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 tapings, 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 M.E. & 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, composed of a designed output of 20 b.h.p. at 800 r.p.m. The firm is also exhibiting a McLaren-S.L.M. four-cylinder marine engine, with Parsons reversing 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 150 mm. The gear is designed to give equal speed ahead and astern. A twin-cylinder L.M. unit of similar design has a designed output of 30 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.-Boo! feed pumps and atomisers, and several of the units are demonstrated in actual operation.

THE RAPID MAGNETISING 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 ware, pottery, or sanitary ware is made contains small particles of iron, a speckled appearance is found in the product. This separator is suitable for the removal 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 divertsors also serrated. It is found that fine particles of iron are particularly attracted by the edges of the magnet and the serrations create a number of such edges and thereby increase the magnetic effect. The divertsors of the chute, of course, obstruct 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 acting through the magnets is turned on, is magnetically raised to the position shown in the engraving. On the current being switched off, the "collapsible bridge" is "collapsed" and swings into a position which diverts the flow of the fluid away from the path of the cleared liquid into a suitable receptacle. At intervals, of course, the current is turned off in this manner for "washing down" and the automatic action of the collapsable bridge makes the device practically fool-proof.

The magnet illustrated in Fig. 34 is also exhibited by the Rapid Magnetting Machine Company, Ltd., and is used for the separation of brass scrap and other materials, among which there may be certain quantities of ferrous materials.

Fig. 31—37 B.H.P. Marine Emergency Generating Set—MCLAREN

prasing a McLaren M.D. B.M. type five-cylinder engine, with a designed output of 87 b.h.p. at 1800 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. F. abs., but the provision of a large radiator and fan makes the set suitable for tropical service. The engine follows the standard McLaren practice and operates on the pre-chamber combustion system with C.A.V.-Boo! 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 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 divertsors of the chute, of course, obstruct 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 acting through the magnets is turned on, is magnetically raised to the position shown in the engraving. On the current being switched off, the "collapsible bridge" is "collapsed" and swings into a position which diverts the flow of the fluid away from the path of the cleared liquid into a suitable receptacle. At intervals, of course, the current is turned off in this manner for "washing down" and the automatic action of the collapsable bridge makes the device practically fool-proof.

The magnet illustrated in Fig. 34 is also exhibited by the Rapid Magnetting Machine Company, Ltd., and is used for the separation of brass scrap and other materials, among which there may be certain quantities of ferrous materials.

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

A S 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 288 miles, at an average speed of 70-3 m.p.h., by the "Silver Jubilee," in celebration of H.M. King George V's twenty-fifth year on the British throne. The following observations on the schedule and on the design of the engine 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. in 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. in 2 minutes only is saved. For the 288 miles from Newcastle to London the average speed including a 3 minutes' stop at Darlington is 67.67 m.p.h.

For the 349 miles from Newcastle to Darlington 40 minutes only is allowed, and the average speed is only 54 m.p.h. This slower 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, and the average speed is only 54 m.p.h. Throughout the course, the speed is reduced by 10 m.p.h. owing to line restriction.

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 283 miles from Peterborough to Grantham, with its long gradient of 9 miles, varying between 1 in 65 uphill and 1 in 47 downhill at Darlington, the speed is 55 m.p.h., 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 60 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 always more or less on one quarter.

An extended investigation has been made into locomotive streamlining from these 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 that partial vacuum draws the steam and smoke down into the boiler, and tends to confuse the look-out. If the locomotive front end is designed with a vertical wedge front to pierce the atmosphere by parting it as the miles, 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.-Boo! 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 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 divertsors of the chute, of course, obstruct 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 acting through the magnets is turned on, is magnetically raised to the position shown in the engraving. On the current being switched off, the "collapsible bridge" is "collapsed" and swings into a position which diverts the flow of the fluid away from the path of the cleared liquid into a suitable receptacle. At intervals, of course, the current is turned off in this manner for "washing down" and the automatic action of the collapsable bridge makes the device practically fool-proof.

The magnet illustrated in Fig. 34 is also exhibited by the Rapid Magnetting Machine Company, Ltd., and is used for the separation of brass scrap and other materials, among which there may be certain quantities of ferrous materials.
to the smoke-box the sloped front plate is divided into two parts, the larger hinged at the top lifting forward and the lower hinged at the bottom lifting forward and downwards over the buffers. These doors are operated from the smoke-box by a hand-wheel or staff via rod from the smoke-box, the lower door overlapping the top door when closed. Inspection doors have been provided along the side of the engine to give access to the different parts of the motion.

The chimney is a three-cylinder simplex 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 41 square feet, a new design of fire grate being adopted giving a space opening equal to 56 per cent. of the grate area. Part of the grate is arranged to swing, and the exhaust backhead is completely welded. The fire-box is insulated with fireclay and gives a free air flow under the outer side bars. The boiler barrel is made in two courses. The first course is parallel, 31 ft. 9 in., outside diameter, the plates being 9 in. thick; the second course is circular, having a maximum diameter of 41 ft. and is of plate 1 in. thick. The distance between tube plates is 11 ft. 11 in.

The grate area of the engine is a composite of two forms, a special boiler, steel pressed integral with the smoke-box, the steam supply being taken through a series of in. slots cast in the top of the barrel plate. The fire-box is of copper and, including the combustion chamber, is 108. 1 ft. long. The throat plates of both the copper box and the outer casing are each in one piece. The copper wrapper plates are 9 in. thick and the tube plate 1 in. thick.

The regulator is of the double-beat type and feeds into a main steam pipe of 7 in., diameter. The superheater is of the Robinson type, the forty-three elements being expanded into a cast steel header. The Curchward of the G.W.R. for working the engine at a long cut-off.

The valve gear is of the company's standard type, in which the outline of the connecting rods is similar to those at present fitted to the ordinary "Pacific" engines. Forty per cent. of the total reciprocating weight is balanced at the wheel base.

The overall speed is 87-07 m.p.h.
The floor is covered with blue linoleum, over which is laid a blue jasper Wilton rug.

**Dining Cars and Third-Class Compartments.**

The third-class compartments are designed to seat six in each, and all of them are being carried out in green and the fittings chromium-plated. Lighting is provided with 35-watt lamplights, has a large central and in the open portion of the adjacent semi-open car being panelled in figured maple and walnut.

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

Plywood has been used throughout for the interlining 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 plate.

The whole of the train with the exception of the kitchen cars and Wilton carpet. The dining cars are of the Institution of Locomotive Engineers, the well having its own well, the former being heated by direct heating of the hot water tank. A fish fryer is provided in the kitchen, together with an ice cream cabinet operated from the same unit. An extension of the refrigerator for the dining cars is on a level tangent, and paper, 64.5 centimetres.

**First-Class Compartments.**

The interior decoration of the various units introduces several novel features. The first-class compartments, each with a side window. The seats are upholstered in silver and blue brocade, the seat fillings being of the Vi-Spring and cotton wadding, 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 linoleum, whilst silver and blue silk curtains are fitted to each body light.

Tubular lamps are used throughout, a 36-watt lamp in a chromium-plated fitting being fitted in the centre of the ceiling. Tubular reading lamps of 15 watts capacity are fitted in each compartment over the back seat. Each tubular reading lamp previously described provides illumination from one particular position, but in order to give a general lighting, just above seat level a large rectangular mirror has been placed over each seat back below the parapet. 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.

The engineering is reported that oil has been struck by Mr. D. Whurst, and of the Institution of Locomotive Engineers (page 469).

It is that on the G.I.R. Railway with standard Coaching stock, for each specific radius of curvature, there is a critical speed, at which the speed of the train remains on the curve is less than that on level track.

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

If this theory is correct, the argument for reducing the play in the wheelset is weakened.


Goldford, September 18th.

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