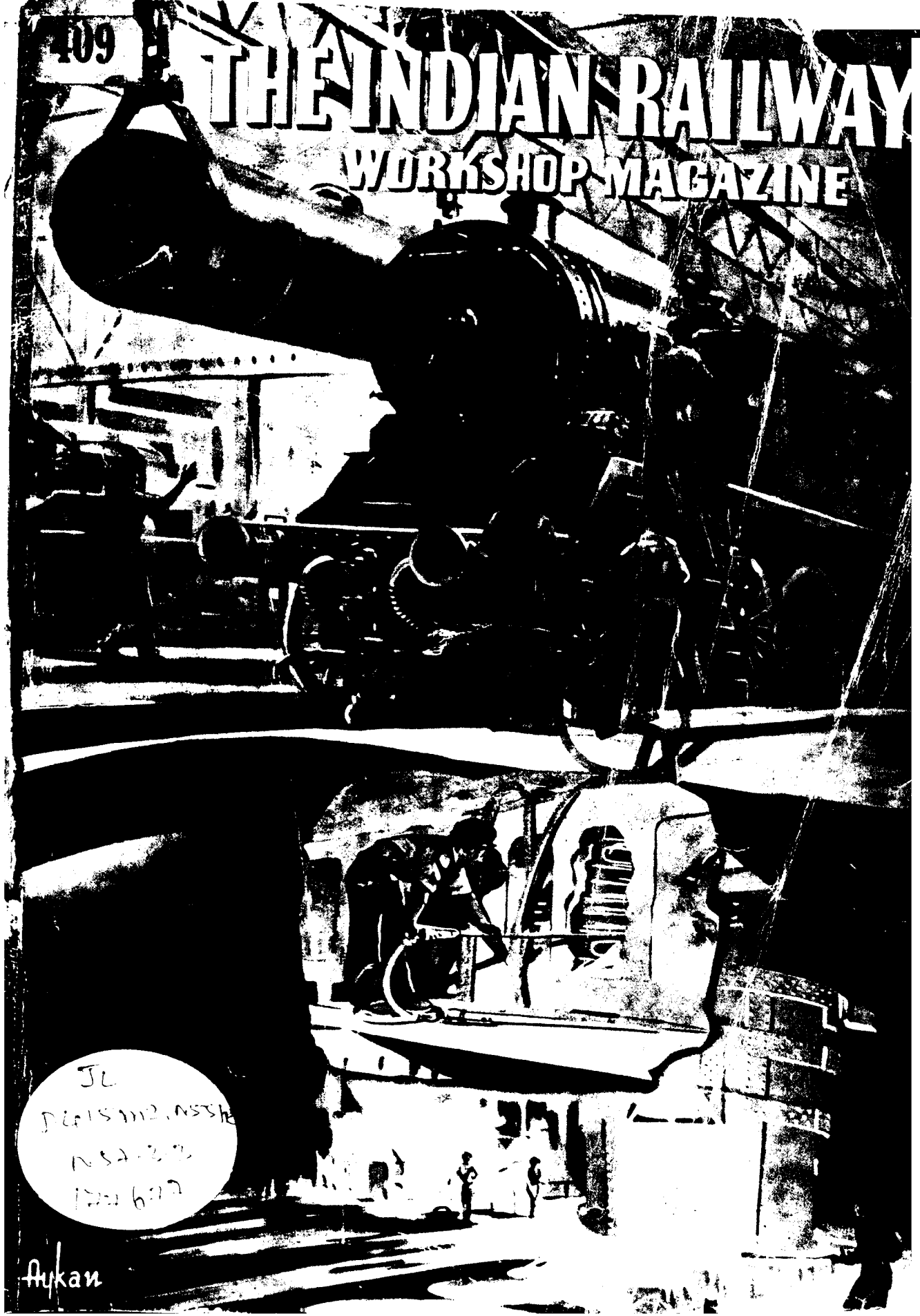


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THE INDIAN RAILWAY

WORKSHOP MAGAZINE



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THE INDIAN RAILWAYS WORKSHOP MAGAZINE

ENGINEERING & LOCOMOTIVES SUPPLEMENT

Vol. III No. 3

MAY 1957

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BRITISH PAINTS SPECIALITIES FOR LOCOMOTIVES

DIESEL LOCOMOTIVES

To meet this demand a special coating has been evolved known as "Luxol" Crankcase Enamel. Used in connection with a preliminary coat of "SYNTEX" Wash Primer, to promote better adhesion, this treatment gives excellent service.

The water spaces surrounding the cylinder are often subject to corrosion which can be prevented or checked by the application of "Apexior" No. 1 to properly cleaned surfaces. This material is already well known in the field of steam raising and its efficiency in Diesel Engines is quite equal. The inert "Apexior" film does not interfere with the transmission of heat, is less soluble than the metal itself, and is incapable of reaction with any corrosion-inducing influences present in the water.

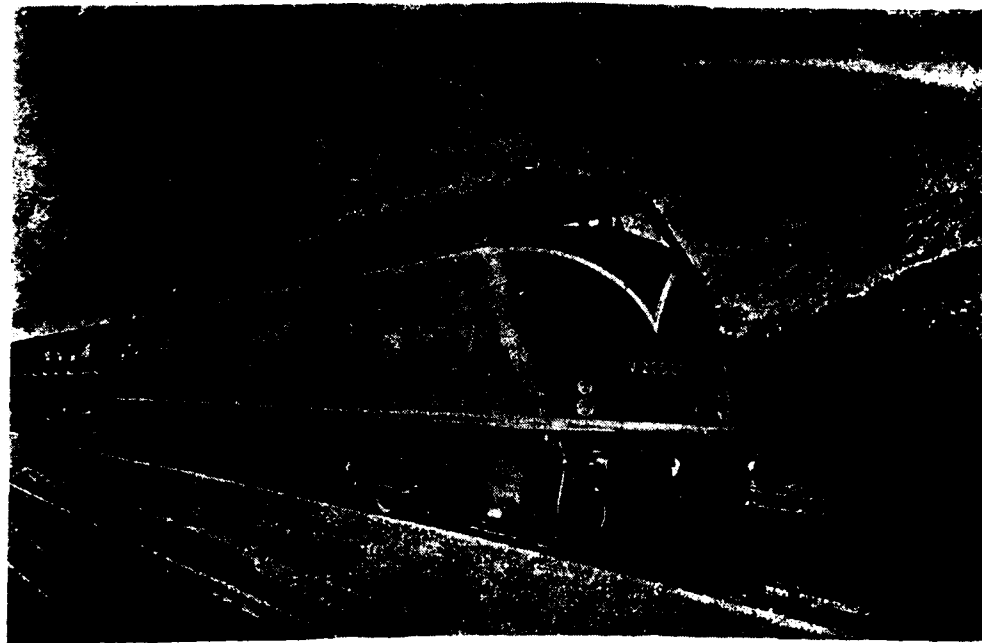
The regular use of these two products will ensure freedom from corrosion in areas which are usually very difficult to protect.

STEAM LOCOMOTIVES

Corrosion on the external surfaces of the barrels can be completely eliminated by the application of three coats "Apexior" No. 3, applied to thoroughly cleaned bare metal before the lagging is applied. "Apexior" No. 3 is a highly specialised bitumen coating of proved ability in this particular field.

Internal corrosion in Steam Locomotives can be checked if already present, by the timely application of "Apexior" No. 1 to the interior of the Barrel and the exterior surfaces of the tubes.

Both "Apexior" Coatings have been specified for large numbers of I. S. R. Locomotives during the past 30 years.



Diesel-powered locomotive of the German Federal Railways equipped with Mercedes-Benz engines, model MB 820, fitted with supercharger. (Represented in India by M/s. Tata Locomotive & Engineering Co., Ltd., Automotive Division, Bombay.)

THE SURE SHIELD

Against corrosion in steam-raising plant



Applied like paint "APEXIOR No. 1" which is less soluble than steel guards against corrosion in boilers and steam-raising plant. Generally "APEXIOR" has been the standard remedy for 50 years and is still supreme. Withstands hot-wet temperatures up to 1000°F. (For cold-wet temperatures below 125°F, use "APEXIOR No. 3".)

PREVENTS CORROSION
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Write for the 33rd Edition of "The Apexior Manual" which gives full details of "APEXIOR No. 1", and "APEXIOR No. 3".

Electric and Diesel-Electric motive power by G. E. C.

IN its works at Witton, Birmingham, and Dudley Port, near Wolverhampton, The General Electric Co. Ltd. of England manufactures traction equipment for all types of electric and diesel-electric railway motive power. Complete locomotives and rolling stock for all electrification systems and voltages and for diesel-electric services are supplied in conjunction with leading British manufacturers of mechanical parts.

Orders in hand and work recently completed are representative of the many different railway operating requirements of which the Company has experience. Following the decision of British Railways to adopt the 50-cycle, single-phase system of a.c. traction, equipments are in production for multiple-unit suburban trains and for main-line locomotives to operate on a normal line voltage of 25 kV, with automatic changeover for running on a 6.6 kV supply

on sections where clearances are restricted. The seventy suburban train a. c. equipments now in course of manufacture for British Railways are for installation in three-coach units each comprising a driving trailer, motor coach, and second driving trailer. The power equipment will be mounted on the motor coach underframe, and the battery, battery charging equipment and compressor, will be carried on the underframe of the second driving trailer.

The motor coach transformer, the switchgear for series or parallel connection of the primary winding to permit operation on 25 or 6.6 kV, and the cam group tap changer in the secondary circuit for control of the traction motor voltage, will form a single assembly, all parts being oil-immersed and cooled by forced oil circulation.

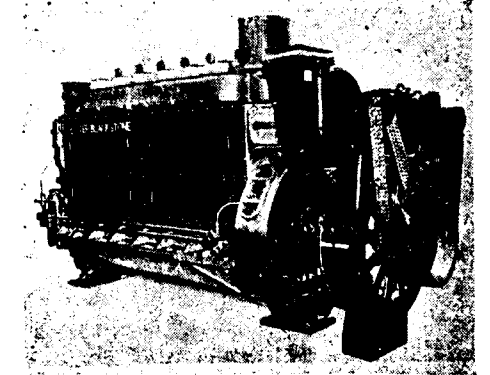
The alternating current will be rectified by a group of single-anode rectifiers with liquid

cooling by forced circulation. Smoothing of the d. c. input to the traction motors will be provided by air-cooled chokes.

The four axle-hung, nose-suspended, self-ventilated traction motors will be rated at 200 h. p. (one-hour) and will be designed specially for operation on d. c. with a ripple component. Silicone insulation (Class H) will be used for the traction motors and smoothing chokes. The motor contactors, weak-field contactors and reverser will be electro-pneumatic. All auxiliary machines will be driven by rectifier-fed d. c. motors supplied from a low-tension tertiary winding on the transformer. Overall protection of the equipment will be given by an air circuit-breaker, which, with the pantograph, will be supplied by British Railways.

Acceleration will be automatically controlled and the control scheme will provide a shunting notch followed by three running notches, in the last of which the motors will operate in weak field.

Ten complete main-line locomotives are also being supplied for the British Railways 50-cycle electrification. This design has been developed in close collaboration with the North British Locomotive Co. Ltd., who will build the mechanical parts. Five of the locomotives will be geared for a top

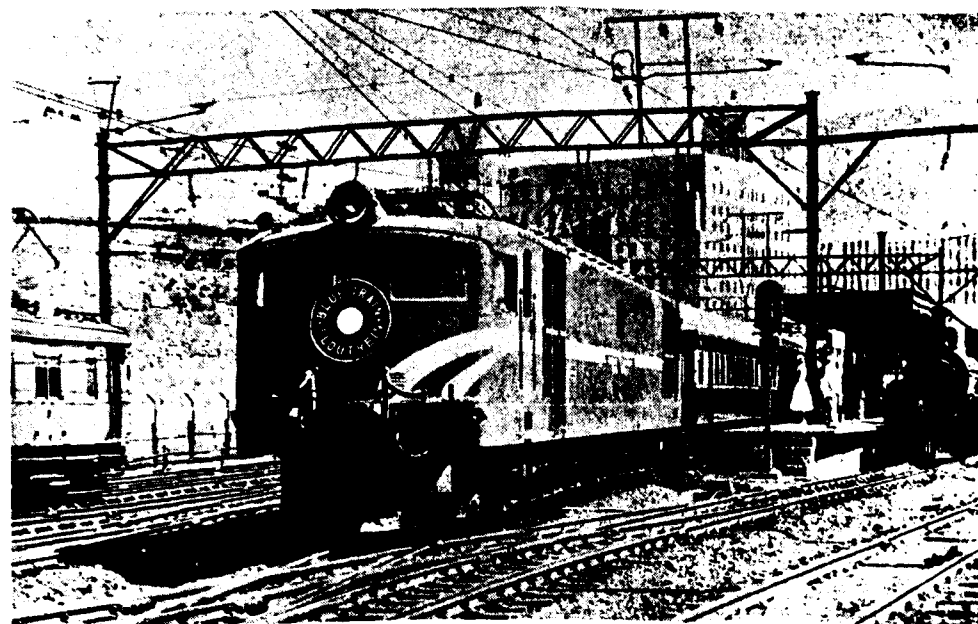


Power unit of 350 h.p. diesel-electric shunting locomotive comprising Lister-Blackstone engine and G.E.C. main and auxiliary generators, with belt-driven traction motor blower.

speed of 100 m. p. h. and five for 80 m. p. h., but both versions will be mixed traffic units in the fullest sense for those with the 100 m. p. h. gear ratio will be able to haul mineral trains of up to 950 tons at 55 m. p. h. The locomotives geared for 80 m. p. h. maximum will be capable of hauling a 1,250-ton freight train between Manchester and Willesden (London) at an average speed of 42 m. p. h., including four one-minute stops and observance of all speed restrictions, with a top speed of 55 m. p. h.

The locomotive body will be of special lightweight construction using light steel sections, the underframe, sides and ends forming an integral load-bearing structure. It will be carried on two two-axle bogies, in which the traction motors will be fully-springborne and will be geared to the axles through spring drives. There will be a driving cab at each end of the body. Weight in working order will be 80 tons and the continuous rating 3,300 h. p. The tractive effort at starting is a maximum of 60,000 lb.

Control of the locomotive will be effected on the high-tension side of the transformer. For 25 kV operation the regulating trans-



The Blue Train of the South African Railways leaving Cape Town Hauled by N.B.L. — G.E.C. 3,000 V. d. c. electric locomotive



Battery locomotive equipped by the G.E.C. for operation on tube lines of the London Transport Executive.

MAY 1957

former will act as an auto-transformer, the voltage across the tapped portion of the winding being 6.6 kV. When running on 6.6 kV the tapped portion only will be in circuit, the necessary switching for either line voltage being effected automatically. By means of the tappings a variable voltage will be supplied to the primary of the main step-down transformer feeding the traction circuits, the maximum on either contact line voltage being 6.6 kV.

The main and regulating transformers, high-tension tap-changer and the selective switchgear for alternative line voltages will form a single assembly, all parts being oil-immersed and cooled by forced oil circulation. An air-blast circuit-breaker will protect the electrical equipment.

The alternating current from the main transformer secondary will be rectified by a group of single-anode rectifiers, the d. c.

output from which will be smoothed by air-cooled chokes and fed to the forced-ventilated traction motors.

Principal auxiliaries will be powered by d. c. motors fed from a mercury-arc rectifier or from d. c. generators. A special winding on the transformer will provide a supply for electric heating in rolling stock.

The rectifiers to be used in the foregoing 50-cycle, single-phase equipments have a particularly favourable power/weight ratio and are of small dimensions, the design having been developed specially to meet the requirements of installation in locomotives and motor coaches.

DIRECT CURRENT TRACTION

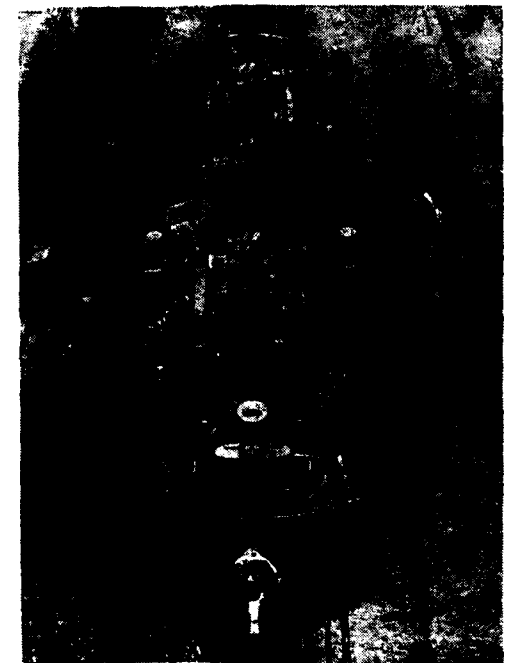
This year has seen the introduction of semi-express type rolling stock for limited-stop services on the 1500V d. c. electrifica-

tion between London (Liverpool Street) and Southend-on-Sea, a popular resort and large residential area at the mouth of the River Thames. The equipments supplied by the G. E. C. for the 32 four-coach multiple-unit trains built by British Railways for these services are representative of the Company's latest practice for the 1,500V system. Each motor coach is powered by four axle-hung, nose-suspended motors, the two motors in each bogie being permanently in series and controlled by series or parallel connection of the two pairs. Ratings of a four-coach unit are as follows:

	Full-field	Weak-field
1-hr.	800 h. p.	880 h. p.
Continuous	632 h. p.	696 h. p.

Two rates of automatic acceleration, selected by alternative "forward" positions of the reverser handle, are available. The normal rate is 1.1 m. p. h. p. s., while the lower rate, intended for use in greasy rail conditions, is 0.85 m. p. h. p. s. The electro-pneumatic contactor control equipment, with the relays, reverser and motor cut-out switch is accommodated in three cases mounted in the motor coach underframe, and is operated from master controllers in the driving trailers at each end of a unit, the motor coach being the second vehicle from one end. In the main contactors the butt contact interlocks, protected by "Perspex" covers, and the electro-pneumatic valves are mounted at the front so that both are accessible when the front covers of the equipment cases are removed.

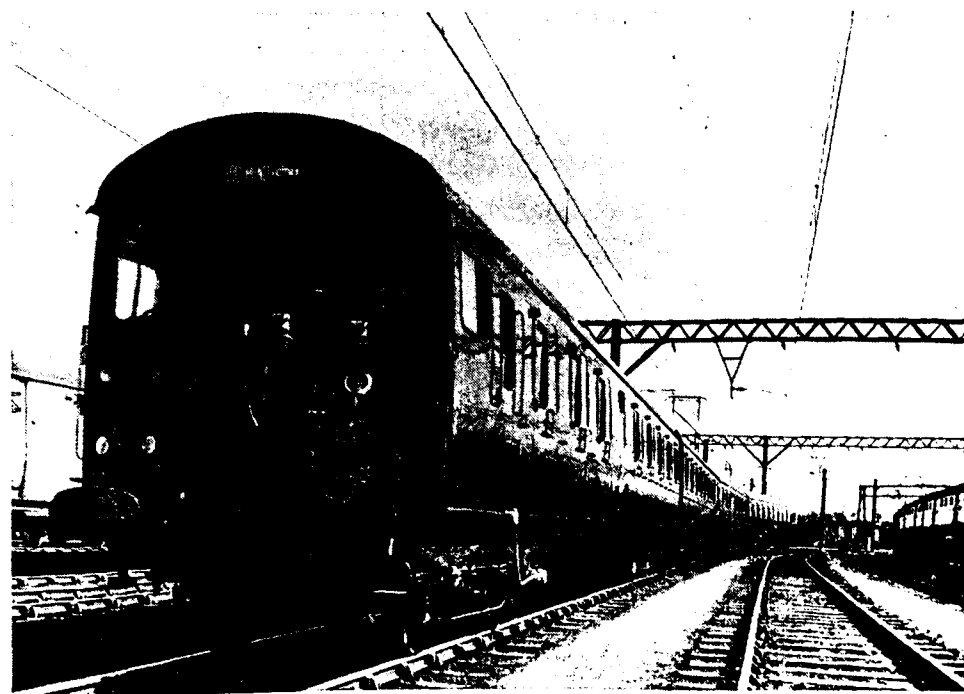
In this stock as in other recent G. E. C. equipments the tripping of an overload relay is arranged to illuminate an indicator lamp in the unit affected through a contactor which latches in. Consequently the lamp remains alight after the driver has reset the overload relay from his cab



Motor bogie of N.B.L. — G.E.C. 3,030 h.p., 3,000 V d.c. locomotive for the South African Railways.

pushbutton, and, as long as the control key is in position, identifies the motor coach in which the overload has occurred. The indicator lamp contactor is reset by the maintenance staff at the depot when investigating the cause of the overload or its effects.

In supplying equipment for electric rolling stock the G. E. C. provides from within its own organisation the electrical services which contribute to the comfort and convenience of railway travel. Typical of the facilities available is the toilet water heating installation in the Southend stock. The 1½ kW, 1-gal. water heaters in each toilet compartment are thermostatically controlled via contactors in underframe equipment cases. A special locking device is incorporated to secure the thermostat at any of three temperature settings so that it is



Four-coach multiple-unit set with G.E.C. electrical equipment for the Liverpool Street—Southend Service, British Railways, Eastern Region.

unaffected by vibration, and the complete heater is thoroughly shock-tested.

The Company is also supplying electrical equipments for 57 three-coach multiple-unit sets which are about to go into service on the London suburban routes of the London Midland Region, British Railways, from the Euston and Broad Street termini. These trains operate on a 630V d. c. third—and fourth-rail supply and incorporate an improved design of shoe gear in which rubber is used as a noise-damping and springing medium. The power busline connections between coaches, through which the various sets of shoe gear in a train are interconnected, are provided by jumpers and receptacles of a new design in which line contact with the plugs is obtained by the use of spring-loaded fingers. Air-operated cam groups are employed for reversing and field-weakening. In addition to two rates of automatic acceleration selected from the reverser handle, an emergency setting of the accelerating relay can be obtained by operating a normally-sealed pushbutton if it is necessary to start against a severe gradient with one pair of motors of the four-motor equipment cut out of circuit.

Ratings of a unit of these London Midland Region trains are as follows:—

	Full-field	Weak-field
1-hour	680 h. p.	740 h. p.
Continuous	540 h. p.	600 h. p.

The two motors in each bogie are permanently in parallel and are controlled by series or parallel connection of the two pairs.

Other low-voltage d. c. equipment supplied by the G. E. C. includes large numbers of motors for the underground and tube lines of the London Transport Executive, the latest design being an 80 h. p. (continuous rating) machine for new prototype tube trains in which one axle of every bogie

will be motored. An air-operated camshaft controller for tube rolling stock has been developed, and two experimental regenerative equipments are being supplied for the Executive's trials with regenerative braking in tube stock.

D. C. ELECTRIC LOCOMOTIVES

The efficiency of the modern d. c. electric locomotive as an operating unit is based both on the wide range of duties a single design can undertake and on high availability resulting from minimum maintenance requirements. Several years' service of the 3,000V, 3,030 h. p. Class "4E" locomotives on the South African Railways have demonstrated their merits in both respects. The locomotives were built by the North British Locomotive Co. Ltd. and equipped by the G. E. C. for service on the Cape Town-Touws River section of the main line to Johannesburg. Heavy gradients in the Hex River Valley imposed special requirements, such as the ability to start a 1,070-ton goods train on a 1 in 66 grade, or a 610-ton passenger train on a 1 in 50 grade. Regenerative braking alone was required to hold trains of these two types at speeds of 25 to 40 m. p. h. and 40 to 55 m. p. h. respectively down a gradient of 1 in 66. To meet these braking demands the locomotives are equipped for regeneration in all three groupings of the six traction



British Railways standard 350 h.p. diesel-electric shunter with G.E.C. power equipment

motors, while flexibility of control when motoring is obtained by the provision of three weak-field notches in each grouping. Two of the locomotives can be operated in multiple when required.

In these locomotives the lateral forces imposed on the track have been considerably reduced by allowing the motors a limited amount of transverse movement relative to the axle under the control of rubber springs between the motors and the bogie frame.

BATTERY LOCOMOTIVES

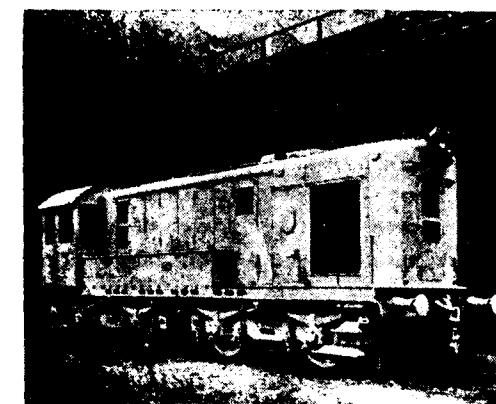
On electrified systems provision must be made for hauling trains for permanent way and other maintenance duties when power is off. Numbers of equipments for work of this type have been supplied by the G. E. C. to the London Transport Executive for installation in battery locomotives. In this particular instance provision is made for taking a supply from the third rail when power is available. The control system is designed to permit very fine control at crawling speeds when cable-laying as well as for running at speeds which do not interfere with normal traffic. These service conditions have resulted in the development of equipment able to meet economically any requirements likely to be put forward for battery locomotives or passenger vehicles.

DIESEL-ELECTRIC TRACTION

At the present time the G. E. C. has orders in hand for the diesel-electric traction equipment of high-speed Pullman trains, main-line locomotives and shunting locomotives. The five high-speed trains, which are being built by the Metropolitan-Cammell Carriage and Wagon Co. Ltd., Saltley, Birmingham, will operate on British Railways between London and Bristol, London and Manchester, and London, Birmingham and Wolverhampton. There will be two power cars in a train, each with a machinery compartment containing a N. B. L./M. A. N. 1,000 h. p. pressure-

charged vee 12-cylinder engine direct-coupled to a G. E. C. single-bearing main generator with belt-driven auxiliary generator. Eight self-ventilated traction motors will be distributed through the train. The motors will be fully-springborne in the bogies and will be geared to the axles through Brown-Boveri spring drives. Cooling air will be supplied to the motors through ducting from protected intakes.

The control system will comprise a combination of main generator field control



A 625 h. p. diesel-electric locomotive for the Ceylon Government Railway built by the North British Locomotive Co., Ltd., with G.E.C. power equipment.

and engine speed variation, with automatic torque control through an oil servo-regulator. A range of several engine speeds will be provided by means of three air-operated pistons acting on the engine governor through a system of interconnected levers.

Equipments are being supplied for 20 Bo-Bo locomotives being built by the North British Locomotive Co. Ltd. for British Railways in connection with the British Transport Commission's modernisation programme. One of these is a 1,000 h. p. design powered by a 12-cylinder N. B. L.—M. A. N. engine and the other a 800 h. p. locomotive with a 16-cylinder Paxman YHXL engine. In each case the diesel engine will be direct-coupled to a G. E. C. main

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generator with overhung auxiliary generator, and the four axle-hung, forced-ventilated traction motors will drive the axles through Wiseman resilient gearwheels. When running on any power notch, transitions between full-field and weak-field in the traction motors, both forward and backward, will be made automatically, thus ensuring maximum utilisation of engine power over a very wide speed range.

In G. E. C. diesel-electric equipments for horsepower ratings of the above order, the control system operates by a combination of main generator field control and variation of engine speed. An automatic load control system, acting on the main generator field, is available on all controller notches, and although it does not normally come into action on the lower engine speeds it acts immediately to relieve over-loading should the engine power output fall for any reason while running on any notch. Otherwise, the system acts to match the generator output to the power demand over the widest possible range of locomotive speed, ensuring that the output is fully utilised and protection is given against overloading the diesel engine.

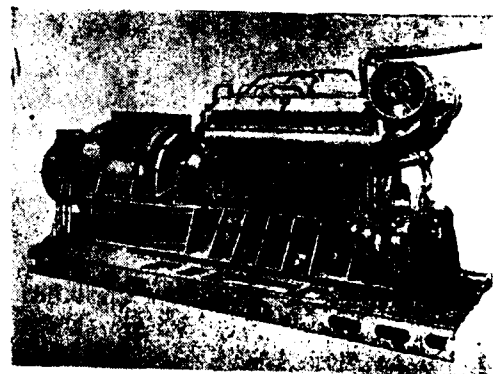
The oil servo regulator in the automatic load control system provides very finely-graded adjustment of the field circuit resistance in a compact form by means of numerous tappings connected to the segments of a fixed commutator, around which brushes are moved by the servo mechanism. The vane type servo motor ensures precise adjustment to varying conditions with negligible hunting.

Many of the British Railways 350 h. p. standard 0-6-0 diesel-electric shunting locomotives are now being powered by the G. E. C. The equipment supplied for duties of this type comprises a Lister-Blackstone 6-cylinder vertical 4-stroke engine with a flange-mounted main generator, on

top of which are mounted an auxiliary generator and a traction motor blower, both belt-driven. The generators and blower form a combined unit with the engine, thereby dispensing with the need for a separate bedplate, but they can be detached from the engine as a single combined assembly.

With the diesel engine running at idling speed, ten steps of generator field control provide control of the locomotive speed, after which the engine speed can be adjusted continuously between idling and maximum r. p. m. to provide a stepless control which is of particular value on shunting duties. Series or parallel connection of the two traction motors is selected by means of an off-load switch. When running in parallel with the controller moved to its furthest extent, generator excitation is increased automatically subject to the overriding control of a voltage relay which restricts working in these conditions to the upper part of the speed range. The controller and reverser handles are duplicated at each end of the desk to permit driving from either side of the cab.

In these shunting locomotive equipments the drive is through double-reduction gearing. The whole gear train is located on the same side of the traction motor, which



Engine-generator set supplied by the G. E. C. for Ceylon Government Railways 625 h. p. diesel-electric locomotives. The engine is a Davey, Paxman 12 RPHXL 12-cylinder vee type.

facilitates demeshing when a locomotive has to be towed. The hollow intermediate shaft and its roller bearings are mounted in eccentric housings which are joined by a spindle passing through the hollow shaft. A square end on this spindle projects beyond the inner bearing cap so that it can be turned by a spanner. Two bolts lock the bearing housings in the meshed or demeshed positions, and after they have been removed, rotation of the spindle by the spanner moves the gears into or out of mesh as required. The operation can be carried out quickly and easily by one man.

GENERAL DEVELOPMENT

Means of increasing the output from G. E. C. traction machines are being studied continuously and improvements have been effected in the transfer of heat from windings

to the cooling air, giving higher output for a given temperature rise. Practical experience has also been gained in the use of Class H insulation, which permits higher operating temperatures. Investigations of bogie construction, and of adhesion with various methods of motor combination and control, have contributed to understanding of the fundamental problems common to all types of locomotives and rolling stock powered by electric motors.

The G. E. C. organisation as a whole enables the Company and its associates to supply complete equipment for railway electrification from its own resources, including substation plant, distribution cables and overhead line equipment, remote supervisory control systems, signalling installations, and all electrical services for rolling stock.



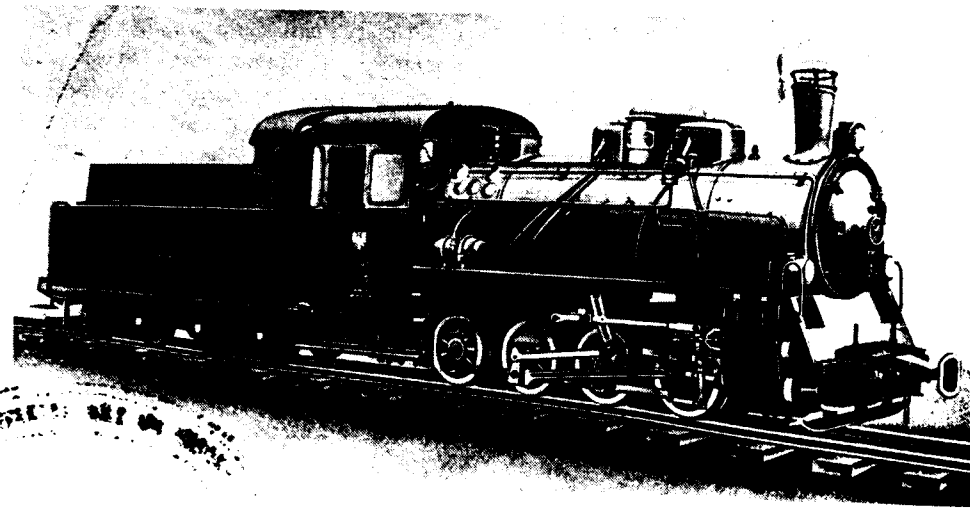
Makers of HIGH QUALITY Arc Welding Electrodes

WE THANK
The Railways,
Integral Coach Factory
And Chittaranjan Loco Works
for the support and patronage
extended to our Industry
and assure them of our
continued service.

J. B. ADVANI-DERLIKON ELECTRODES PRIVATE LTD.,
ADVANI CHAMBERS,
SIR PHIROZSHAH MEHTA ROAD,
BOMBAY-1

Factory: BHANDUP

WHAT METAEXPORT OF POLAND CAN OFFER TO INDIAN RAILWAYS?

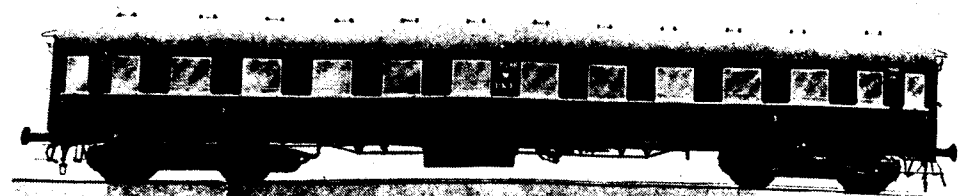


Narrow-Gauge Steam Locomotive

Type 0-8-0 - Series Px-48

Gauge
Working-steam pressure
Maximum speed
Maximum axle load
Water capacity of tender
Coal capacity of tender
Total length of locomotive with tender over buffers
Total wheel base of locomotive with tender
Weight of locomotive and tender, empty
Draws at 9.3 miles/h. a loaded wagon-convoy of maximum

2 ft. 5½ in.
185 lbs./sq. in.
21.7 miles/h.
5.4 tons
1320 galls.
3.9 tons
42 ft. 10 in.
30 ft. 5½ in.
27.6 tons
445 tons

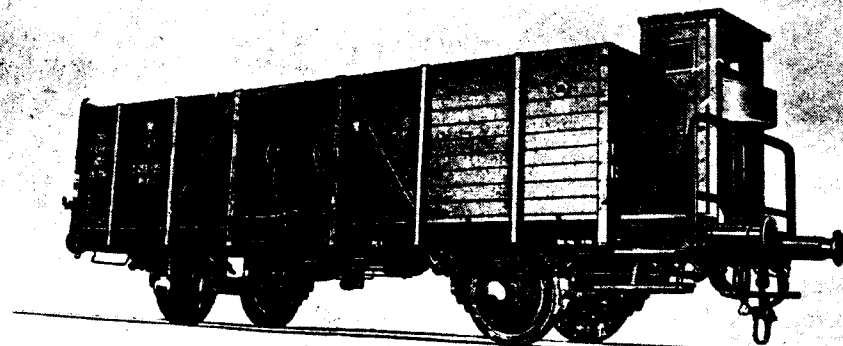


Third Class Coach

Type 2A

Gauge
Number of compartments
Total seating capacity of compartments
Total sleeping capacity of the coach
Weight of coach, empty
Length of coach over buffers

4 ft. 8½ in.
10
80
60
37.4 tons
73 ft. 7 in.

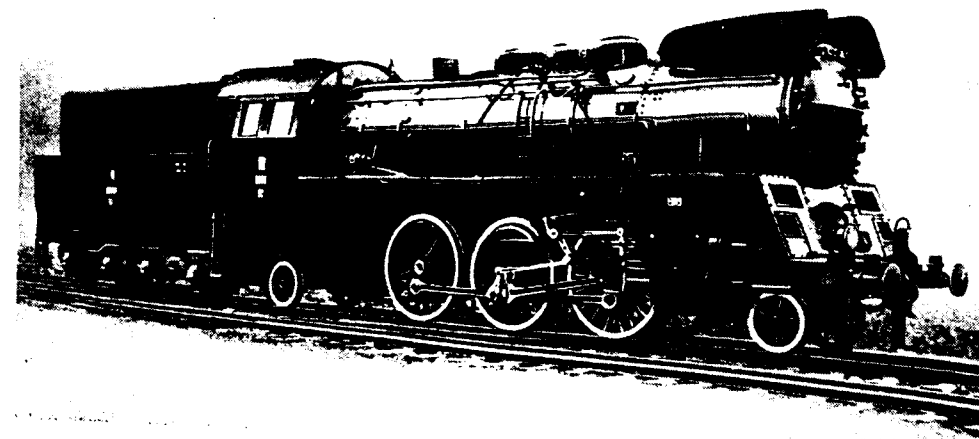


Coal Truck with Brakeman's Cabin

Type 10 W

Gauge
Loading capacity
Loading surface: length
width
Cubic capacity
Max. clearance of open door
Weight of empty truck
Total length of truck over buffers

4 ft. 8½ in.
22.6 tons
26 ft.
9 ft.
1194 cu. ft.
4 ft. 11 in.
10.1 tons
32 ft. 7 in.

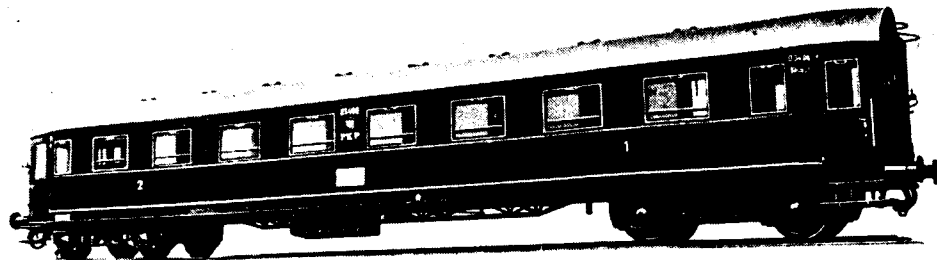


Passenger Steam Locomotive

Type 2-6-2 - Series 01-49

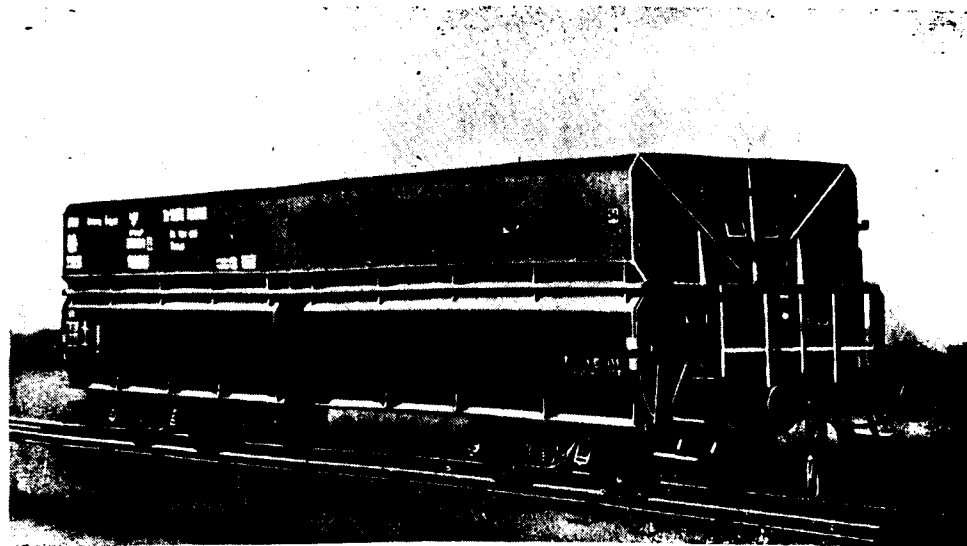
Gauge
Working steam pressure
Maximum speed
Maximum axle load
Water capacity of tender
Coal capacity of tender
Total length of locomotive with tender over buffers
Total wheel base of locomotive with tender
Weight of locomotive and tender, empty
Draws at 37 miles/h. a loaded wagon-convoy of maximum

4 ft. 8½ in.
228 lbs./sq. in.
62 miles/h.
16.7 tons
5500 galls.
11.8 tons
67 ft. 10 in.
56 ft. 8 in.
98.5 tons
740 tons



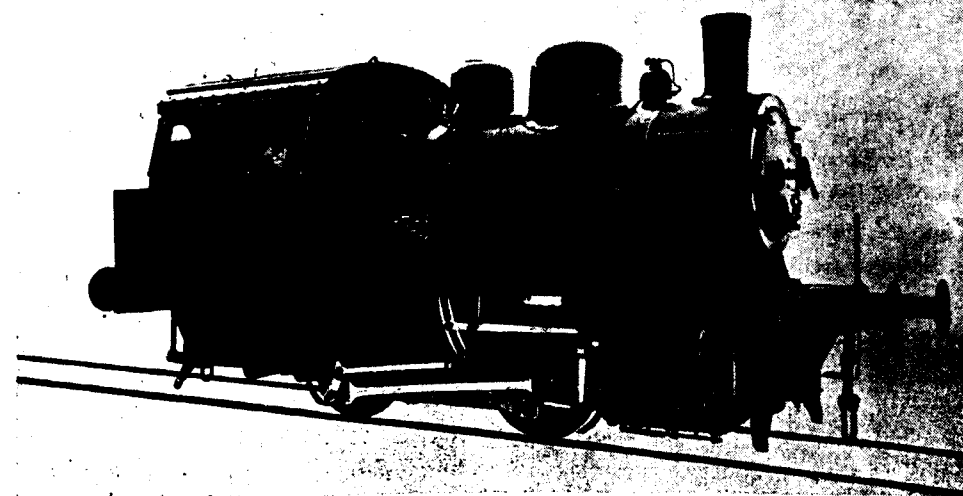
Composite Coaches
Types 5A and 6A

	5 A			6 A	
	1st class	2nd class	3rd class	1st class	2nd class
Number of compartments	2	2	4	2	6
Seating capacity of the compartments	8	12	32	8	36
Number of sleeping berths	4	8	24	4	24
Gauge	4 ft. 8½ in.				
Weight of coach, empty	36.4 tons				
Length of coach over buffers	73 ft. 7 in.				



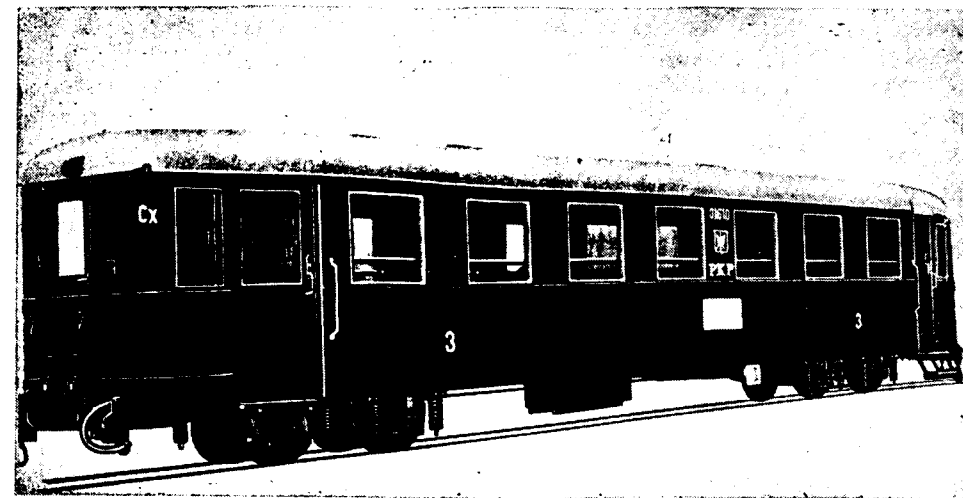
Self-Clearing Truck
Type 20 W

Gauge	4 ft. 8½ in.
Loading capacity	53.1 tons
Weight of empty truck: for coke	23.6 tons
for coal	23.1 tons
Cubic capacity: for coke	3178 cu. ft.
for coal	2472 cu. ft.
Total length of truck over buffers	47 ft. 11 in.



Steam Tank-Locomotive
Type 0-4-0 - Series BA

Gauge	2 ft. 11⅝ in. — 3 ft. 3⅝ in. — 4 ft. 8½ in.
Working steam pressure	200 lbs./sq. in.
Maximum speed	21.7 miles/h.
Maximum axle load	12 tons
Water capacity	660 galls.
Coal capacity	1 ton
Total length of locomotive buffers	23 ft. 3 in.
Total wheel base	6 ft. 10 ⅛ in.
Weight of locomotive, empty	18.7 tons.
Draws at 9.3 miles/h. a loaded wagon convoy of maximum	560 tons



Narrow-Gauge Third Class Coach
Type 1 AW

Gauge	2 ft. 5½ in.
Seating capacity	38
Standing capacity/maximum/	62
Maximum total number of passengers	100
Weight of coach, empty	12.8 tons
Length of coach over buffers	50 ft. 8 in.

OIL-FIRED GEARED STEAM SHUNTING LOCOMOTIVE

A new design of 0-6-0 steam shunting locomotive has been developed by Sentinel (Shrewsbury), Ltd., for heavy industrial duty. It is of 200 h.p., weighs 50 tons and has a starting tractive effort of 26,000 lb. In this locomotive the makers have introduced oil firing, all-gear transmission, roller bearing axleboxes, steam braking, and all parts are designed for accessibility and interchangeability.

TRIALS were recently completed on the prototype of a new design of 200 h. p. steam shunting locomotive at the works of Sentinel (Shrewsbury), Ltd., and eleven of the locomotives are now under construction—eight for Dorman, Long and Co., Ltd., and three for Guest Keen Iron and Steel Company, Ltd. This new 0-6-0 locomotive weighs 50 tons and, although it is in many respects similar to the shunters made by the firm for a number of years, it incorporates several noteworthy new points in design to bring it into line with modern practice and to suit it for its particular duties in heavy industrial operation. Like all Sentinel locomotives, it is designed to work at specific shunting speeds and develop maximum power at these speeds. In low gear the locomotive has a starting tractive effort of 26,000 lb. and a tractive effort of 5720 lb. at the maximum speed of 11.8 m. p. h. In high gear the starting tractive effort is 15,100 lb. and at the maximum speed of 20.3 m. p. h. the continuous tractive effort is 3330 lb. The power available is more than sufficient for the locomotive to haul a 1400-ton train of ordinary wagon stock on level track. The torque characteristics of the locomotive can be seen in the accompanying diagram.

Its box-section chassis frame has 2 in. thick steel side members, and 3 in. thick steel buffer beams extend down to within 8 in. of the rails. Cast steel axle horn guides faced with manganese steel on the wearing surfaces are

dowelled and riveted to the frame. The axles on which the disc wheels are mounted inside the frame members are carried in Timken roller bearing axleboxes supported by heavy duty laminated springs. Drive is transmitted to the middle axle, which is coupled through fly cranks and rods to the two outer axles.

In this new design of locomotive the engines are mounted at the front end and the boiler at the rear end, the driver's cab being situated immediately in front of the boiler and separated from the engine compartment by the fuel and water tanks. The engines are a development of the firm's standard high-speed poppet valve vertical design and are arranged side by side.

Each engine has two double-acting cylinders of 6½ in. bore by 9 in. stroke and develops 105 b. h. p. at 500 r. p. m. The poppet valves of the engines are operated by push rods from a camshaft in the crankcase and this camshaft slides in its bearings to adjust the valves for cut-off or for reversing purposes. Two cut-off positions are provided, giving 75 per cent and 40 per cent admission of steam in both forward and reverse and all the valves can be held in the open position at one setting for draining purposes. In this improved engine detachable valve guides are fitted and the valve chests are enclosed by readily detachable lagged casings to reduce heat losses. Each set of valve mechanism is built as an interchangeable unit, so that when valve regrinding or other maintenance

work is necessary a spare valve assembly can be fitted and the locomotive can be kept in service. A selector fork and control spindle through which the camshaft is moved is coupled through links and a rod to the reversing lever in the driver's cab. The original method of splash lubrication has been replaced by a pressure lubrication system fed by an integral gear pump. This pump feeds into a distribution box, which via reducing valves supplies high-pressure lubricant to the big-end bearings, low-pressure lubricant to the valve gear and camshafts, and oil to a pocket from which it cascades on to the timing gears and drive. The engines are now supported on the frame and gearbox by self-aligning spherical bearing members.

Drive from the side-by-side engines is transmitted to a common gearbox, which has a fabricated steel casing extending across the full width of the locomotive frame. The lower half of this gearbox is dowelled and bolted to the locomotive side members to form a rigid frame stretcher, and it incorporates the self-aligning spherical bearings for the engine bearers. Forged nickel-chrome pinions with hardened and ground teeth on the engine crankshafts are in constant mesh with high and low-ratio gears on the output shaft of the gearbox which is parallel with the longitudinal axis of the locomotive. These output gears are mounted freely on the gearbox main shaft, which is carried on ball and roller bearings. Two internal gear dog clutches splined on the shaft can be moved along the shaft by operation of a lever in the driver's cab to engage either the high or low ratio gears, or set in an intermediate neutral position. Drive from the output shaft of the gearbox is transmitted through a cardan shaft, fitted with a Layrub coupling at each end, to the final reduction gearbox on the centre driving axle of the locomotive. This cardan shaft is located on spigots, and washers fitted in the Layrub couplings facilitate

removal of the shaft without need for disturbing the gearboxes.

All of the gears in the main transmission box and those on the engines are clearly marked to ensure their correct phasing in the event of dismantling for inspection or overhaul purposes. A plunger oil pump driven through a cam on the gear shaft and drawing oil from the sump circulates lubricant throughout the box.

The final reduction gearbox is supported by white metal-lined steel-backed bearings on the axle and it is connected to the main frame by a torque reaction member. The gearbox incorporates bevel input reduction gearing driving the axle through final spur reduction gears. All the gears are of forged nickel-chrome-molybdenum steel with hardened teeth, and the input shaft is mounted on Timken taper roller bearings. The cascade lubricating system of this box incorporates a magnetic filter and is fed by a cam-operated plunger pump. The overall gear ratio is 6.37 to 1 in low gear and 3.7 to 1 in high gear.

The axles are mounted on Timken roller bearing boxes which slide vertically in horn check plates. Torque stay pads carried on the final reduction gearbox move vertically in guides on a ballast weight member which also serves as one of the frame stretchers. With this arrangement the axle and gearbox assembly with the torque reaction members move vertically in unison. The torque stay pads are faced on one side with "Oilite" and on the other with manganese steel and the guides in which they slide are anchored on machined faces on the ballast beam.

In order to provide for the variations in track layout and gauge usually encountered in industrial establishments the manganese liners of the horn check plates are machined to permit up to ¾ in. side float each way on the centre axle and 1 ⅜ in. each way on the leading

and trailing axles. To permit side float of the axles the coupling-rods are fitted with spherical bushes, which are fully floating on the bore and outside diameter and allow up to 7 deg. swing of the rod. These bushes are retained on the crankpin by collars and are designed for quick and easy removal and replacement, their dimensions being such that they can be inserted into the bore at right angles and simply rotated into alignment.

A new design of oil lubricator, which has been developed for the connecting-rod bushes, is designed to cut off the feed of oil when the locomotive is stationary. A float in the oil chamber of the lubricator has a light valve on its stem, which normally seals the oil feed hole. When the locomotive is running the movement of the float is sufficient to open the valve to release an intermittent flow of oil to the bearing. The bushes have three holes drilled through their sides and oil passes through these holes to lubricate the crankpin bore.

Easy access is provided to the engine compartment and main gearbox through large panels on each side and in front of the engine compartment for maintenance and inspection. For major overhaul purposes the engines and top half of the gearbox can be withdrawn from the compartment through a space sealed by removable panels at the top.

The vertical water-tube boiler situated at the rear of the driver's cab is arranged for oil firing by a Laidlaw Drew single burner installation and has a working pressure of 275 lb. per square inch. It is fitted with a four-coil superheater giving a maximum total temperature of 750 deg. Fah. The evaporative capacity is 5500 lb. per hour and the heating surfaces are as follows: tubes, 92.4 square feet; firebox, 51 square feet; and superheater, 53.5 square feet.

The firebox and shell of the boiler are made of welded steel plate and the boiler, which has no foundation ring, is supported by three spaced feet, which register on stools on the cab floor. The firebox incorporates three feet and, after dropping out the combustion chamber, the box can be lowered right out of the boiler with the use of built-in jacking points which are intended to facilitate maintenance and inspection.

The combustion chamber is suspended from seven angle brackets and is about 18 in. deep. For oil burning purposes twenty-four air tubes are arranged at angles round the base of the chamber. Three tuyeres spaced around the side at the upper part of the chamber provide secondary air for combustion.

The Laidlaw Drew burner projecting through a central orifice at the bottom of the chamber is supported on a trunnion mounting. By simply turning a handle at one side of its mounting the complete burner can be quickly and easily released and dropped out for nozzle cleaning or replacement purposes. The oil fuel line is coupled to one side of the hollow bar on which the burner is mounted, and the steam line to the opposite side. The body of the burner is centralised in the combustion chamber orifice by pegs set at right angles to the line of the mounting bar. A pressure-controlled fuel restriction valve is fitted to prevent too rapid heating of the boiler from the cold condition. If at any time it is required to change over to solid fuel firing, a suitable combustion chamber can be readily fitted to the boiler and the firebox setting changed without need for major alterations to the main structure. The funnel is attached to the boiler top plate and has four inner tubes in its base, each tube being fitted with a combined blast nozzle and blower ring.

The main water tank of 850 gallons capacity and two fuel tanks are situated in the body of the locomotive between the driver's cab and the engine compartment. The main tank for heavy fuel oil is of 300 gallons capacity and is fitted with a thermostatically controlled steam heater. A separate 100-gallon tank holds the light fuel oil used when first lighting the burner. If at any time the locomotive is changed over to solid fuel firing the fuel tanks can be taken out and the casing centre section removed for the compartment to be used as a bunker.

A double-acting boiler feed pump and a non-lifting injector with water control and shut-off valves are fitted and the automatic oil firing gear is carried on the side casing.

In addition to the conventional screwdown brake gear power braking is provided by two 7 in. diameter steam cylinders mounted on a common shaft which actuates pull rods operating a single brake block on each wheel. The main steam brake valve operates in conjunction with a small supplementary valve, which, when shut, cuts off the supply of steam to the main valve. When the brake valve handle is moved to the open position a cam is first turned and opens the supplementary valve to admit steam to the main valve and on to the brake cylinders. The steam brake cylinders, like the axle-boxes and spring gear, are mounted outside the main frames to facilitate maintenance and inspection. A gravity feeding sand box

is fitted in front of each of the two leading wheels and behind the two trailing wheels, and duplicated control levers for these boxes are mounted at each side of the driver's cab.

The cab is particularly roomy and has large windows in the front and rear panels and sliding windows in each side to give the maximum possible unobstructed vision during shunting operations. The cab layout is so arranged that without moving from his main controls the driver can see the buffers and maintain a constant watch on the train in all shunting movements in both directions from both sides of the cab.

All parts of the locomotive are designed to give ease of accessibility, for maintenance and inspection, and a majority of the main parts, such as the boiler, engines, gearbox and tanks, can be removed in a relatively short time as complete units. With this form of construction it is possible, when operating a number of the locomotives, to keep them in constant service by maintaining a minimum number of spare units, which can be fitted whilst carrying out any necessary repairs or major overhauls.

We are informed that these locomotives can be made ready to go into service from the cold condition in about forty minutes. The fuel storage capacity is sufficient of twenty-four hours' operation without refilling, and the water capacity is sufficient for ten to sixteen hours' working according to the duty.

FOUNDRY FORGE PROJECT

An integrated unit would be set up by the National Industrial Development Corporation (NIDC) for the manufacture of heavy castings of iron and steel as well as heavy forgings. The NIDC would also set up capacity for fabricating certain categories of structurals near the steel plants. Details of schemes submitted to Government are under examination.

Diesel Railcar for Swedish State Railways

Compiled by AB Svenska Järnvägsverkstäderna, Linköping, Sweden

A quarter of a century has now passed since the Swedish State Railways began to prepare the light, fast railcars as a replacement for trains hauled by steam locomotives on non-electrified lines.

These first railcars made an aluminium-covered superstructure of wood on an underframe of steel, the design being taken from road buses of that time.

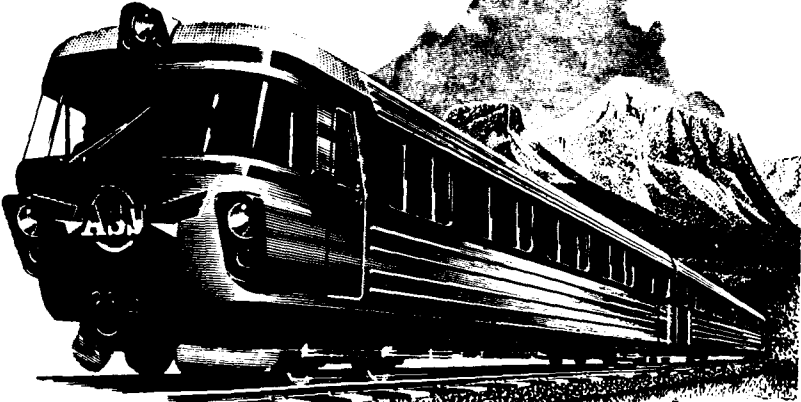
But already in the years before World War II, a number of collision-proof all steel diesel railcars could be taken in service, the war, however, causing an interruption in the dieselization programme. After the war all the steam trains on the

non-electrified lines have been replaced by diesel railcars, very often coupled together to train units, in which way great advantages have been gained both from operating and economical points of view. Among these advantages, in comparison with trains driven by steam or diesel locomotives should be mentioned superior traction dynamics as well as the fact that the multiple-unit diesel train offers the great economy of flexibility. The superior traction dynamics comes from a better adhesion relation, i. e. a larger part of the total weight of the train lays on the traction wheels and, furthermore, the diesel railcar can generally be designed to have a greater effect per ton of train weight, meaning that the diesel



Fig. 1. Diesel railcars for Swedish State Railways.

All clear for delivery from ASJ to Colombia



In about two years' time passengers travelling between Bogotá—Buena-ventura and other towns in Colombia, South America, will be enjoying a new standard of comfort. Ferrocarriles Nacionales de Colombia (The Colombian State Railways) have just ordered 28 diesel trains from ASJ for delivery in 1958—1959.

Each train consists of a motor coach with seating accommodation for 44 passengers and a trailer coach carrying a further 46 passengers. Accommodation is both spacious and com-

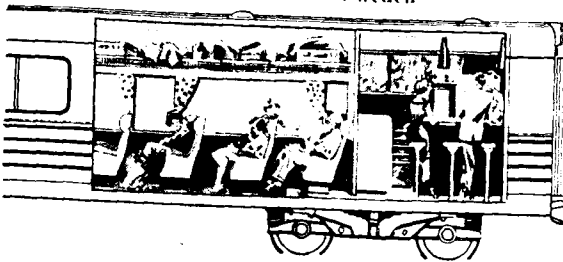
fortable and the trailer coach is furnished with an elegant bar.

The machinery, too, is first class and more than satisfies the requirement that the trains must be able to climb 46 ‰ gradients and round sharp bends at heights up to 8,500 feet above sea level. Each motor coach is driven by two Cummins diesel engines generating a total of 460 h.p. Power transmission is over UVA hydraulic gears on the SRM system. Once again ASJ "made the grade" in the face of keen international competition.



AB SVENSKA JÄRNVÄGSVERKSTÄDERNA

Arlöv LINKÖPING Falun
Sweden



Buenaventura - Bog			
ARIO	Dist. kms.	Alt. mts.	ESTACIONES
00	0	0	S. Buenaventura
42	174	1100	Ll. Cali
73.00	174	1100	S. Cali
8.23	361	1170	Ll. Armenia
30	361	1170	S. Armenia
30	461	1172	Ll. Ibagué
54	461	1172	S. Ibagué
29	710	2620	Ll. Bogotá



Fig. 6 and 7. Interior of passenger compartment.

inside and outside walls is filled with Isoflex, a plastic material, or glass fibre panels for temperature insulation and for acoustic purposes. The floor is laid with linoleum or rubber mats on plastic glued $\frac{1}{2}$ " plywood resting on wooden beams on a steel underframe. Under the plywood there is a layer of Isoflex or glass fibre panels on a wallboard sheet.

The entrance doors, of an all pressed steel construction, are placed in each of the driver's cabs. They are of the folding type, automatically operated by door machines working on the compressed air system. The doors can be operated either from inside or from outside of the car and the driving gear provides control to prevent the opening of the doors when the car is in motion. The doors in the ends of the car are of the swinging type, turning outwards, and the doors between driver's cab and passengers compartment are turning to both sides.



Fig. 8. Interior of toilet.



Fig. 9. Driver's cab.

All windows have double glass and the front windows are equipped with safety glass. In each passenger compartment there are two openable windows of the half-drop type. All the window panes are fastened by means of rubber profiles.

The seats are made of enamelled steel tubes and furnished with seats and backs of foam rubber, which are clad with specially made fabric. The cars are provided with other amenities for passengers such as tables, ashtrays, luggage racks, curtains, etc.

The toilet is fairly spacious, self-flushing and well equipped.

The interior of the car will be seen on figure 6, 7, 8, and 9.

The interior lighting of the passenger compartments is supplied by 1000 V 50 c/s cold cathode tubes mounted in two rows in

the ceiling in shock proof mountings. Each end of the car is provided with one headlight of 50 watts and two sidelights of 50 watts each.

The car is heated by hot air from the fan for the engine radiator. The air is thoroughly filtered. The driver's cab is additionally heated by aero-tempers in front of the driver's seat. In this way the car is well ventilated, but to increase this, the platforms and the passenger compartments are equipped with hand operated roof ventilators.

As stand-by, and for extra cold days, an oil burning heater is inserted in the water system.

Figure 10 shows the design of the bogies. They are all welded and equipped with resilient SAB wheels on SKF roller bearings, see figure 11. The axles are held parallel by long swing arms connected to the central bogie frame by rubber bushes. The spring system consists of involute springs between the swing arms and the bogie-frame. The driving bogie has a differential gear box fitted to its central frame. This gear box is connected to the conical gears mounted directly on the wheel axles by universal driving shafts. The car body rests on rubber pads on side brackets attached to the central bogie frame. The rubber pads permits the car body to make lateral movements and the bogie to turn by passing curves. The traction and braking forces between the bogies and the underframe are transformed by a rubberbushed rod not shown on figure 10. The wheel diameter is 670 mm.

The brakes are electro-pneumatically operated and of a self-adjusted hydraulic type with one block per wheel. The car is further equipped with a mechanical hand-brake for parking.

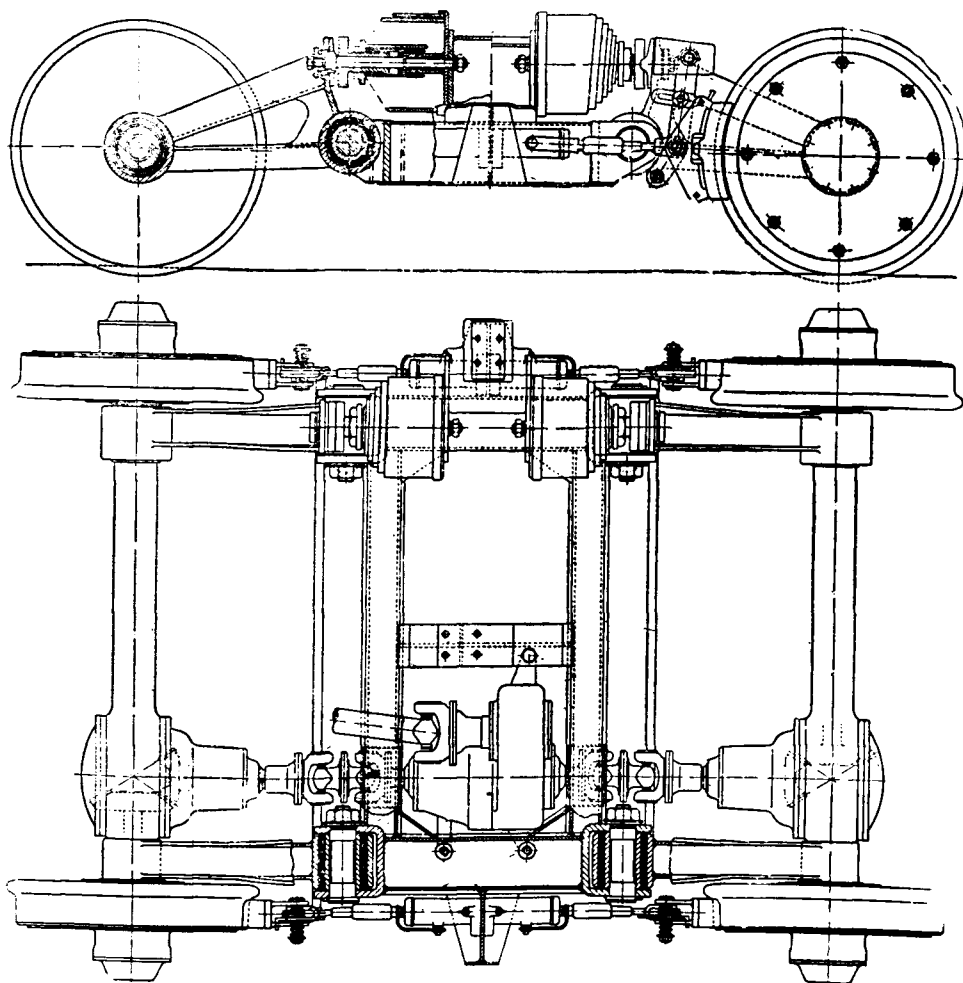


Fig. 10. Principle drawings of driving bogie.

Traction power is supplied by a Swedish direct injected diesel engine, Scania Vabis 815, 8 cylinders supercharged to give 205 HP at 1750 RPM for railway service. The engine is rubber mounted direct to the underframe in one end.

The radiator is situated below the floor and the fan is driven by an auxiliary shaft from the diesel engine.

The transmission consists of a hydraulic coupling Daimler 18", a five speed epicyclic Wilson gearbox R 11 B, a reversing unit, the differential gear box mentioned above and the conical axle gears. See figure 5

and 10. The Wilson gear box and the reversing unit are operated by compressed air by means of E. P.—valves controlled from the driver's stands in both ends.

The air compressor Knorr V 70/155 is beltdriven from the engine. A 24 V 1600 W DC generator and an accumulator battery of 200 amp. hrs. capacity supplies power to the engine starter, lighting and signalling equipment, auxiliary heating fans, sirens, sanding, door machines, electropneumatic control system etc. E. P.—valves, relays, switches etc. are easily accessible in the apparatus box in one of the driver's cabs as can be seen from figure 12.

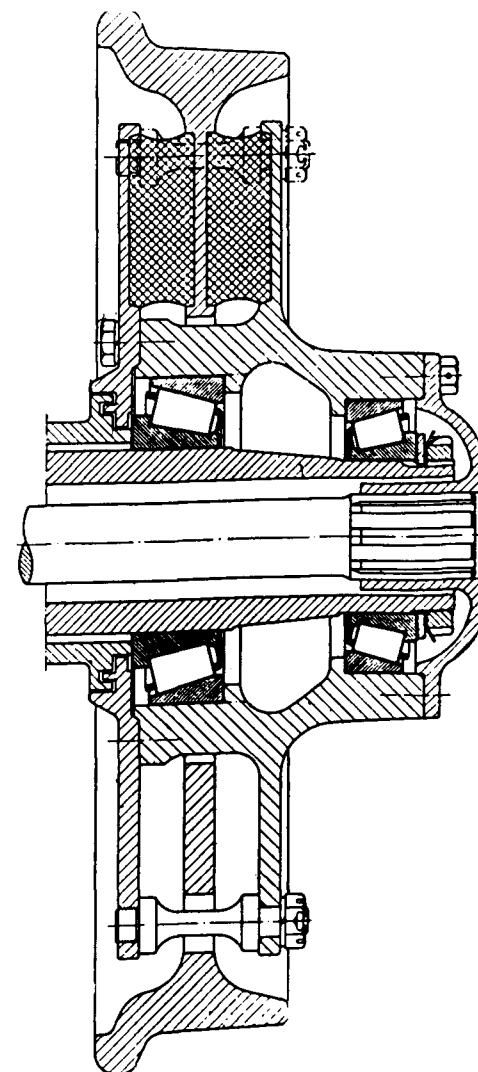


Fig. 11. SAB resilient wheel with SKF roller bearings.

The driver's controls are much simplified. The operations for accelerating, braking, and coasting are carried out by one handle, operating a master-controller of the drum type. The starting of the engine, gear changing, reversing, sanding, and blowing of the sirens can all be done through press-button switches situated on the driver's control-panel, which is further equipped with various indicator lamps and door locking switches. In view of the variations in the traffic intensities during the different

(Continued on page 28)

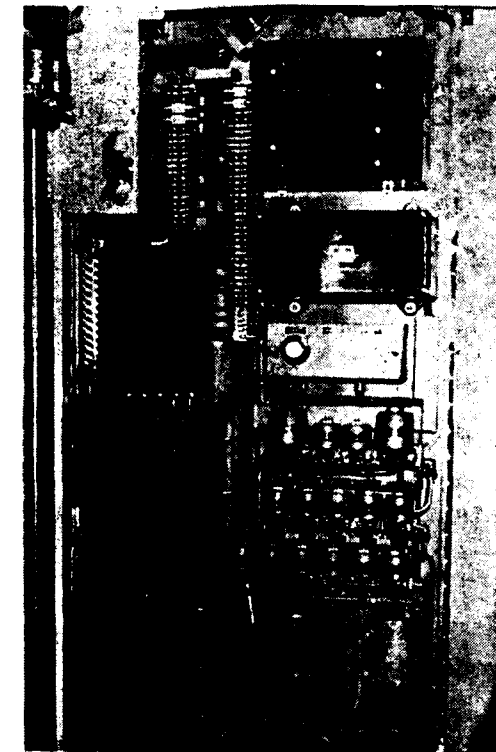


Fig. 12. Apparatus box in driver's cab.

hours of the day, the cars are so designed that any number up to 10 can be coupled together through automatic couplers and the whole train can be driven from any one of the very easily operated driver's controls.

The automatic couplers are of Scharfenberg type with built-in pneumatic connections. The car is in both ends provided with hand-operated junction boxes for control current.

The Swedish State Railways have also a great number of trailer cars in the same size as the engine cars, in multiple service generally coupled at a number corresponding to the proportions 3:2 or 2:1 between engine cars and trailer cars.

These trailer cars are arranged in the same way as the engine car described, i. e. with driver's cabs in both ends, or with half

Sulzer Type 12LDA 28 2,300-H.P. Locomotive Engines

By Karl Brunnschweiler, Winterthur

[The new four-stroke twin-row engine with Sulzer exhaust-gas turbo-charger for Diesel-electric locomotives has been very well received by railway companies and a large number of orders have been placed within a very short time. In the type test carried out under U.I.C. regulations, the engine fulfilled all guarantees.]

THE first units of a new type of Sulzer traction Diesel engine have been in service since 1955 in the 060-DA locomotives of the French National Railways illustrated in fig. 1. The order originally placed was for twenty units. Shortly after the first engine had been put in service, five further engines were ordered, to which

ten more were added in April 1956. The mechanical part (bogie and superstructure) was manufactured by the *Compagnie des Ateliers et Forges de la Loire*. The *Compagnie de Construction Mecanique Procèdes Sulzer* (CCM) supplied the Diesel engines, and the *Compagnie Electro-Mecanique* the electrical equipment. The first ten

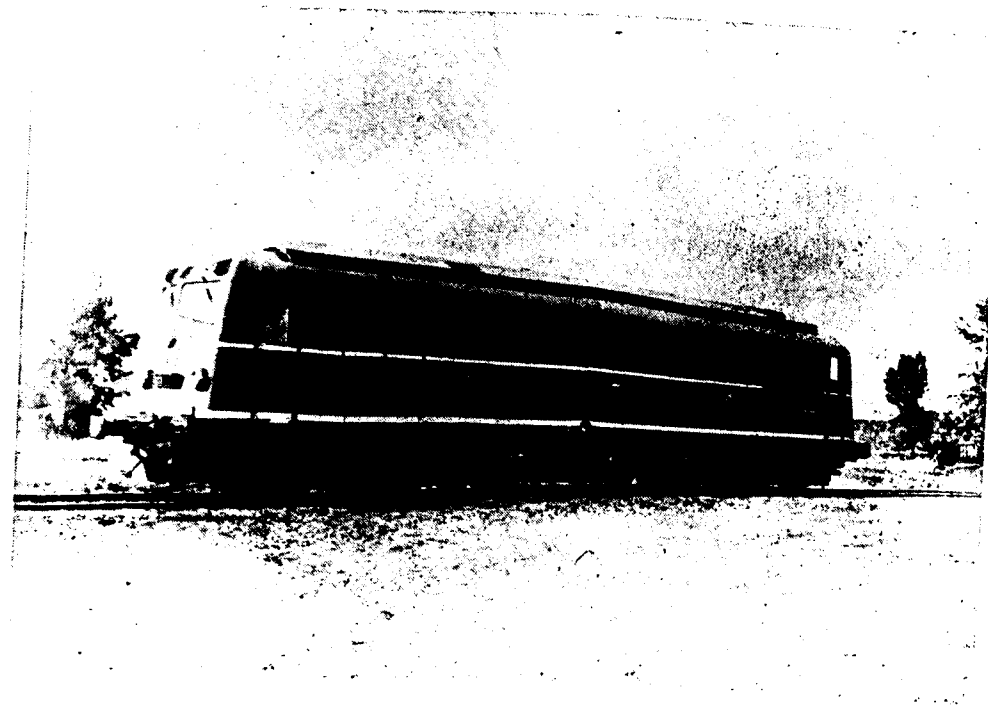


Fig. 1. Diesel-electric locomotive of the French National Railways.
The Sulzer twelve-cylinder four-stroke twin-row engine operates with solid injection and is pressure-charged by an exhaust-gas turbo-blower (see figs. 2 and 4).

(Continued from page 27)

the car adapted to luggage space and with one driver's cab, or, finally, as combined luggage and post cars, without driver's cab.

The same type of cars, but with reduced breadth is used also on the narrow track lines with a track of 0,891 m.

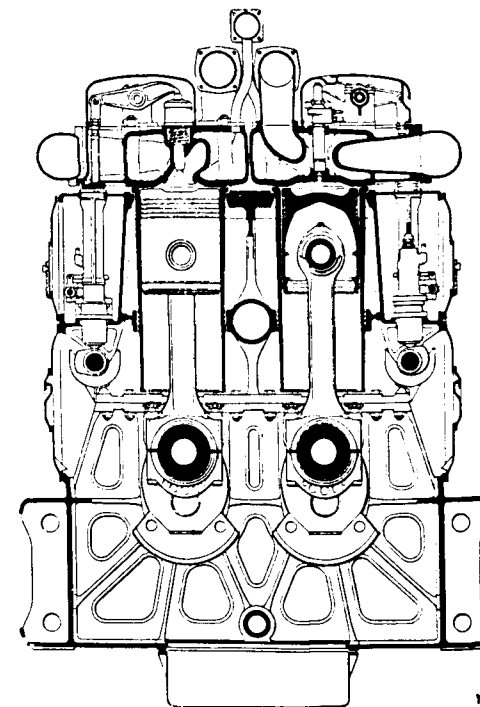


Fig. 2. Section through the Sulzer four-stroke locomotive engine of type 12LDA28.

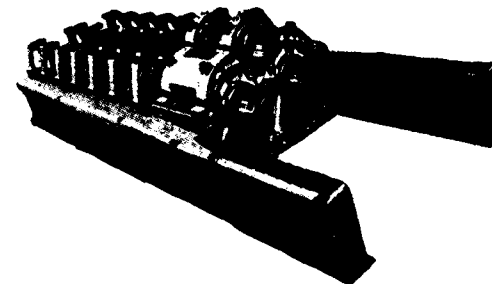


Fig. 3. Welded crankcase.

The longitudinal girders are extended to take the generator. The last two transverse members, with three bearings each, carry the synchronising gear.

engines were manufactured by Sulzer Brothers Ltd. in Winterthur, the others have been or are at present being built by the C. C. M. in their works at St. Denis, France. These 120-ton locomotives of type CoCo are being used on the "Grande Ceinture", a line joining the main goods stations in the suburbs of Paris, for hauling goods trains of 1,600 to 2,000 tons.

MAY 1957

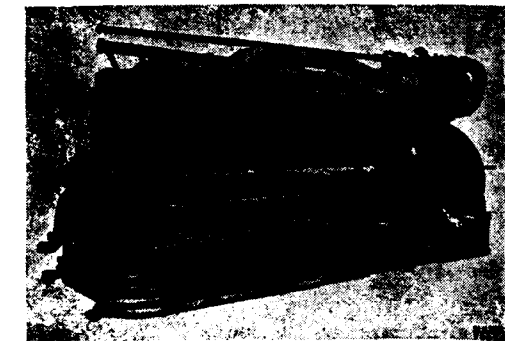


Fig. 4. Engine-generator set.
The compact character of the set is apparent.

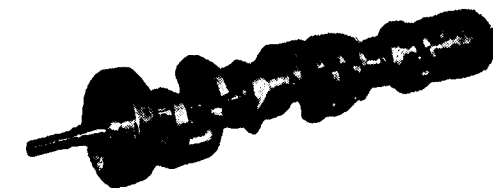


Fig. 5. Crankshaft of the 12LDA28 engine.
On the left, the vibration damper; on the right, the gearwheel. The counterweights are fitted on the crank webs.

In the meantime British Railways have ordered ten identical engines from Sulzer Bros. (London) Ltd., who are also acting as general contractors for the electrical equipment. The superstructure is being manufactured by British Railways in their own workshops at Derby.

If three standby sets for the French National Railways are included, 48 engines of this type have thus been supplied to these companies or are at present on order. As other railway companies are also evincing a keen interest in the engines, it is to be expected that this number will soon be exceeded.

One of the first batch of engines for the "Grande Ceinture" was selected at random by the inspection authority of the French National Railways and submitted to the

so-called type test. Under the regulations of the *Union Internationale des Chemins de Fer* not more than two stoppages of twenty minutes each are allowed in the course of this 100-hour test. In actual fact the engine remained in continuous operation throughout, so that it more than satisfied the requirements.

DESCRIPTION

The twelve-cylinder four-stroke Diesel engine is designed for solid injection and is pressure-charged by a Sulzer exhaust-gas turbo-blower. It has two rows of six cylinders each (fig. 2). Originally intended for 2,000 B. H. P., it has now been brought up to 2,300 B. H. P. by raising the mean effective pressure and the speed. The two crankshafts drive the generator through a common gear with a transmission ratio of 1.44:1.

The main dimensions of the engine are the following:

Bore	= 280 mm. (11 in.)
Stroke	= 360 mm. (14.17 in.)
Nominal rating	= 2,300 B.H.P. at 750 revs. per min.

The crankcase (fig. 3) is of the welded design which has given such good results in Sulzer traction engines for the last twenty years. The cast-steel transverse members which take the bearings of the two crankshafts are welded to form a rigid whole with the longitudinal girders of steel plate. The latter are extended at one end to carry the generator. The two transverse members nearest the generator support the gear, which synchronises the two crankshafts and steps up the engine speed by 44% for driving the generator.

The Diesel engine thus forms a very compact block with the gear and generator. U-shaped ribs running round the crankshaft

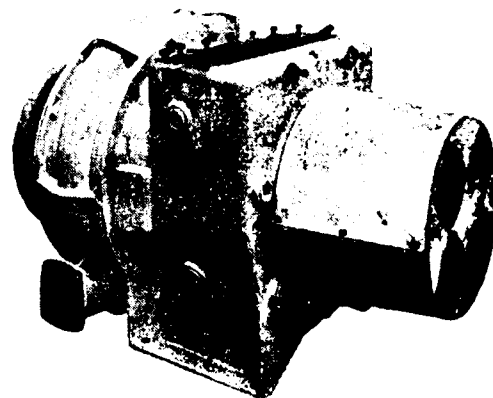


Fig. 6. Sulzer pressure-charging set.

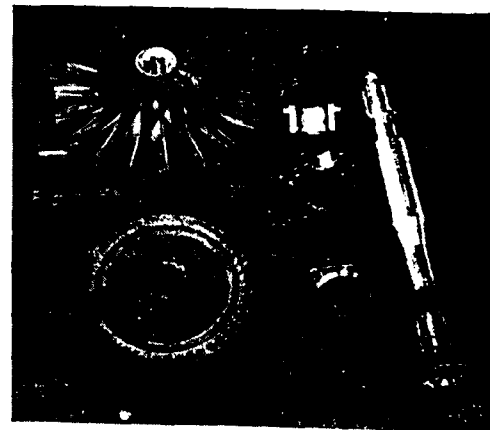


Fig. 7. Components of the exhaust-gas turbo-charger after the test.
Top: Blower impeller Bottom: Turbine wheel
Right: Shaft with bearings.



Fig. 8. Crankshafts after the type test.

bearings in the transverse members are carried up into the cylinder block, so that the

gas forces acting on the cylinder cover are transmitted by the shortest route to the crankshaft bearings, while the other parts of the casing are relieved. This design also permits the crankshafts to be fitted and removed with ease from above.

When the lateral covers visible in fig. 4 are removed, the crankcase is readily accessible, so that the connecting-rod bearings can easily be changed. The main bearings, pistons, cylinder liners and all other parts subject to wear can be replaced speedily and with a minimum of trouble.

The crankshafts (fig. 5) are provided with counterweights which partially balance the masses. Frequencies which might give rise to torsional vibrations are eliminated by the dynamic damper, so that the engine runs very smoothly over the whole range from no-load to well above the nominal speed.

The cylinder block also consists of cast-steel transverse members welded to longitu-

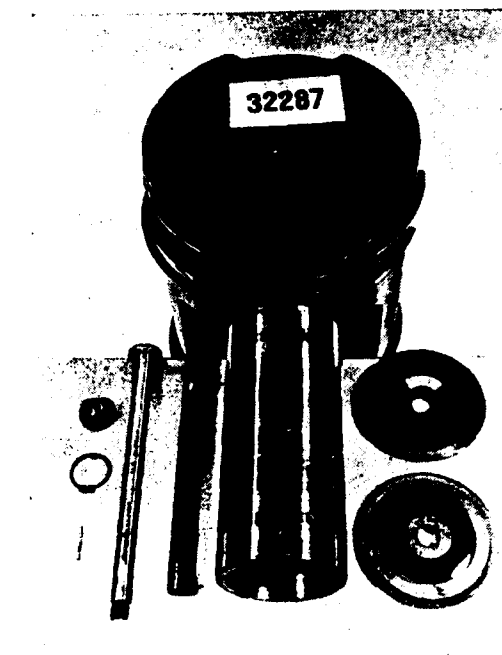


Fig. 9. Piston components after the test.



Fig. 10. Connecting-rod after the test.

dinal walls of steel plate. The cross-section (fig. 2) shows how the cylinder block is bolted to the crankcase. Removal of the lateral covers gives access to the injection pumps.

The valve push-rods are enclosed in tubes, so that leaking fuel oil cannot mix with the lubricating oil.

The Sulzer exhaust-gas turbo-charger (fig. 6) is fitted on the generator casing. The bearings are lubricated with oil from the forced-circulation system supplying the engine.

A special pressure-charging safety device ensures that the quantity of fuel injected is never more than would correspond to the momentary volume of charging air. This point is particularly important during rapid load increases, as at such times the air delivery is always somewhat in arrears owing to the inertia of the turbo-blower rotor.

Other safety devices stop the engine or slow it down to no-load speed when the pressure in the cooling-water or forced-circulation oil systems falls below a certain minimum or when the water temperature rises too high.

TEST RESULTS

In the type test already mentioned the air was aspirated from the atmosphere and was not cooled between the blower and the engine. As the out-side temperature averaged only 7°C during the test, the output was raised to 2,360 H. P., so that thermal loading was roughly the same as at 2,300 H. P. and

20°C (the definition of the nominal output in the regulations of the U. I. C. being based on this temperature). The mechanical stressing during the test was thus somewhat higher than at nominal output.

The fuel used had a specific gravity of 0.843 (measured in gr. per cu. cm.) at 20°C and a net calorific value of 10,090 cal. per kg. (18,015 B. Th. U. per lb.).

The results of the test are given in Table 1. The figures are averages of measurements made every hour, or every half-hour in the tests of shorter duration.

Type of test	Duration	Output B.H.P.	Speed	M.e.p.	Consump- tion gr./ B.H.P.	Charging air			Exhaust gases			Speed of turbo- charger	
						Temp. at blower inlet °C	Pressure at entry to engine mm.Hg.	Temp. at entry to engine °C	Temp. after valve °C	Pressure at turb. inlet mm.Hg.	Temp. at turb. inlet °C		Temp. at turb. outlet °C
CONTINUOUS RUN at nominal load	80	2360	750	10.84	169.15	7.15	498	70.2	482	262	592	490	10 843
10% OVERLOAD													
Increased m.e.p.	3/4	2625	750	12.07	169.2	5.0	604	78.7	498	310	611	504	11 700
Increased speed	1/4	2590	825	10.75	172.7	3.9	636	79.4	485	348	596	492	11 800
Partial load	2 1/2	2050	700	10.1	162.5	2.4	364	49.7	454	188	547	460	9 600
	2 1/2	1460	600	8.4	159.9	-0.3	194	28.4	403	96	491	422	7 050
	2 1/2	980	500	6.76	158.0	-0.8	98	14.4	354	51	419	366	5 160
	2 1/2	490	400	4.22	165.4	-3.0	36	5.0	268	29	294	263	3 250
ALTERNATING	For 9 hours the engine was run intermittently for 6 minutes at nominal load and 4 minutes at no-load, the speed												

For 9 hours the engine was run intermittently for 6 minutes at nominal load and 4 minutes at no-load, the speed being 750 revs. per min.

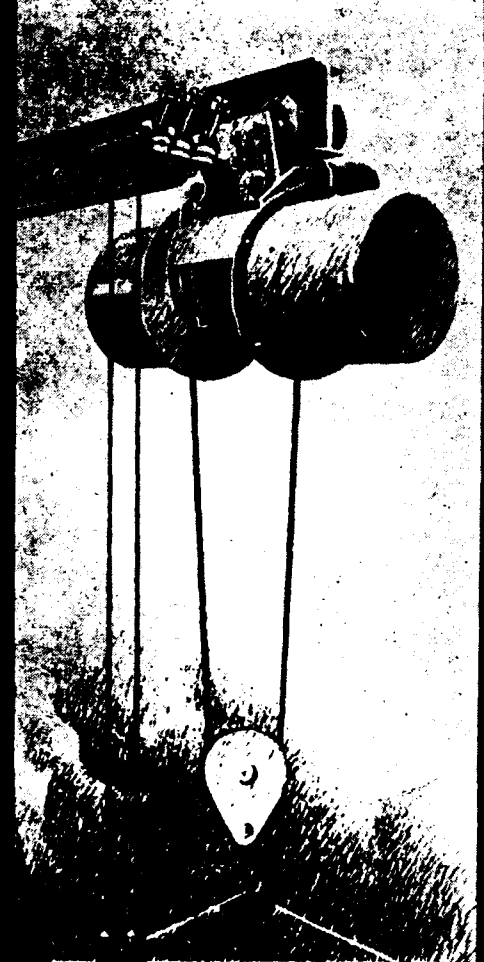
Lubricating oil consumption at full-load = 1.8 gr. per B.H.P. — hr.

Relative humidity = 75% Barometric pressure = 727 mm. Hg.

Of the total heat supplied during the continuous test at 2,360 H. P., the following percentages were converted into power or led off in gases, coolant and lubricant :

- 37.2 % converted into power
- 14.9 % dissipated by cooling water
- 5.9 % dissipated by lubricating oil
- 42.0 % led off in exhaust gases, lost by radiation, etc.

After the test the engine was completely dismantled for inspection. Figs. 7—10 illustrate the good condition of the various components.



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The First Indigenous Firm to achieve success in the manufacture of Automotive Diesel Engines

[The world famous PERKINS P6 engines are now in full indigenous production at Madras.]

ONE Hundred and Sixteen years are but a moment in the long history of the ancient land of India.

Travel along any of the shady roads of the mofussil and you may see how short these one Hundred and Sixteen years are, for in the space of an hour or so, the history of road transport in the century rolls before you.

Through the dappled light and shade of the dusty roadway comes the coolie, tramping along on his bare feet, his bundle on his head. Creaking past him in a covered wagon, the bullock driver sits his patient bullocks plodding along slowly with an occasional spasmodic effort at speed as the driver applies his stick or gives their tails a twist. Nearing a temple town, an elephant slouches along—the transport of the ancient and still used on occasions of ceremony and splendour. Passing these age old transporters comes the modern streamlined internal combustion engine powered motor coach, speeding along in safety with its passengers. Diesel Trucks also roll along, all these methods of transport linking up village to village.

And so, in a short hour, more than a century's progress in road transport is bridged over, and we see the ancient and modern side by side.

The firm of Simpsons, Madras, has had the proud privilege of living through these one Hundred and Sixteen years of India's life, beginning with the manufacture of the Howdah, Litter and Palanquin, then Traveling Vans, State Carriages, Pony Tongas,

Landaus, Victorias, etc., always keeping abreast with improved methods of road transport.

The year 1903 ushered in a new era in road transport in India with the introduction of internal combustion engine propelled vehicles and since that time, the firm specialised in Automobile Engineering, including Motor Car, Motor Coach and Motor Truck body building, in which field they have achieved and maintained an excellent reputation throughout India.

The advent of the Diesel Engine for Road Transport Vehicles was one of the most important developments in recent



Shri S. Anantharamakrishnan

Perkins
HIGH SPEED DIESEL ENGINES

THE POWER BEHIND MODERN TRANSPORT

There are
**MORE Perkins DIESELS IN OPERATION THAN ALL
OTHER MAKES OF DIESEL ENGINES PUT TOGETHER.**

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years and as Simpsons realised the popularity diesel transport would quickly gain, they entered into an agreement with F. Perkins Limited, Peterborough, as Distributors for the whole of India for the famous Perkins "P" Series Diesel Engines. Subsequently, they entered into a manufacturing agreement with the approval of the Government of India, following which a Phased Manufacturing Programme was submitted to the Government of India and on June 5, 1955, the Chairman of Simpson & Co., Ltd., Shri S. Anantharamakrishnan, the noted South Indian industrialist, gave an assurance to Government that by December 1956, i. e., in the remarkably short period of 18 months, Simpson & Co. would achieve complete indigenous manufacture of the Perkins P6 Automotive Diesel Engine to a capacity of 3,000 Engines per annum.

This was a tremendous task and under the able direction and control of the Company's Director & General Manager, Mr. A. J. Lund, a Chartered Engineer, possessing



Mr. A. J. Lund

considerable administrative, organising and production ability, the programme was fully completed.

The utmost co-ordination and co-operation of all administrative staff, draughtsmen, jig & tool designers, other technical, managerial and general staff, Workers' Union, and every employee of the Company was most essential for such an undertaking, and it is undoubtedly a great credit to all that a project of such magnitude was accomplished in the very short space of 18 months.

Specifications and capacities of all plant and machinery had to be worked out to suit all machining operations for each and every component part of the Engine. Orders then had to be placed for deliveries Madras to suit the respective phased periods of the Manufacturing Programme. Complete factory layout plans for positioning of the machinery for flow-line production had to be prepared, excavations made and machinery foundations laid ready for installation of machinery on arrival. Additional electric power supply had to be provided including purchase and installation of additional Transformers, new electric power cables and feeder lines together with distribution boards and switch gear. The entire lighting arrangements throughout the factory had to be re-planned.

Jigs, Fixtures and special Toolings had to be designed and manufactured at their Madras Works to the tune of nearly 3 lakhs of rupees value. Simultaneously, necessary labour force had to be trained, especially for the manufacture of high precision work involved in the production of Jigs and Fixtures. And high tribute should be paid to Indian labour for their remarkable adaptability and progress in this specialised sphere of engineering.

SIMPSON'S WORKS

A massive modern construction, double-storied building houses the Administrative

Offices, Financial and Cost Accounts, Drawing and Design Office, Sales Department, Central Stores, Purchasing Department, Material Control and Planning Office. And behind this building is the spacious and most modern Workshop. The factory area covers approximately 2,50,000 sq. ft.

THE PERKINS P6 AUTOMOTIVE DIESEL ENGINE

This is a 6-cylinder unit, having cylinder bore 3.1/2" and stroke of 5". Swept volume is 4.73 Litres (288.6 cu. inches) and develops a maximum commercial vehicle rating of 83 b. h. p. at 2,400 r. p. m. Maximum torque is 202 lbs. ft. (27.9 Kgms.) The weight of the Engine with electrical starting equipment but without flywheel and starter ring is 696 lbs. In its power range, Perkins P6 is unquestionably the most popular diesel transport engine in the World and in India alone about 40,000 of these engines are operating with extreme reliability and efficiency.

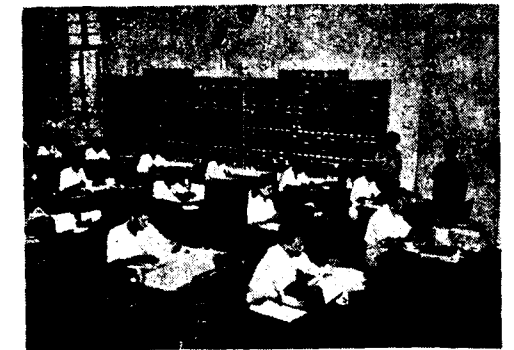
THE MANUFACTURING PLANT

The Perkins P6 Diesel Engine consists of nearly 1,800 component parts, and, of these, 20-odd items are still not manufactured in the country, viz., Proprietary items consisting of Motor Starter, Dynamo, Fuse Box, Venturi, Timing Chain, Starter and Heater Switch Assembly, Etc.

PLANNING FOR PRODUCTION

The organization of the Planning Department has been done on the modern lines, using very extensively the Graphdex Board Charting System and with this the day-to-day stock position of the various engine components and also the flow of the manufacturing programme can be gauged at a glance.

Job Control Boards are operated by the Loading Section of the Planning Office and



this method ensures very proper loading of the various production machines and also helps to keep an effective eye on the planned and actual production hours for doing various machining operations. The efficient organization of the Planning Department and co-ordination with the Works and the Cost Office facilitate accuracy in determining the manufactured cost of the component parts day to day.

PLANNING OF CUTTING TOOLS

The various cutting tools required by the Machine Shop are planned and procured, taking into consideration the tool life and the monthly tool consumption. The tools are properly numbered and as per the Operation Sheet, these are stocked in the Tool Stores for easy delivery. The procurement of tools has become a very important function to keep the Machine Shop running uninterruptedly, especially in view of the country-wide shortage of and import restrictions for various cutting tools. In the selection of various cutting tools, factors governing maximum production and tool life, and also the materials to be machined are taken into consideration.

MATERIAL CONTROL DEPARTMENT

The different types of raw materials required for the production of P6 Engines are procured through the Material Control Department. This Department is responsible for the location of suitable materials

and ordering them as required. They take very suitable steps to contact various suppliers and ensure that only the right type of material as specified in the designs are procured. All raw materials received at the Works are bonded until material and chemical analyses as required have been taken. This procedure is rigidly followed to ensure that only approved materials to specification are used for the production of the Engine.

This Department also looks after the procurement of various purchased components and also maintains a close liaison with Messrs. F. Perkins Ltd., Peterborough, England, and their Resident Chief Inspector, for obtaining their approval for these items. In the case of completely machined purchase items, a rigorous inspection is instituted in our inward goods section and these goods, like parts manufactured in Simpsons' Works, are constantly under review by F. Perkins Ltd.'s Resident Chief Inspector and his assistants.

MACHINE SHOP

The Machine Shop is broadly divided into two sections: one section manufacturing miscellaneous component parts and the other is laid out for flow-line machining of Cylinder Blocks with Main Bearing Caps, Cylinder Heads, Connecting Rods, Camshafts, Crankshafts, Lubricating Oil Pumps, Water Circulating Pumps, etc. The arrangement of Plant and Equipment has



been carried out with a view to obtain a good deal of flexibility in production. Various Capstan Lathes and Automatics have been grouped in one section and several Radial and Pillar Type Drilling Machines in another and in this manner general purpose Milling Machines including Gear Hobbing Machine and SS & SC Lathes have been arranged in different groups.

Four of the Machine Shop bays extend lengthwise within the buildings and this arrangement enables very effective supervision and easy flow of components from machine to machine to be achieved. Manual handling of the components is minimized by necessary mechanization and goods, wherever possible, are palletised and the movement of components at various stages of machining is carried out by the employment of a large variety of specially designed pallets.

CYLINDER BLOCK BAY

The rough castings are delivered at one end of the bay and these are first washed with paraffin in a cleansing tank.

Gravity Roller Conveyors are arranged all along the bay and the castings travel on these from machine to machine, thus reducing to the minimum physical handling. This also helps to avoid 'stock piling' of components on the floor at the various machine stations.

After fettling and washing, the castings are inspected with necessary inspection fixtures to ensure the correct locations of cores, jig location points and machining allowance, and placed on the roller conveyor.

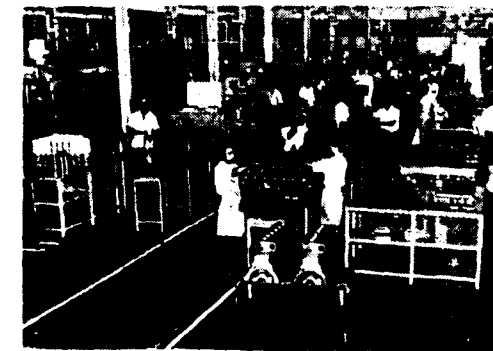
From these the work is loaded directly into the fixture on the first machine, this being a Duplex Miller provided with 2 Nos. 16" dia. inserted tooth carbide cutters. After this operation the work is moved on the roller conveyor to the next operation, i. e., drilling of sump and head faces. In this operation two locating holes are drilled and reamed on the same face for jig location purposes for subsequent operations.

In the Cylinder Block Bay there are several special purpose machines of the modern type such as 6-spindle Snout Borer specially designed for the rough boring of all the cylinder bores, Special Horizontal Drilling Machine for drilling the pressure



oil hole in one setting and the wide base Miller for straddle gang milling the Crankshaft bearing sides and also for form milling the Crankshaft bore. 2 Nos. specially tooled Borematrics are stationed for finish boring the parent bore of the Block and the Liners with hydraulically-operated 3 station fixtures. The Honing Machines are positioned next to the Borematrics for rough and finish honing the Cylinder bores after finish machining of the Liners.

Most of the other operations are carried out on general purpose machines including



Radial Drilling Machines, Vertical and Horizontal Milling Machines, Radial Arm Tappers, etc. All machines have been tooled up for doing particular operations through suitably designed jigs and fixtures.

The Crankshaft and Camshaft bores are finish bored in a Horizontal Boring Machine after fitting the main bearing caps which are processed alongside the Block and brought over to a fitting station. When the machining operations on the Block are completed, the Main Bearings are fitted and line bored.

At every stage of machining, strict inspection is maintained by well trained stage Inspectors to ensure that only correctly machined Blocks are allowed to move forward to their next operations.

Before line boring the Blocks these are water tested and also the pressure rail paraffin tested to ensure that the Blocks are leakproof in every respect.

Completely machined Cylinder Blocks before delivery for assembly are inspected by Final Inspection Department, although rigid stage inspection has already been done at different stages of production.

CYLINDER HEAD BAY

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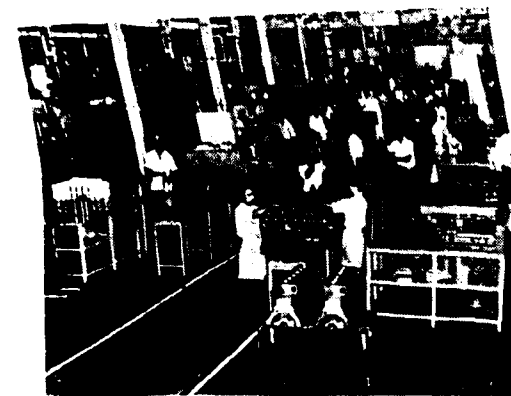
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MAY 1957



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for maintaining necessary supplies of correctly ground milling cutters, reamers, drills, taps and other small tools. All jigs and fixtures are periodically checked for wear and are carefully maintained to ensure absolute interchangeability and maintenance of very close machining tolerances.

ASSEMBLY OF ENGINES AND TESTING OF ENGINES

The Engines are assembled in the well laid out Assembly Section on a line assembly basis and every Engine, after complete assembly, is subjected to very rigorous functional tests utilising Hydraulic Dynamometers. Fuel and Lubricating Oil Consump-



tion figures are checked to ensure that each and every Engine complies with the very rigid standards laid down. Each engine averages 5 to 6 hours of actual functional test. After test, each and every Engine is very carefully examined, after finish painting and packing prior to despatch from the Works.

The production of an automotive type diesel engine of the Perkins P6 type calls for very efficient technical planning, extreme skill and supervision and also the adoption of modern production methods. The Perkins P6 Engine is world famous for its simplicity, rigidity, accessibility, economy and high quality, and Simpsons have taken every care



to ensure that each and every component fitted into the Madras—manufactured Engine is, in every respect, equal to, if not better than, the previously imported product. From the manner in which the various machining operations on the several components of the Engine are produced in Madras and the excellent administrative co-ordination, one can very boldly state that the Perkins Engine being produced in Madras is not, in any way, inferior to the foreign product.

TRADE AGREEMENT BETWEEN INDIA AND ITALY

The Trade Agreement which was concluded between the Government of India and the Government of Italy on the 29th July, 1954 and was last extended upto the 31st December, 1956, has been further extended for a period of one year ending 31st December, 1957.

Diesel-Electric Locomotive Lubricated by Tecalemit

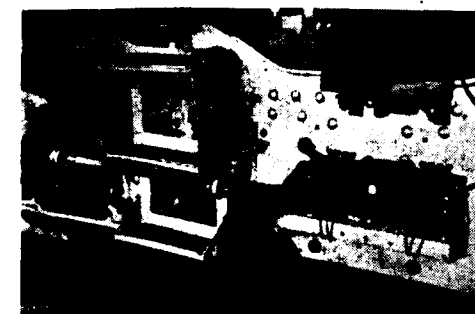
THE attached photographs are of the standard Type 1 C. O.—C. O. 1 British Railways Diesel-Electric Locomotives, the end bogies of which are automatically lubricated by a Tecalemit Brentford Oil Pump.

This interesting locomotive weighs 135 tons and is capable of a speed of 90 M. P. H. The fuel capacity is 1,150 gallons. The diesel car unit is a 16-cylinder Vee-form engine operating on the 4 stroke cycle and rated at 1,750 B. H. P. The engine is pressure-charged by 4 exhaust gas turbo-blowers. Within the interior of the locomotive, the engine and generator rooms are separated by a partition. On the latter is a filtered air compartment. A self-contained boiler compartment houses an automatically-controlled oil fire boiler, which provides steam for train heating, and for the convenience of the crews is installed an electric cooker, a tip-up wash basin fed by hot and cold water and also a water closet. The driving compartments at both ends are double-panelled throughout to reduce noise and provide heat insulation. Two automatic alarm systems are embodied in the control equipment, one for fire protection, and the other to give the crew a preli-

minary warning of an impending shut-down of the power unit due to operation of one or other of the safety devices. A Tecalemit Brentford Mechanical Pump is mounted on the left-hand side of each bogie and driven from the end of one axle. These two multi-feed pumps provide lubrication for the suspension links, etc. on the leading axles.

LUBRICATION OF SIGNAL GANTRY

It will be appreciated that the number of bearing points in wire rope pulleys and point rod cranks between a signal box and the ultimate bearing points on semaphore signals is large, and unless these bearings are properly lubricated, much wear and tear of pins and bushes takes place.

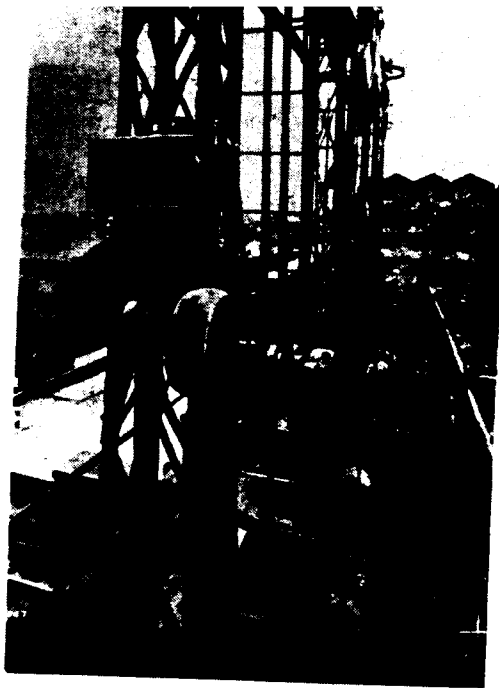


This shows the British Railways Diesel-electric Locomotive which has Tecalemit Automatic Lubrication fitted to the mechanism of end bogies. The Tecalemit Automatic Pump can be clearly seen here mounted on the left-hand side of each bogie and driven from the end of one axle on a British Railways Type 1 C.O.-C.O. 1 Diesel Electric Locomotive.



Diesel Electric Locomotive No. 10201

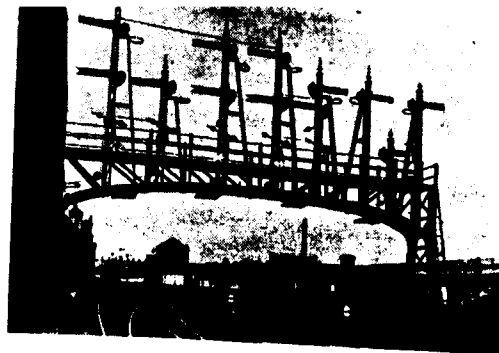
To lubricate such bearings, British Railways installed on a bridge signal situated on the main line junction at Bridge Street, Glasgow, Tecalemit Automatic Lubrication.



The Tecalemit Mechanical Oil Lubricator can be clearly seen mounted on one of the signal lattice frames on this signal gantry in use by British Railways.

It is interesting to note that 55 bearing points are lubricated from a central point by means of a mechanical oil pump, actuated by a lever link from the balance lever of one of the signals.

A main pipeline is run from the pump along the side of the gangway. From this main pipeline distribution pipes are run up the various signal lattice frames and branched



This bridge signal on the main line at Bridge Street, Glasgow, has a Tecalemit Mechanical Lubricator fitted to it, which has been marked.

to each of the signal bearings which are fitted with meter valves to allow a calibrated quantity of oil only to be passed in a given time.

Each time the lever is operated for the particular signal on which the pump is mounted, a definite quantity of oil is discharged into the system.

The definite advantage of this system is at once apparent when it is noted that less than two pints of oil are required during a period of two weeks to lubricate the signal gantry and the entire system is furthermore insulated against the ingress of foreign and abrasive substances. All bearings, therefore, automatically receive a regular quantity of oil and the danger of overlooking them is eliminated. The time factor is also another important feature as apart from filling the oil reservoirs at a scheduled time and routine inspection, no further attention is required.

PRODUCTION OF LATHES IN H.M.T. FACTORY

In February 1957, 22 lathes were manufactured in the Hindustan Machine Tools factory at Bangalore, bringing the total number of lathes so far manufactured to 132.

During the second fortnight of May 1957, four lathes were despatched to the Works Manager, North Eastern Railway, Gorakhpur. Lathes in stock in the factory at the end of the month were 21.

Editorial Notice

The Editor invites contributions from the Engineers and Works Managers of Railway Workshops as well as company-managed Engineering Workshops in the form of original articles, research write-up, production technique etc. relating to Workshop practices in India and abroad. Besides, suggestions for the technical improvement of various aspects of Railway Workshop practice are also invited with suitable write-ups accompanied by photographs wherever possible.

Contributions are accepted on the distinct understanding that they are sent solely to "THE INDIAN RAILWAYS WORKSHOP MAGAZINE". The Editor accepts no responsibility for the views and statements of the contributors.

All contributions intended for publication in any particular issue should reach the Editor at least 30 days prior to the scheduled date of publication. This Journal is issued quarterly i. e. February, May, August, November.

All published contributions are paid for at our usual rates.

Editor.

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B 226

300 B.H.P.—0-4-0 Type Diesel Electric Shunting Locomotives

GENERAL

BRUSH-BAGNALL diesel-electric locomotives can be designed and supplied for various gauges and structures to meet the requirements of industrial and main line users.

The shunting locomotive dealt with in this publication is the 0-4-0 type for heavy shunting duty. In the design of this type of locomotive special attention has been given to the routine arduous service of such locomotives and the whole structure is sturdily built to withstand the heavy stresses and strains due to traction and buffing shocks.

All Brush-Bagnall locomotives conform to accepted railway practice, and in this particular locomotive ample accommodation has been made available for the driver by the provision of a large cab with exceptional visibility in all directions.

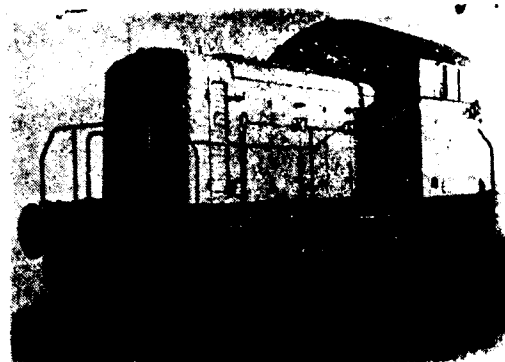
Easy access is available to all parts of the locomotive which also ensures ease of maintenance.

MECHANICAL CONSTRUCTION

The Underframe is a steel fabrication of heavy section plate, which forms an extremely rigid base for the mounting of the power unit.

The Superstructure is of welded steel construction, thoroughly braced to withstand power unit vibration and the track shocks and rough usage associated with shunting duties.

The roof section over the power unit is completely removable, and hinged doors are

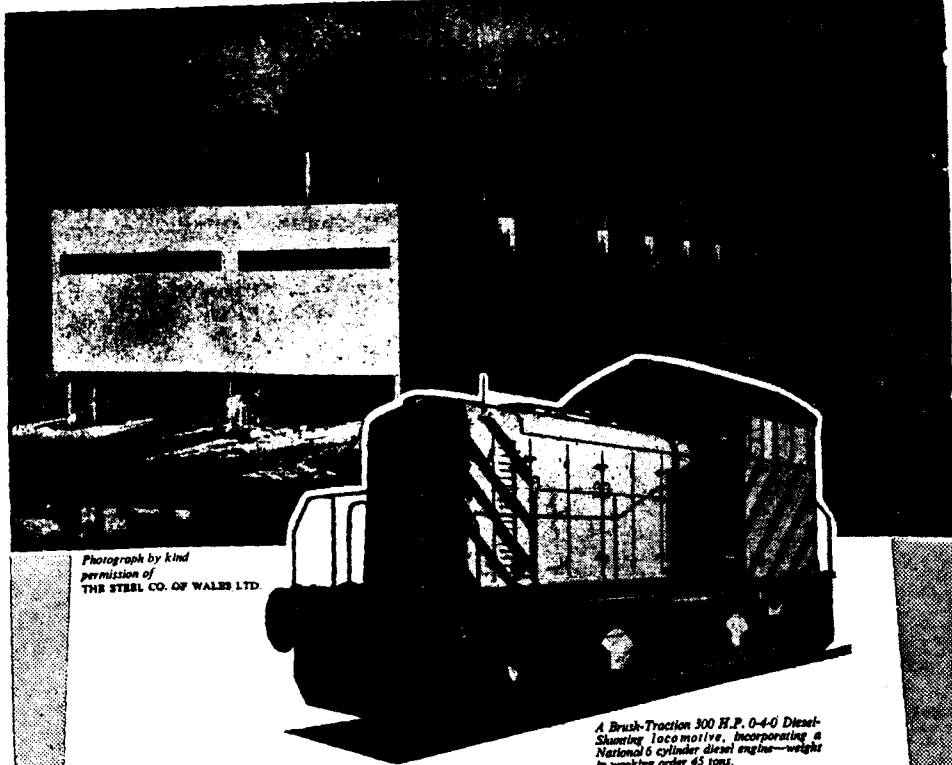


also provided over the diesel engine to enable maintenance and inspection work to be carried out on the cylinder heads.

A bulkhead is fitted between the generator compartment and the engine compartment so that the electrical machines are isolated from the engine fumes and oil.

Steel doors in the middle of the rear wall and left side of the front wall of the driving cab provide access to walkways round the locomotive. Steel doors in the side of the engine and generator compartments provide easy access to all the equipment mounted within.

The Driver's Cab is of steel construction with a seasoned beech floor and the interior



Photograph by kind permission of THE STEEL CO. OF WALES LTD.

A Brush-Traction 300 H.P. 0-4-0 Diesel Shunting locomotive, incorporating a National 6 cylinder diesel engine—weight in working order 45 tons.

In action at PORT TALBOT

Europe's most modern steel making plant consistently chooses Brush-Traction diesel-electric locomotives.

Thirty seven Brush locomotives, ranging from 220 H.P. to 660 H.P. are now in service or on order for The Steel Company of Wales Ltd. for use in their plants at Abbey, Margam, Newport, Port Talbot, Trostre and Velindre.

Brush-Traction locomotives are also in use in steelworks at Consett and Corby.

Repeat orders are the best proof of Brush quality.



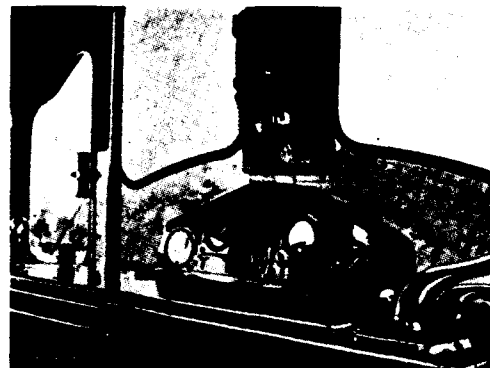
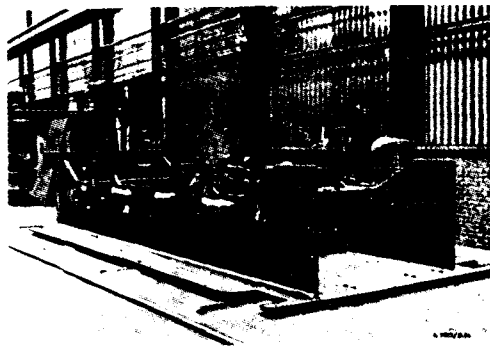
**BRUSH
TRACTION**

**DIESEL-ELECTRIC
SHUNTING LOCOMOTIVES**

The logical choice

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BRUSH EXPORT (INDIA) LTD. Chowdhary Building, K Block, Connaught Circus, New Delhi.
or BRUSH TRACTION LTD Loughborough · England · (Member of the Brush Group)

B.T.I.



Driver's control desk showing instrument panel and radio telephone.

is insulated against heat and noise. Adequate trapdoors and removable panels are provided for access to the equipment behind the panels. A fluted aluminium kicking panel protects the lining boards. The Driver's seat is swivelling, adjustable in height and tips up when not required. The assistant's

seat is over the radio equipment and houses two arm rests for use when the sliding windows in the cab are open. There is excellent all round visibility and the front side windows are fitted with Trico Folberth window wipers. Access to the cab is by front door on the assistant's side and rear door centrally. Particular attention has been paid to waterproofing and draught proofing the cab. Ventilation is by extractor vents in the cab roof and heating by a Clayton-Dewandre heater of ample capacity.

Axles are of forged open hearth steel, and run in roller bearing axle boxes. White metal bearings on the axles support the axle-hung nose-suspended traction motors. The gear wheels which transmit torque from the traction motors are pressed on to the driving axles.

Wheels are of the rolled steel disc type with tyres shrunk on.

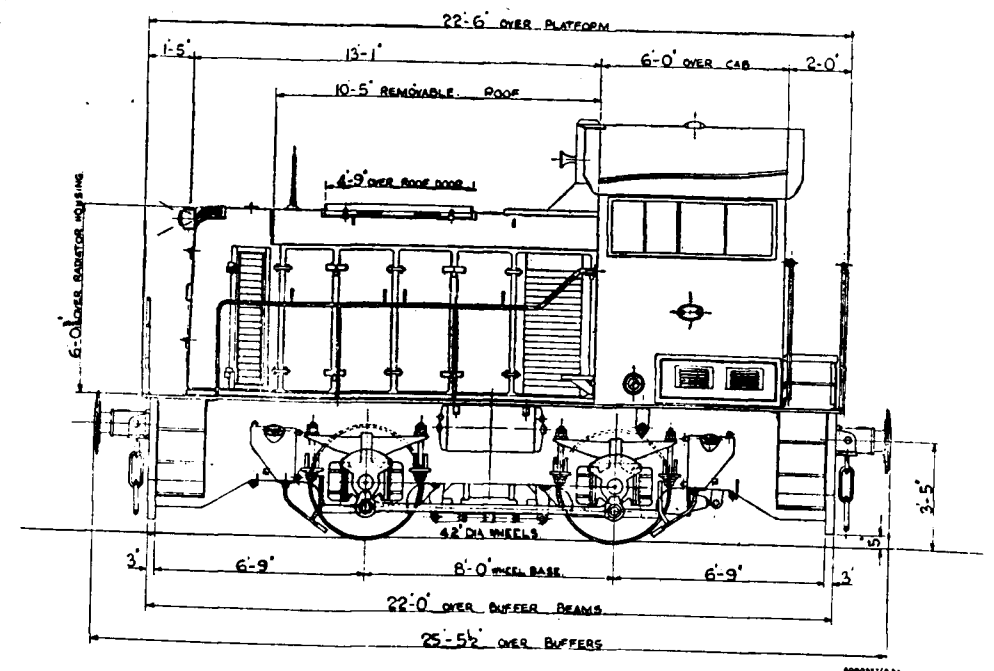
Liners are of manganese steel for axle boxes and guides.

Brakes are of the straight air type and operate on all wheels, one brake shoe per wheel acting on the inner side of the wheel. All brake rods are bushed. A hand brake located inside the driving cab acts on all wheels.

The compressed air for braking is supplied by one single-stage twin-cylinder air compressor, belt driven by the diesel engine.

A Radiator Structure for the engine water and oil is mounted in the superstructure, cooling air being blown through the radiator by a fan which is belt-driven from the engine.

A Fuel Tank of welded steel construction is mounted below the cab timber floor of the locomotive. Provision is made for draining and cleaning the tank.



Side Elevation of 300 B. H. P. Shunting Locomotive.

DIESEL ENGINE

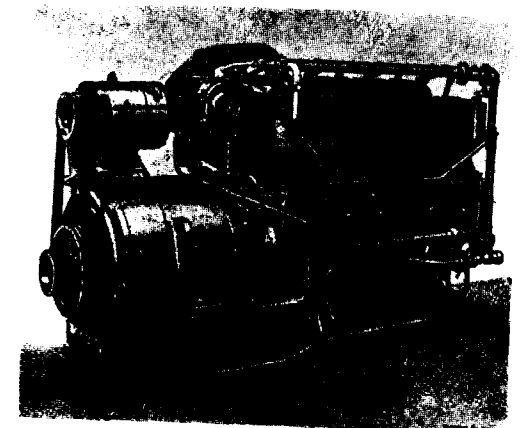
The locomotive is powered by a National M4AAU6 diesel engine, of the 4-stroke direct injection type. Brief technical particulars are as follows :—

Bore of cylinder	6"
Stroke of piston	8½"
Piston speed 1,200 r. p. m.	1,700 ft./Minute
Maximum output at 1,200 r. p. m.	300 b. h. p.

Bedplate and column are strongly ribbed separate iron castings with large inspection doors, permitting removal of piston and connecting rod.

The Crankshaft is of nickel steel, dimensions being in excess of Lloyd's requirements.

Cylinder Heads are of the four-valve type having two inlet and two exhaust valves.



Power unit comprising "BRUSH" main and auxiliary generators, "NATIONAL" M4AAU6 diesel engine mounted on a fabricated steel underbed.

Cylinder Liners are of the wet type, the bottom end being free for expansion. All liners are interchangeable and are easily replaceable.

Pistons are of aluminium alloy and are fitted with three pressure rings and two oil scraper rings. The gudgeon pin is floating.

Connecting Rods are H section stampings of alloy steel EN8, drilled the full length of the rod for lubrication of the small end. The big end is of the marine type, housing steel-backed shell-type bearings.

Two Cam Shafts machined from solid forged bar are fitted, one each side of the engine, each shaft operating one inlet and one exhaust valve of each cylinder. One cam shaft also operates the fuel pumps and drives the governor. The cam shafts are driven from the crankshaft by a triplex roller chain.

Water and Lubricating Oil Pumps are gear driven from the crankshaft.

A Fuel Injection Pump is fitted to each cylinder, arranged so that independent and easy adjustment of each pump can be made easily.

Lubrication is pressure fed by means of a gear-type pump, the suction side of which is fitted with a metal gauze-type strainer. A fine mesh full-flow Auto Klean strainer is fitted on the delivery side of the pump.

Pressure Charging of the engine is carried out by an exhaust-gas-driven turbo-charger.

The Fuel Supply is pressurised, an engine-driven fuel pump delivering the fuel under pressure to the engine fuel bus-rail.

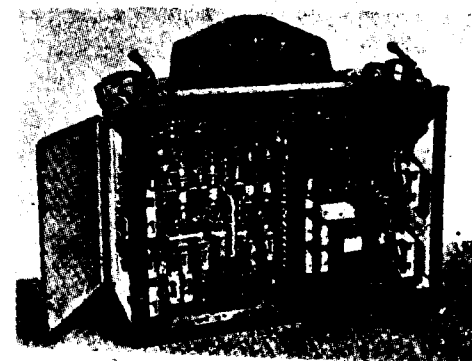
Engine Starting is effected electrically by motoring the main D. C. traction generator from the starting battery.

ELECTRICAL EQUIPMENT

The electrical transmission and control consists of the following main and auxiliary equipment.

MAIN GENERATOR

A direct-current main generator is coupled to the diesel engine, the complete power



Control cubicle and instrument panel with access doors removed.

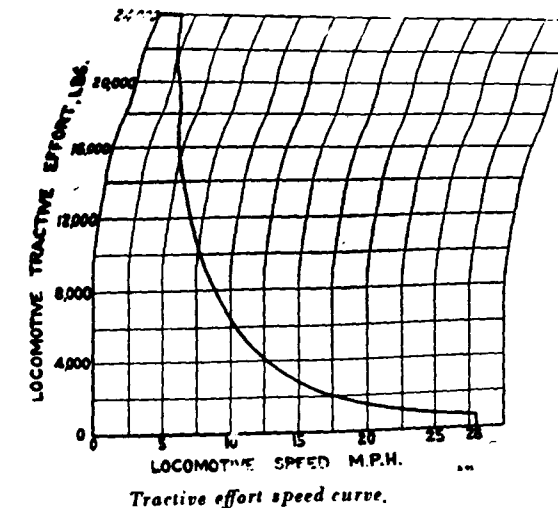
unit being mounted on a fabricated base-plate.

AUXILIARY GENERATOR

Power for the auxiliary machines, control circuits, lighting and battery charging is supplied from an auxiliary generator which is mounted on top of the main generator and belt-driven from it. Direct current is supplied from the machine, which operates at a constant voltage under the control of an automatic voltage regulator.

TRACTION MOTORS

A. D. C. traction motor is axle-hung on each of the two driving axles of the locomotive and the two motors are supplied with



power from the main generator. The motors are four-pole, double-reduction machines, of very robust construction, designed to withstand the severe conditions of operation. They are forced-ventilated, the air being supplied by an electrically driven traction-motor blower mounted in the superstructure of the locomotive.

CONTROL EQUIPMENT

All the control equipment, including the main and auxiliary contactors and relays, is mounted in a control cubicle of the desk type. The driver's control handles, consisting of the Master Controller, Main and Reversing Switch, and Air Brake Handle, are mounted on this desk, and the controls are duplicated so that operation of the locomotive is easily carried out from either side of the driving cab.

All the instruments which are necessary for driving are arranged for easy inspection by the driver.

The control cubicle is dust-proof and fitted with large doors in the front and sides to enable inspection and maintenance to be carried out with ease.

BATTERY

A 24-cell 108 ampere-hour lead-acid battery is installed in the locomotive, providing power for starting the main power unit by motoring the D. C. main generator, and also providing power for the auxiliary circuits and lighting when the main power unit is shut down.

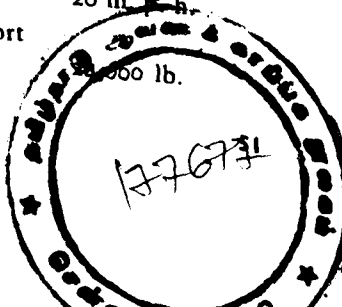
GENERAL

All the electrical equipment is of robust construction, and designed specifically for traction duties. The electrical machines are all built with Class "B" insulation to B. S. 173 of 1941.

Specification

300 B. H. P. DIESEL ELECTRIC LOCOMOTIVE GENERAL PARTICULARS AND LEADING DIMENSIONS

Wheel arrangement	0—4—0
Track gauge	4' 8½"
Rigid wheel base	8' 0"
Length of locomotive over buffers	25' 5½"
Height of locomotive	13' 2¾"
Maximum width of locomotive	9' 8"
Wheel diameter	42"
Minimum curve negotiable	80' 0" radius
Weight in working order	43 tons 5 cwt.
Fuel capacity	275 gallons
Maximum output of diesel engine	300 h. p. at 1200 r. p. m.
Transmission to wheels	2-double reduction nose-suspended axle-hung traction motors.
Maximum track speed	20 m. p. h.
Maximum tractive effort at starting	24,000 lb.



British Firm to make well-known American Vacuum Melting and Heat-Treatment Equipment

WILD Barfield Electric Furnaces Ltd., of Watford, Herts, England are pleased to announce that by virtue of an agreement recently concluded with the National Research Corporation of Massachusetts, U. S. A., they are now manufacturing in their works at Watford, which have been extended considerably in the last 12 months, vacuum melting, heat-treatment and analysing equipment of proven NRC design.

The National Research Corporation has had unrivalled experience of the problems appertaining to such vacuum processes, having made and operated more high vacuum furnaces than any other company in the world. With this and their own 40 years manufacturing experience behind them, Wild-Barfield are uniquely qualified to supply equipment suited exactly to customers' requirements.

In brief, the following are covered :

VACUUM MELTING FURNACES

Arc furnaces with consumable or non-consumable electrodes, for the production of pure metals such as titanium, steels etc., making ingots in cold moulds and casting from skull moulds.

Induction furnaces ranging in capacity from 12 lb. to 3000 lb for the vacuum melting of special steels, heat-resisting alloys for jet engines, copper and copper alloys, uranium etc.

Resistance furnaces for laboratory and research applications in capacities varying from 2 lb. to 8 lb.

VACUUM ANALYSIS EQUIPMENT

Hydrogen in Titanium Analyser for routine tests by producers and users of titanium to obviate service failure of highly stressed titanium parts caused by hydrogen embrittlement.

Vacuum Fusion Gas Analyser for determining oxygen and hydrogen content of metals and nitrogen too, in certain of them. The technique of operation has been proven by years of application in many laboratories.

In addition to the foregoing, Vacuum Diffusion Pumps and other items of equipment are available.

The agreement follows the Wild-Barfield policy of only offering for sale equipments that have been designed by experts with years of experience and proved in operation over a wide range of applications.

A Wagon Every 20 Seconds—India's Largest Rail Yard Creates A Record

India's largest railway marshalling yard at Moghalsarai, near Banaras, in April set up a record of operating performance, which has never before been achieved in its long history.

Daily during March, an average of 2,082 wagons were despatched to a multitude of destinations on the Northern, Central and Western Railways, marking a 17 per cent increase over the performance in March last year, and a 24 per cent increase over March 1955.

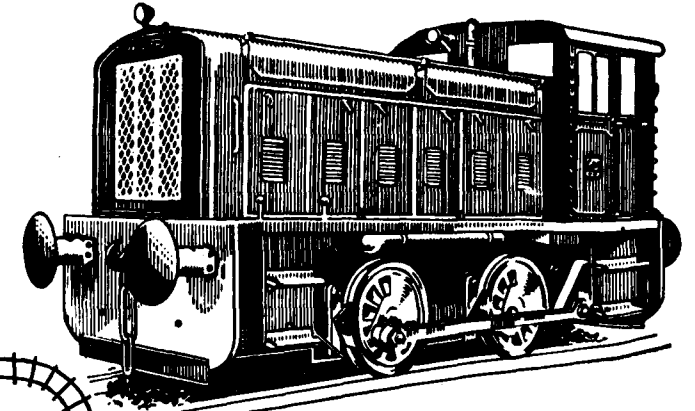
In the opposite direction to the Eastern Railway an average of 2,101 wagons left Moghalsarai daily during March, an increase of nearly 20 per cent over the daily average for March last year.

During the last 11 days of March, an average of one wagon left Moghalsarai every 20 seconds. This process continued all round the clock.

Mighty 'work horses' for a growing nation

The benefits of diesel loco haulage are to be observed readily at industrial works sidings, harbours, docks etc., in countless situations throughout the world.

Clean and economical running, easy maintenance, low costs, no stand-by losses, always ready to get on with the shunting job from cold, and ready to demonstrate fuel economy...these sum up the Ruston diesel shunting locomotives...but may we send you more details?



GC-4

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AIR-CONDITIONED TRAIN SERVICE BETWEEN BOMBAY AND DELHI PROVES VERY POPULAR

The bi-weekly Air-conditioned De Luxe train service between Bombay and Delhi is proving very popular with the travelling public and is now running to more or less full capacity.

Apart from the air-conditioning of the entire train, which provides comfortable travel both in summer and in winter, this service affords maximum comfort to third class passengers. The chairs provided for third class passengers are so designed as to give restful comfort. The train is vestibuled giving freedom of movement to passengers from one end to the other. Specially designed air-conditioned Dining Car has been provided where cheap and wholesome food is provided by Departmental Catering of the Western Railway. Overcrowding is avoided, as only tickets to the extent of the number of seats available are issued.

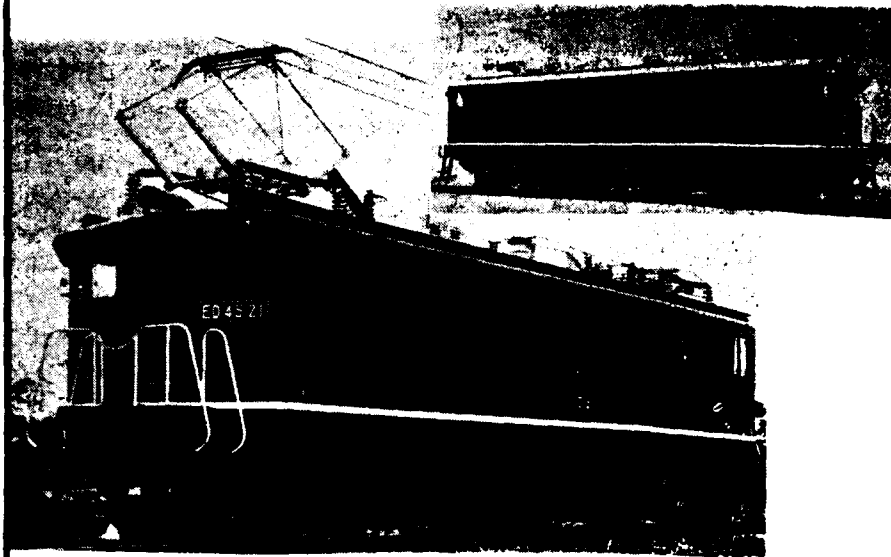
Public are requested to have their luggage brought to the stations about an hour before the departure of the train to ensure that all luggage is loaded into the luggage compartments of the train in time. Passengers are not permitted to take heavy packages into the compartments as this would cause inconvenience to the other passengers on the train.

* MAJOR INCREASE IN U. K. STEEL OUTPUT PLANNED *

Britain's steel production capacity next year will be 24,000,000 ingot tons—twice as much as was being made at the end of the war. This was revealed on March 20 in London by Sir Andrew McCance, president of the British Iron & Steel Federation.

Sir Andrew said that future demand for steel might continue to rise by at least a million tons a year.

HITACHI offers for the Development of
the Railway System of your country



The Newest in Locomotives

HITACHI

A. C. Locomotive

Shown here are the two types of A.C. Electric Locomotives which have recently been completed at the Mito Works of Hitachi, Ltd. These locomotives are drawing great attention from the Japanese authorities of the concerned field, since they are the foremost products in this country and each respectively represents a most important type of A.C. Locomotive; viz., the Mercury Rectifier Type and the Commutator Motor Type.

Hitachi, Ltd. is held in high repute not only as a leading designer and builder of D.C. Electric, Diesel Electric and other types of locomotives but also as a pioneering producer of A.C. Electric Locomotives which are engaging the strong interest of those communication authorities of the world who are mindful of electrification of their country's railway network.



Hitachi, Ltd.

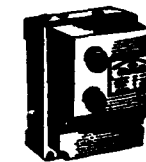
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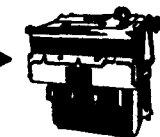
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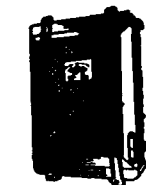
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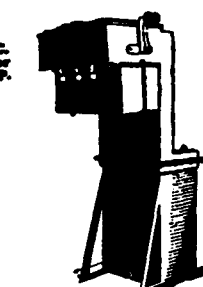
Direct-On-Line A. C.
Motor Starters for
Motors upto 10 H. P.



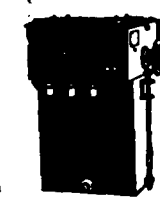
Oil Immersed Star/
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Air Break Star/Delta
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Oil Immersed Auto-
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Oil Immersed Com-
bined Rotor-Stator
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Motors upto 100 H. P.

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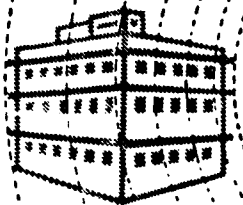
TRANSFORMERS

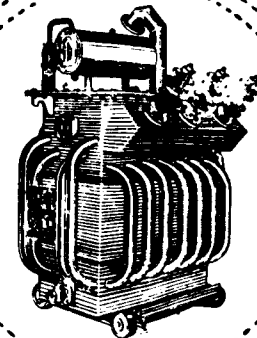


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