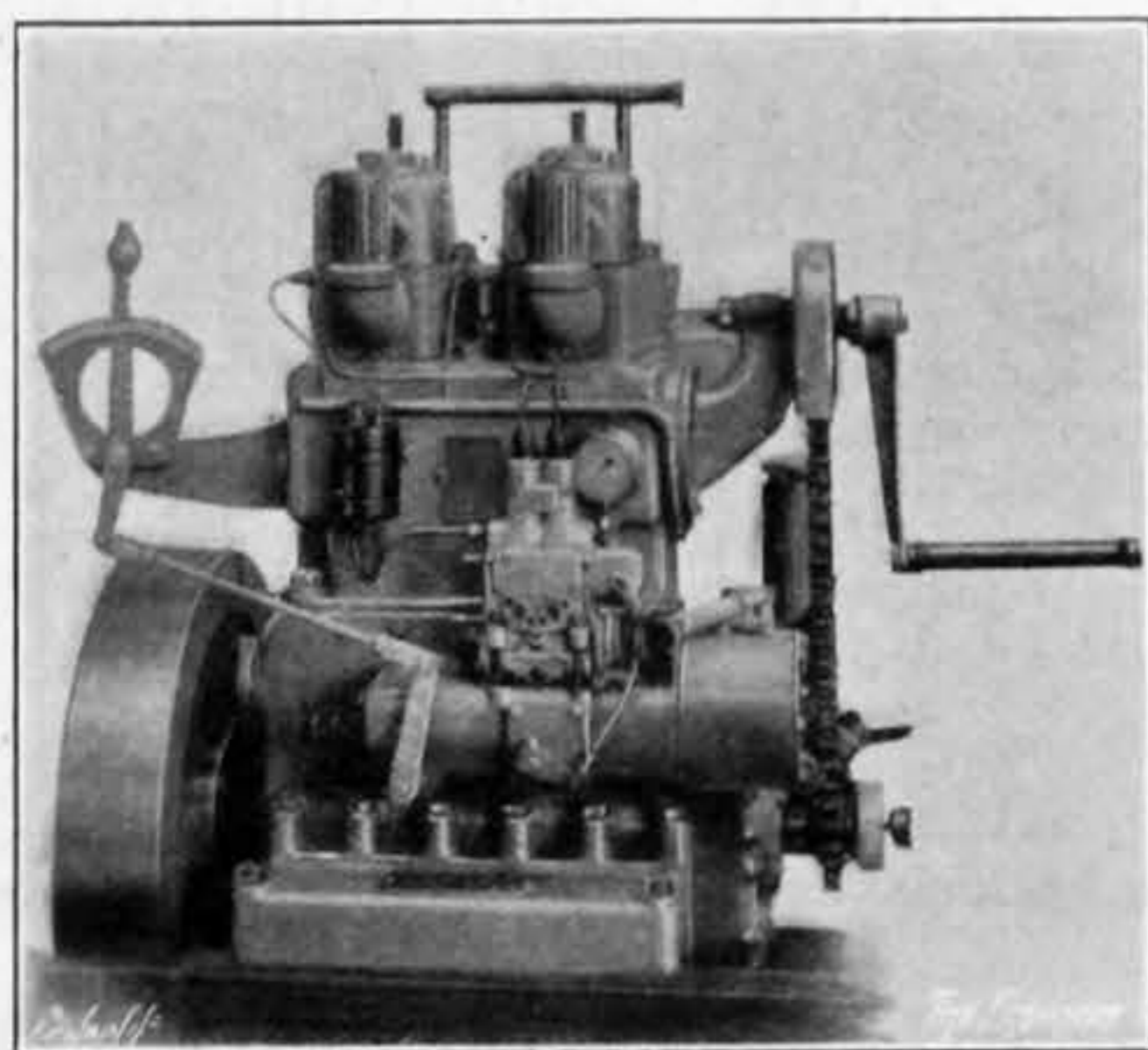


FIG. 32—30 B.H.P. TWIN-CYLINDER ENGINE—MCLAREN

suitable for tropical services. The engine follows the standard McLaren practice and operates on the pre-chamber combustion system with C.A.V.-Bosch fuel pumps and atomisers. The cylinder bore is 135 mm., with a stroke of 200 mm., and the fuel consumption is 0.47 lb. per b.h.p. hour at full load, the corresponding lubricating oil consumption being 0.01 lb. per b.h.p. hour. The lubrication system is of the latest forced feed type and splash lubrication is relied upon for the lubrication of the cylinder walls. Another engine shown on the stand, which we illustrate in Fig. 32, is a twin-cylinder unit of the same type and dimensions

## L. and N.E.R.—"The Silver Jubilee" Train

AS already announced in our columns, the London and North-Eastern Railway will introduce as from September 30th, 1935, a four-hour service between London (King's Cross) and Newcastle, the distance being 268 miles and including an intermediate stop at Darlington. This train has been named "The Silver Jubilee," in celebration of H.M. King George's twenty-five years' reign.

The following observations on the schedule and on the design of the engine and train have been supplied by the L. and N.E. Railway Company.

### THE TIME TABLE.

The high average speed can only be maintained by running at high speeds uphill, and it is not anticipated that it will be necessary to run at extra high speeds on the falling gradients. If the speed of uphill running on a 20 miles section can be increased from 40 to 60 m.p.h. a saving of 10 minutes is realised, but if the speed of downhill running over 20 miles is increased from 60 to 80 m.p.h. 5 minutes only is saved. For the 268 miles from Newcastle to London the average speed including a 2 minutes' stop at Darlington is 67.07 m.p.h.

For the 36 miles from Newcastle to Darlington 40 minutes is allowed and the average speed is only 54 m.p.h. This lower average speed is owing to restrictions of 25 m.p.h. through Durham and two other permanent speed restrictions of 20 m.p.h. owing to colliery workings.

For the 232 miles from Darlington to London 198 minutes only is allowed, or an average speed of 70.3 m.p.h., notwithstanding the severe speed reductions through York, Selby, and Peterborough to 15, 30, and 10 m.p.h. respectively.

Details of the mileage, running times and speeds are given in the table on the next page.

From a close analysis of the timings it will be seen that high speed uphill is the feature of the schedule. For instance, over the 29 miles' section from Peterborough to Grantham, with its long rising gradient of 9 miles, varying from 1 in 200 to 1 in 178, 24½ minutes is allowed in running, but in the opposite direction the time allowed is only reduced to 24 minutes, the speeds being 71.3 and 72.7 m.p.h. respectively.

### STREAMLINING.

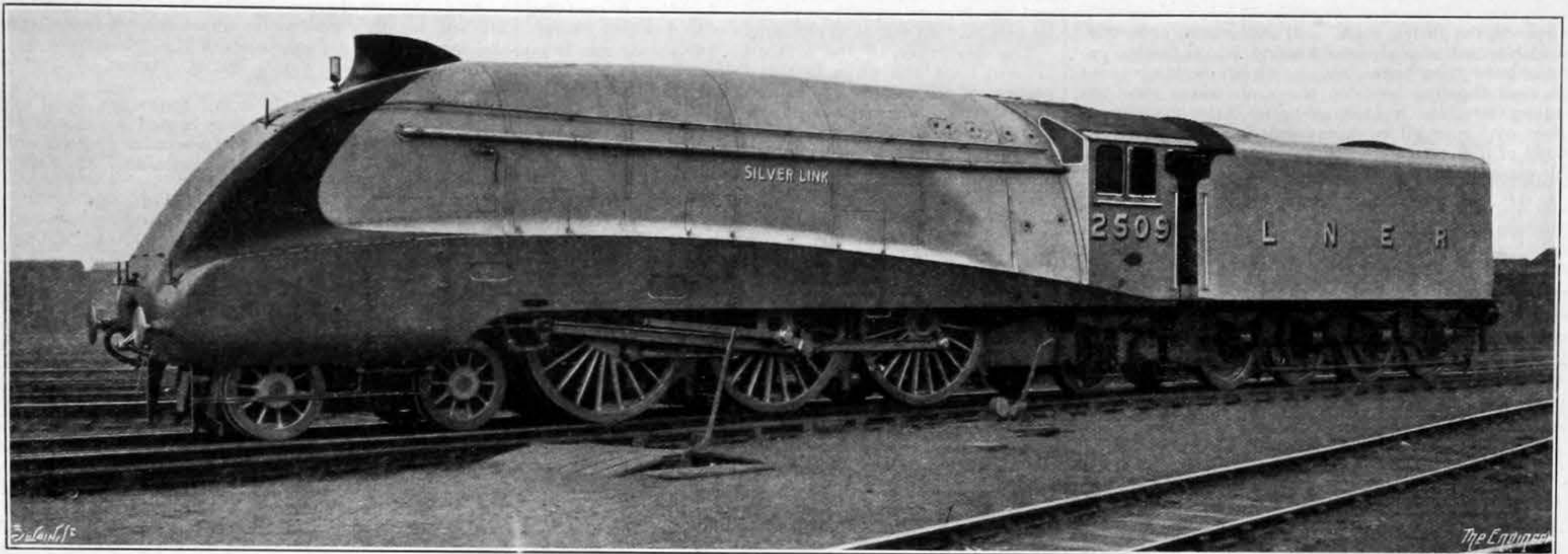
Recognising that the power required to overcome the air resistance on the front of the engine at 70 m.p.h. is approximately 50 per cent. greater than that required at 60 m.p.h., it becomes necessary to facilitate the running, and in the interests of coal economy that the front of the engine should be streamlined.

The form of streamlining to give the best results on aircraft is not necessarily the most suitable for a train or motor car. The nose of the airship or the fuselage of the aeroplane is always pointed directly into the wind whatever its direction. Trains and racing motor cars have to follow a track, and consequently the air flow owing to side winds is almost always more or less on one quarter.

An extended investigation has been made into locomotive streamlining from three aspects: (1) reducing the head resistance; (2) lifting the steam and smoke; and (3) minimising the disturbance of the atmosphere alongside the train. A wind other than a head-on wind causes an increase in pressure on the windward side of the boiler barrel, but also induces a reduced air pressure on the lee side, and this partial vacuum draws the steam and smoke down into it and tends to obscure the lookout. If the locomotive front end is designed with a vertical wedge front to pierce the atmosphere by parting it to the sides,

L. AND N. E. RAILWAY—"SILVER LINK" STREAMLINED LOCOMOTIVE

MR. H. N. GRESLEY, CHIEF MECHANICAL ENGINEER



the side wind effect is aggravated and the tendency of the steam and smoke to drift along the boiler barrel is increased. Then, too, considerable disturbance is caused laterally and this is felt by passing trains.

For these reasons Mr. Gresley decided that the best form of front end was a horizontal wedge, as this would cause an upward rising current of air to sweep past the chimney and along the boiler barrel top and by its velocity would assist in carrying the steam and smoke clear over the cab, besides avoiding any lateral displacement of the atmosphere. The running boards were given the form of an aerofoil for the same reason. The form of streamlining adopted is very similar to that incorporated by Monsieur Bugatti in his high-speed railcars in France and in his racing motor cars.

THE LOCOMOTIVES.

Four engines are being built for this service, the first of which has been named "Silver Link."

The streamlining of the front end covers over the smoke-box front end and door. In order to give access

elements are of the short loop type and extend to within 9in. of the copper tube plate.

The whole of the boiler barrel and fire-box is insulated with mattresses comprising five layers of "Alfol" foil and 1½in. mesh wire netting. The outer covering is steel sheeting, 16 S.W.G. thick.

The boiler is fed by two injectors, that on the right-hand side of the engine being a Davies and Metcalfe No. 10 exhaust steam injector, and that on the left-hand side a live steam under-footplate injector.

The three cylinders are each 18½in. in diameter by 26in. stroke. Each cylinder is cast as a separate unit, the exhaust from the outside cylinders being carried to the blast pipe base through a cast steel saddle. The piston valves are of the narrow ring type with ring control. The valves are 9in. diameter with a steam lap of 1½in. Each cylinder has its own 5in. diameter steam pipe from the header, and special care has been exercised to make the exhaust passages smooth in order to reduce the friction.

The blast pipe nozzle is 5½in. diameter and is provided with a jumper ring of the type introduced by the late Mr.

thrust washers and with a special vacuum locking apparatus is provided. Bowden wire is used for the sand gear and cylinder cock controls, as well as for operating the whistle, the latter being of a special type fitted immediately in front of the chimney.

Bucket seats are provided for the driver and fireman, and to eliminate back draught flexible rubber roofing is fitted over the gap between the cab and tender. In addition to the usual cab fittings, a Cambridge pyrometer and Flaman speed recorder are also fitted.

The tender is of the corridor eight-wheeled type and is equipped with well and water scoop, its capacity being 5000 gallons of water and 8 tons of coal. It is fitted with standard Pullman vestibule and buckeye couplers and the back is rounded to conform to the shape of the carriages to which it is coupled.

The principal dimensions and ratios are given in a table and weight diagram on the next page.

THE TRAIN.

The train, which will be known as "The Silver Jubilee,"

Point to Point Mileages, Running Times and Speeds, Newcastle, Darlington, King's Cross.

Distance from Newcastle.	Station.	Time.	Point to point.		
			Time.	Distance.	Speed.
Miles chains.			Min.	Miles ch'ns.	M.p.h.
5 39	Newcastle (Central) .. .. . Dep.	10.0			
14 3	Birtley .. .. . Pass	10.8	8	5 39	41.2
23 18	Durham .. .. . Pass	10.18	10	8 44	51.3
36 6	Ferryhill .. .. . Pass	10.28	10	9 15	55.1
	Darlington .. .. . Arr.	10.40	12	12 68	64.2
	Darlington .. .. . Dep.	10.42			
41 21	Eyrholme .. .. . Pass	10.48	6	5 15	51.9
50 20	Northallerton .. .. . Pass	10.55	7	8 79	77.0
58 0	Thirsk .. .. . Pass	11.1	6	7 60	77.5
69 2	Alne .. .. . Pass	11.9	8	11 2	82.7
80 16	York .. .. . Pass	11.19	10	11 14	67.1
94 2	Selby .. .. . Pass	11.33	14	13 66	59.3
108 11	Shaftolme Junction .. .. . Pass	11.45	12	14 9	70.6
112 30	Doncaster (Central) .. .. . Pass	11.49	4	4 19	63.5
		p.m.			
129 57½	Retford .. .. . Pass	12.3	14	17 27½	74.3
148 18½	Newark .. .. . Pass	12.19	16	18 41	69.4
162 70½	Grantham .. .. . Pass	12.32	13	14 51½	67.6
191 78	Peterborough (North) .. .. . Pass	12.56	24	29 7½	72.7
209 37½	Huntingdon (North) .. .. . Pass	1.12	16	17 39½	65.6
236 33½	Hitchin .. .. . Pass	1.33	21	26 76	77.0
250 52½	Hatfield .. .. . Pass	1.44	11	14 19½	77.7
268 27	King's Cross .. .. . Arr.	2.0	16	17 54½	66.3

Overall speed 67.07 m.p.h.

Point to Point Mileages, Running Times and Speeds, King's Cross, Darlington, Newcastle.

Distance from King's Cross.	Station.	Time.	Point to point.		
			Time.	Distance.	Speed.
Miles chains.			Min.	Miles ch'ns.	M.p.h.
	King's Cross .. .. . Dep.	5.30			
17 54½	Hatfield .. .. . Pass	5.48	18	17 54½	58.9
31 73½	Hitchin .. .. . Pass	5.59	11	14 19½	77.7
58 69½	Huntingdon (North) .. .. . Pass	6.19	20	26 76	80.8
76 29	Peterborough (North) .. .. . Pass	6.35	16	17 39½	65.6
105 36½	Grantham .. .. . Pass	6.59½	24½	29 7½	71.3
120 8½	Newark .. .. . Pass	7.11½	12	14 51½	73.2
138 49½	Retford .. .. . Pass	7.27	15½	18 41	71.7
155 77	Doncaster (Central) .. .. . Pass	7.41	14	17 27½	74.3
160 16	Shaftolme Junction .. .. . Pass	7.45	4	4 19	33.5
174 25	Selby .. .. . Pass	7.56½	11½	14 9	73.6
188 11	York .. .. . Pass	8.9	12½	13 66	66.4
199 25	Alne .. .. . Pass	8.20	11	11 14	60.9
210 27	Thirsk .. .. . Pass	8.29	9	11 2	73.5
218 7	Northallerton .. .. . Pass	8.35	6	7 60	77.5
227 6	Eyrholme .. .. . Pass	8.42	7	8 79	77.0
232 21	Darlington .. .. . Arr.	8.48	6	5 15	51.9
	Darlington .. .. . Dep.	8.50			
245 9	Ferryhill .. .. . Pass	9.3	13	12 68	59.3
254 24	Durham .. .. . Pass	9.15	12	9 15	45.9
262 68	Hitchin .. .. . Pass	9.23	8	8 44	64.1
268 27	Newcastle (Central) .. .. . Arr.	9.30	7	5 39	47.0

Overall speed 67.07 m.p.h.

to the smoke-box the sloped front plate is divided into two parts, the larger hinged at the top lifting upwards and the lower hinged at the bottom lifting forward and downwards over the buffers. These doors are operated from the ground by a handle on a cross shaft in front of the smoke-box, the lower door overlapping the top door when closed. Inspection doors have been provided along the sides of the engine to give access to the different parts of the motion.

The engine is a three-cylinder simple expansion "Pacific" type locomotive with an eight-wheeled tender. The boiler pressure has been increased to 250 lb. per square inch. The grate area is 41½ square feet, a new design of fire-bar being used, giving air space openings equal to 56 per cent. of the grate area. Part of the grate is arranged to drop. The ashpan is completely welded and the design gives a free air flow under the outer side bars. The boiler barrel is made in two courses. The first course is parallel, 5ft. 9¾in. outside diameter, the plates being ¾in. thick; the second course is conical, having a maximum diameter of 6ft. 5in. and is of plate ¾in. thick. The distance between tube plates is 17ft. 11½in.

The steam collector is a steel pressing integral with the dome, the steam supply being taken through a series of ½in. slots cut in the top of the barrel plate. The fire-box is of copper and, including the combustion chamber, is 10ft. 1¾in. long. The throat plates of both the copper box and of the outer casing are each in one piece. The copper wrapper plates are ½in. thick and the tube plate 1½in. thick.

The regulator is of the double-beat type and feeds into a main steam pipe of 7in. diameter.

The superheater is of the Robinson type, the forty-three elements being expanded into a cast steel header. The

Churchward on the G.W.R., to relieve back pressure when working the engine at a long cut-off.

The piston and rod are combined in one forging of B.S.S. Class "C" steel. The connecting and coupling rods of nickel-chrome steel are similar to those at present fitted to the ordinary "Pacific" engines. Forty per cent. of the total reciprocating weight is balanced at the wheel rim.

The valve gear is of the company's standard type, in which the outside valves are operated by means of Walschaerts gear, and the inside valve by the Gresley gear incorporating a system of equal and 2:1 levers. The valve gear throughout is fitted with ball and roller bearings. The maximum cut-off is 65 per cent., at which position the valve travel is 5¾in.

The coupled axle-boxes are lubricated by means of a Wakefield six-feed mechanical lubricator and Armstrong oiler pads are used in the axle-box trays. A Wakefield mechanical lubricator is also used for the lubrication of the valves and cylinders, one feed being placed in each steam pipe and one on the top of each cylinder barrel. The two lubricators are driven from one return crank on the right-hand trailing crank pin and the gear is fitted with ball bearings throughout. Four oil boxes, each with nine syphon feeds, lubricate the valve spindles, piston-rods, &c.

The locomotive is fitted with the vacuum brake. The three 2½in. diameter brake cylinders are arranged to transmit their load to one main shaft and give a total brake power equal to 86 per cent. of the adhesive weight. The brake shafts are of forged steel, the brake arms and levers being electrically welded.

The front of the cab is vee-shaped and provides an exceptionally wide angle of vision for the engine crew. Reversing gear of the vertical screw type fitted with ball

is 392ft. long and consists of seven vehicles, the formation being as under:—

Third-class brake	} Articulated	.. ..	30 seats
Third-class corridor		.. ..	42 seats
Third-class restaurant car		.. ..	48 seats
Kitchen car	} Articulated	.. ..	28 seats
First-class restaurant car		.. ..	30 seats
First-class semi-open	} Articulated	.. ..	30 seats
First-class brake		.. ..	20 seats

The train is vestibuled throughout and has a total seating capacity of 198, the tare weight being 205 tons. The bodies of the twin articulated vehicles and the two restaurant cars of the triplet set are each 56ft. 2½in. long and 9ft. wide, whilst the kitchen car of the triplet set is 45ft. 11in. long and 9ft. wide.

The exterior finish of the train is a distinct departure from the company's usual practice. Instead of the standard varnished teak, the bodies are panelled in No. 16 gauge steel and covered with aluminium rexine, the cornices, door and window facias and bottom beading being in stainless steel. Exterior projections have been reduced to a minimum, and in order further to reduce the air resistance a skirting has been fitted between the bogies extending from the bottom of the body to within 10½in. of the rail. The spaces between the articulated ends of the vehicles have been closed by means of a special rubber sheeting with aluminium finish supplied by G. Spencer Moulton and Co., Ltd., which is fitted with initial tension.

The bogies are of the L.N.E.R. standard four-wheeled compound bolster type. The underframes are of steel rigidly trussed, the whole being fabricated by means of electric welding.

The body framing is of teak throughout, the floors being bolted directly on the underframes, no body cushions being

used. The steel panels are bedded to the pillars with a special paste before being finally screwed into position, and special weather-resisting aluminium finish rexine is secured to the steel panels by means of a chemical adhesive. All edges of the fabric are covered by the stainless steel strips previously referred to.

To deaden the noise to be expected when running at high speeds, the floors, roofs, and walls have been insulated with an asbestos acoustic blanket, whilst further precautions have been taken by electrically welding corrugated steel sheeting between the underframe members, and filling the space thus formed between the sheeting and the floor with sprayed asbestos insulation. The large side windows of the saloons and compartments are fitted with double glass having an air space of  $\frac{1}{4}$  in. between, in order

The floor is covered with blue linoleum, over which is laid a blue jaspé Wilton rug.

DINING CARS AND THIRD-CLASS COMPARTMENTS.

The third-class compartments are designed to seat six persons in each, the decorations being carried out in green and the fittings chromium-plated. Lighting is provided by two 30-watt lamps in chromium-plated ceiling fittings.

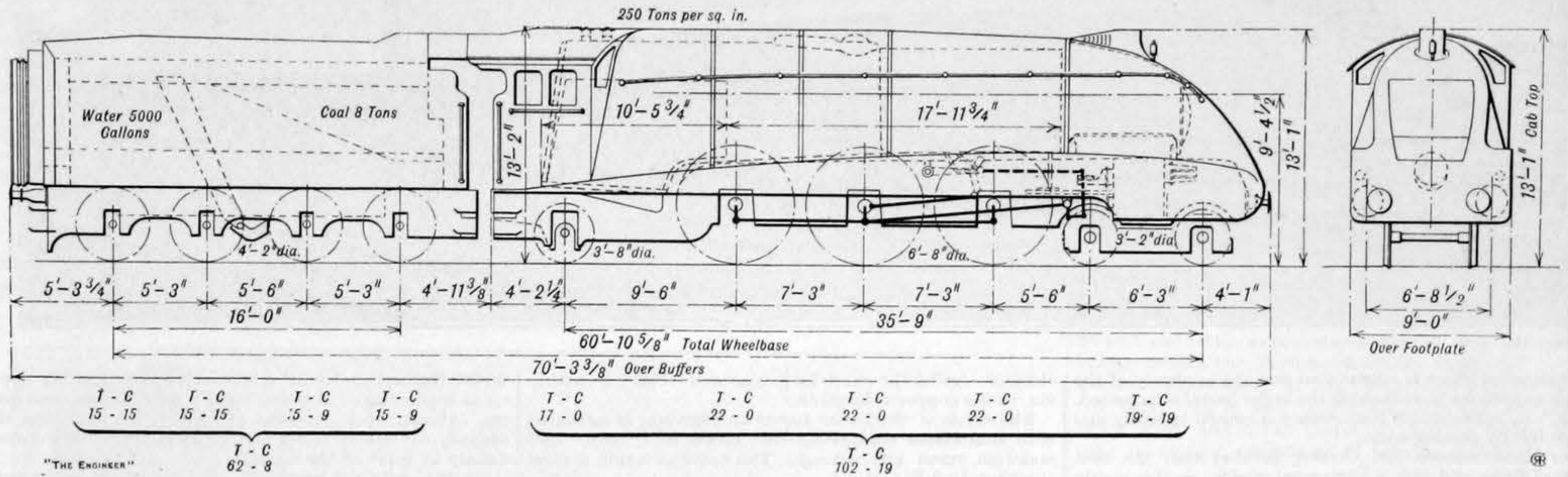
The decoration of the first class restaurant car is on modern lines, the walls in this saloon and in the open portion of the adjacent semi-open car being panelled in figured Australian maple.

The whole finish is entirely flush, the necessary decorative and architectural effects being provided by the grain of the timber, the whole forming a hygienic finish

water tank of 4 gallons capacity is provided for kitchen use. A fish fryer is also provided. A novel feature is the provision of sinks, each having a 1-kW heating element clamped to the underside, to ensure that the water remains hot during the process of washing up. The tops of the benches are covered in stainless steel plates.

An automatic electric refrigerator is also provided in the kitchen, together with an ice cream cabinet operated from the same unit. An extension of the refrigerator for the accommodation of wines, butter, cheese, &c., is also fitted.

The main hot and cold water tanks are fitted in the corridor roof, the former being heated by means of an electric element together with an auxiliary steam coil for use during the autumn and winter seasons.



Leading Dimensions and Ratios.

<p><b>Grate :</b>                  Length of slope . . . . . 5ft. 10 1/2 in.                  Width . . . . . 6ft. 11 1/2 in.                  Grate area . . . . . 41.25 sq. ft.</p> <p><b>Fire-box :</b>                  Height of crown above foundation ring :                  Front . . . . . 6ft. 8 1/2 in.                  Back . . . . . 6ft. 0 1/2 in.                  Interior length at top . . . . . 8ft. 11 1/2 in.                  Interior width at boiler centre . . . . . 5ft. 4 1/2 in.                  Thickness of copper plate :                  Sides and back . . . . . 3/8 in.                  Tube plate . . . . . 1 1/2 in.</p> <p><b>Boiler :</b>                  Outside length of fire-box overall . . . . . 10ft. 5 1/2 in.                  Outside length of fire-box at bottom . . . . . 6ft. 8 in.                  Outside width of fire-box at bottom . . . . . 7ft. 9 in.                  Maximum diameter of barrel . . . . . 6ft. 5 in.                  Length of barrel . . . . . 17ft. 11 1/2 in.                  Thickness of barrel plates . . . . . 3/8 in. and 1/2 in.                  Thickness of wrapper plates . . . . . 1/8 in.</p> <p><b>Tubes, small :</b>                  Material . . . . . Steel                  Number . . . . . 121                  Diameter outside . . . . . 2 1/2 in.                  Thickness . . . . . 10 I.W.G.</p>	<p><b>Tubes, superheater flue :</b>                  Number . . . . . 43                  Diameter outside . . . . . 5 1/2 in.                  Thickness . . . . . 3/8 in.                  Length between tube plate . . . . . 17-11 1/2 in.</p> <p><b>Heating surface :</b>                  Fire-box . . . . . 2312 sq. ft.                  Tubes . . . . . 1281.4 sq. ft.                  Flues . . . . . 1063.7 sq. ft.                  Total evaporative heating surface . . . . . 2576.3 sq. ft.</p> <p><b>Superheater :</b>                  Number of elements . . . . . 43                  Diameter inside . . . . . 1.244 in.                  Heating surface . . . . . 748.9 sq. ft.                  Total heating surface . . . . . 3325.2 sq. ft.</p> <p><b>Two Ross "pop" safety valves . . . . . 3 1/2 in. dia.</b>                  Working pressure . . . . . 250 lb. per sq. in.</p> <p><b>Axles, journals :</b>                  Bogie . . . . . 6 1/2 in. by 9 in.                  Coupled . . . . . 9 1/2 in. by 11 in.                  Trailing . . . . . 6 in. by 11 in.</p> <p><b>Crank pins :</b>                  Outside . . . . . 5 1/2 in. by 6 in.                  Inside . . . . . 8 1/2 in. by 6 in.</p>	<p><b>Coupling pins :</b>                  Leading . . . . . 4 in. by 4 1/2 in.                  Driving . . . . . 6 in. by 4 1/2 in.                  Trailing . . . . . 4 in. by 4 1/2 in.</p> <p><b>Springs :</b>                  Bogie : Helical, 10 1/2 in. long, free, 5 1/8 in. outside diameter, Timmis section                  Coupled : Laminated, 16 plates, 5 in. wide by 1/2 in. thick, 4ft. centres                  Trailing : Laminated, 11 plates, 5 in. wide by 1/2 in. thick, 4ft. 6 in. centres</p> <p><b>Brakes . . . . . Vacuum</b>                  Cylinders : Number . . . . . Three, 18 1/2 in. dia. by 26 in. stroke</p> <p><b>Motion, type :</b>                  Outside . . . . . Walschaert                  Inside . . . . . Gresley                  Valves . . . . . Piston                  Diameter of valves . . . . . 9 in.                  Maximum valve travel . . . . . 5 1/2 in.                  Steam lap, outside cylinder . . . . . 1 1/2 in.                  Steam lap, inside cylinder . . . . . 1 1/2 in.                  Exhaust lap . . . . . Nil                  Cut-off in full gear . . . . . 65 per cent.</p> <p><b>Tractive effort at 85 per cent. boiler pressure . . . . . 35,455 lb.</b>                  Total adhesive weight . . . . . 148,176 lb.                  Adhesive weight/tractive effort . . . . . 4.18</p>
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LONDON AND NORTH-EASTERN RAILWAY "SILVER LINK" LOCOMOTIVE

to reduce to a minimum the transmission of heat and sound.

Plywood has been used throughout for the interior lining of each body with the exception of the ceilings, which are of special millboard. All cross partitions with the exception of those in the restaurant cars are of block plywood.

The whole of the train with the exception of the kitchen car is fitted with J. Stone and Co.'s automatic air conditioning and heating system. Fresh filtered air is forced into the compartments through outlets near the floor level, and in cold weather the air is heated to the required temperature according to the predetermined setting of a special compensated thermostat. The equipment consists of a unit, suspended from the underframe, which contains the necessary fan, air filters, and heating apparatus, from which the conditioned air is conveyed to the compartments by suitably lagged metal ducts, and passes to the outside atmosphere by means of extractor type sliding shutter ventilators situated over each body side light and also through perforated metal grids situated over each compartment sliding door.

FIRST-CLASS COMPARTMENTS.

The interior decoration of the various units introduces several novel features. The first-class compartments, each of which seats four passengers, have been decorated in blue with chromium-plated metal fittings. The walls above the seat backs are covered with blue rexine and the ceiling with rexine of a lighter shade. The basis of the whole design is to provide a feeling of spaciousness in the compartment, and this is enhanced by the provision of vertical chromium-plated luggage strips on the partition.

The seats are upholstered in silver and blue broche rep, the seat fillings being of the Vi-Spring type. The hinged centre armrests, the side armrests and the headrests have fillings of Dunlopillo rubber. Loose feather cushions in blue silk are also provided. Each window is provided with a blind of blue rexine, whilst silver and blue silk curtains are fitted to each body side light.

Tubular lamps are used throughout, a 35-watt lamp in a chromium-plated reflector being fitted in the centre of the ceiling. Tubular reading lamps of 15 watts capacity are fitted in each corner above the seat back. Each tubular reading lamp previously described provides illumination from one particular position, but in order to give a good general lighting, just above seat level a large rectangular mirror has been placed over each seat back below the parcels rack. This mirror is so inclined that the light from the tubular lamp in the ceiling is reflected on to the book or newspaper which the passenger may be reading.

free from any mouldings or projections which might collect dust.

Loose chairs are provided, one on each side of a centre gangway, and are upholstered in a blue tapestry with trellis design, the seat fillings being of the Vi-Spring and Vito type.

The ceiling is tinted pale blue. The floor is covered with a sponge rubber underlay, on which is placed a blue jaspé Wilton carpet.

Tubular lighting is again employed in this saloon, two 35-watt tubular lamps in chromium reflector type fittings being fixed to the cornice above each side window. A fixed standard table lamp with a beige Nacrolaque shade is fixed to the waist rail at each table.

The walls of the third-class restaurant car are flush panelled in quartered teak, the fittings throughout being chromium-plated. The fixed seats are arranged two on one side of the gangway and one on the other, and are upholstered in green uncut moquette.

The carpet in the third-class restaurant car is fawn with a black and green pattern; a sponge rubber underlay is provided. Each section is lighted by means of one 60-watt opal lamp in the centre of the ceiling.

THE KITCHEN.

The kitchen, which comprises the centre unit of the triplet restaurant car set, has a large kitchen, pantry, attendants' compartment and attendants' toilet, and is provided with electric cooking apparatus. The power equipment follows generally the lines of the previous equipments supplied by J. Stone and Co., but considerable changes have been made in the actual cooking appliances, the finish of which is generally in stainless steel and vitreous enamel.

With the exception of the coffee machine, the actual cooking equipment has been supplied by Henry Wilson, Ltd., as sub-contractors. Previous stoves and accessories have been built up with cast iron sections, but in the equipment now being described the framing is of light steel sections electrically welded. A great saving in weight is thereby obtained, together with greater economy in current due to a reduction in radiation losses. The main cooking range is fitted across one end of the kitchen, and comprises a roasting oven, steaming oven and grill, together with a boiling table having four boiling plates. A special feature of the boiling table is that the whole of the top surface is heated and is not, as hitherto, composed of small separate heating elements. A hot cupboard has been provided on the corridor side, the top of which has been constructed to form a heated carving table with special wells for sauces, gravies, &c. An auxiliary hot

The switchboards are in general similar to those on previous equipments of this type, except that the main switchboard is of a special type in which the bodies of the indicator lamps and switches are enclosed, the switchboard being specially ventilated.

An automatic hot water boiler, by W. M. Still and Co., Ltd., supplies hot water to all sinks in the kitchen and pantry.

Letters to the Editor.

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

HIGH-SPEED TRAINS AND VIBRATION.

SIR,—I am, of course, very pleased to find that my friend Mr. Dewhurst agrees with me that the usual amount of play between the flanges and rails is excessive and undesirable, although he proposes a much more difficult and costly remedy, for reasons that I am by no means sure are sound.

I should like to draw attention to a most interesting and quite unsuspected phenomenon which is brought to light in a valuable paper read at Lucknow by Mr. C. W. Clarke, and published in the current number of the *Journal of the Institution of Locomotive Engineers* (page 469). It is that on the G.I.P. Railway "with standard coaching stock, for each specific radius of curvature, there is a critical speed, at which speed the train resistance on the curve is less than that on level tangent track."

I think the only possible explanation is that the running is steadier, owing to the flanges settling against the outer rail (as the speed goes up still more, of course, the friction increases).

If this theory is correct, the argument for reducing the play is strengthened.

C. F. DENDY MARSHALL.

Guildford, September 18th.

It is reported that oil has been struck at Heide, in Holstein, Germany, the well having a daily output of 18 tons.