

The Indian Railways work Shop Magazine.

Vol-4 NOV-1957. NO-1



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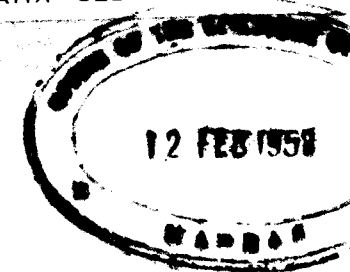
The Indian Railways Workshop Magazine

The CKD Diesel-electric Locomotive of the T. 434 0 series is suitable for heavy shunting service in main railway stations and in industry.

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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.

THE INDIAN RAILWAYS WORKSHOP MAGAZINE

Vol. IV No. 1

Annual Number

Price 50 nP.

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ANNOUNCEMENT

We have pleasure in announcing to all our Advertisers and Readers that we propose to bring out a special Machine Tools Supplement along with our February issue.

EDITOR

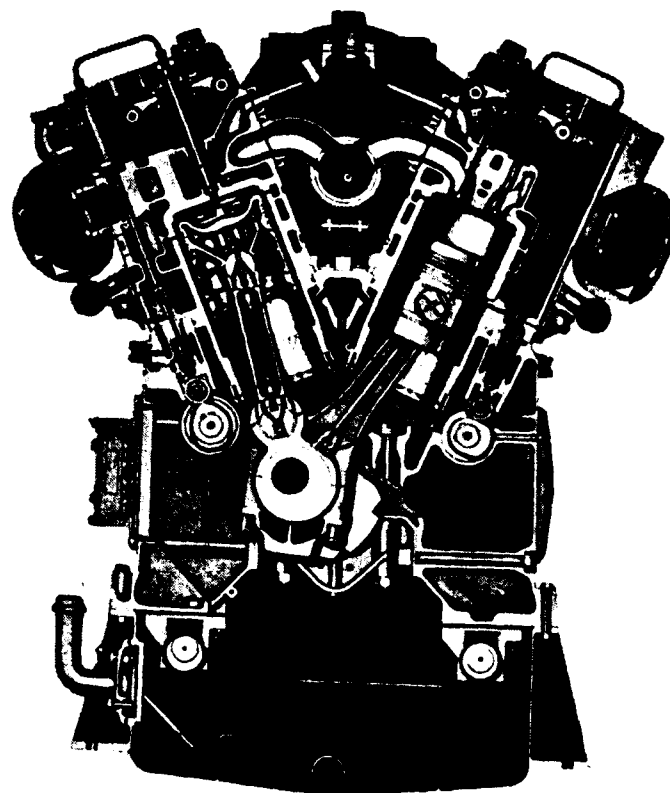
General Electric Locomotives

GENERAL ELECTRIC is marketing a complete line of industrial haulage and road locomotives for the world's railways. Approximately one year ago this company introduced a universal type locomotive that is readily adaptable to varying gauges, braking systems and couplers. By using standard, precision built components which have been tested in millions of miles of railroad service, the world's railways have been furnished with a locomotive that may be used in all types of service—passenger, freight or switching.

A complete line of industrial and mining locomotives is also marketed by this company. Three steel mills in India alone have recently purchased over 38 of these General Electric industrial haulage locomotives. India Iron & Steel Company recently purchased five diesel electric locomotives, two rated at 80 ton, one at 72 tons and two at 31 tons for its plant at Burnpur.

Hindustan Steel Company is currently putting 20 General Electric diesel electric locomotives into service at its new plant in Rourkela.

The third Indian Steel Mill to recently purchase General Electric locomotives was Tata Iron & Steel Company. Two of these are rated at 115 tons and 720 hp. and are the largest size industrial locomotives built by General Electric. Four are 80 ton diesel

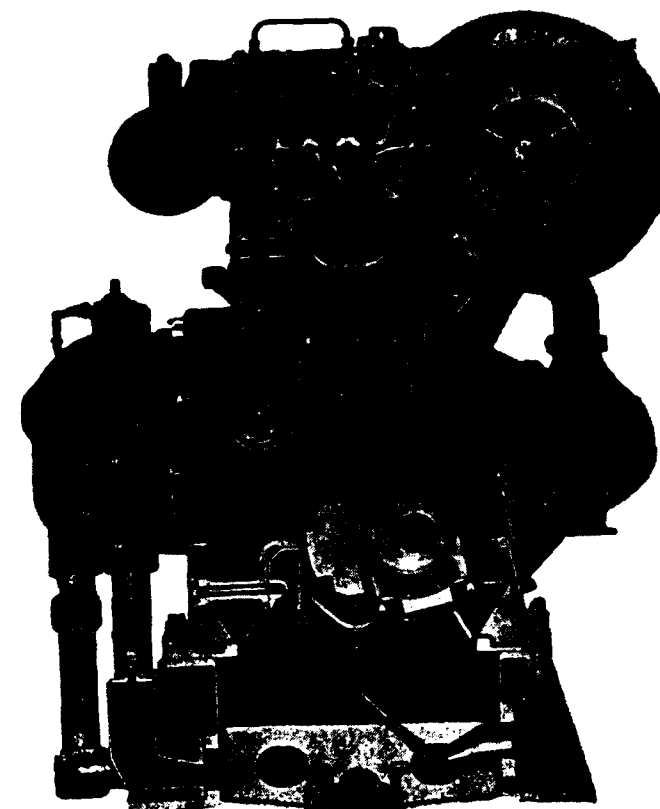


Cut away view of "V" type diesel engine—1320 hp. (8 cylinder) and 1980 hp.

electrics and one is a 25 ton diesel electric. All the locomotives for the three steel mills are broad (66 inch) gauge and have special equipment allowing them to operate under extremely dusty conditions, heat and humidity that is encountered in the blast furnace area of steel mills. General Electric is also furnishing traction motors, generators, and the diesel electric control systems for 100 ALCO locomotives ordered by India for service on the Eastern Railways.

As part of its standard line of industrial switching locomotives the General Electric Company will furnish customers with locomotives weighing from 25 tons and rating 150 hp. up to locomotives which weigh 88 tons and rate at 1200 hp.

The company has always been well known for its export road locomotives and now is selling a complete line of high horsepower universal-type locomotives. These locomotives use a rugged, 4-cycle diesel engine in six models of the line. All together nine models are available. They range from 990 hp. up to and including 1980 hp. and weigh from 148,500 lb. up to



FW engine used in U9B and U9C Locomotives.

211,000 lb. Since the line was introduced in March, 1956, orders have been received from Chile, Mexico, Argentina, and Brazil. According to the manufacturer this new line of locomotives provides superior performance because of the higher horsepower and tractive effort obtainable.

The versatility of the new line is demonstrated in the fact that the locomotives may be used for switching, freight or passenger service. Visibility is excellent in both directions and no turning is necessary. Various braking systems and coupler heights may be specified. The universal locomotives may be used on track gauges from 36 to 66 inches. Dynamic braking and train heating equipment may be installed at a small additional cost. World-wide composite clearance diagrams are also met.

In the medium horsepower range four models of locomotives are being sold. These rate at 990 and 1320 hp. and can be equipped with two 2-axle trucks or two 3-axle trucks. All axles are motored with the reliable GE-761 traction motor.

Higher horsepower and axle loading is also provided in the locomotives rating 1980 hp. This is the U18B or the U18C which weighs 211,000 lb. and 203,000 lb.



12 cylinder "V" type engine used in U18B and U18C General Electric Locomotives—1980 hp. (165 hp. per cylinder)

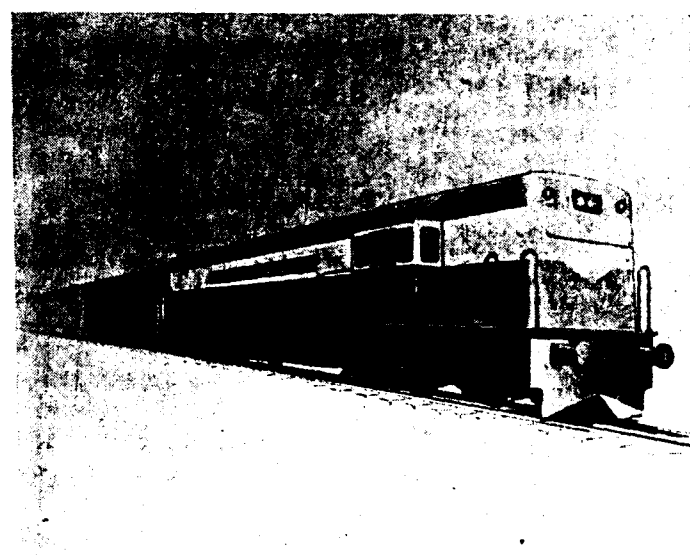
respectively.

All the universal type locomotives are equipped with the General Electric high speed bogie. A floating bolster suspension system is used, which reduces the number of complicated and often inaccessible support members found on most conventional lateral motion trucks. The truck is fully equalized and the weight of the locomotive is distributed through four curved rubber blocks on each bogie. The FV and FW series of engines, which are rated at 165 hp. per cylinder, are used in the heavy duty locomotives. These engines are of a sturdy construction and have been able to achieve their high rating by effectively dissipating engine heat. A unit cylinder with a thin walled, chrome-plated, wet liner is used. This is one of the most advanced developments in the diesel field today. The four cycle engine is easily super charged and a large volume of cooling air is available to the cylinder. Because of valve overlap and the four cycle operation, the cylinder is swept free of the products of combustion and time is allowed for fresh air actually to cool the cylinder.

Effective bearing area on the main bearing is doubled by the use of an articulated connecting rod which is joined to the master connecting rod by means of a special construction that has long been a feature of this FV type engine. The main bearings are interchangeable, precision type aluminum.

Frame and cylinders are made from Meehanite which is a close grained metal bridging the gap between cast iron and tool steel. It combines the high damping capacity, self-lubricating properties and better wear of cast iron with the greater strength, higher resilience and toughness of tool steel.

Agents of the International General Electric Company should be contacted for further information on these locomotives.



U18C—1980 hp. General Electric Diesel-electric Locomotive.

1800 H.P. Diesel-Electric Locomotives for Indian Railways

Until April 1955, ALCO was known throughout the world as the American Locomotive Company—for more than 100 years a foremost builder of railroad locomotives. During the days of steam locomotives—and since 1948, the diesel-electric unit—the company has built power for nearly every railroad in the world. It has 7,652 diesel locomotives in service today.

The corporate name of the company was changed in 1955 in order to reflect a diversification program that has given ALCO a product line of more than 56 separate items for 11 major markets. All of this, of course, while the company continues to produce diesel locomotives.

Among ALCO's present product line are drilling rig power packages for the oil production industry, diesel engines, special steels (including a new leaded-steel that has been tested and proved), guided missile components, pre-fabricated pipe, rings and forgings, heat exchangers, all types of pressure vessels, atomic power plants and nuclear components.

ALCO operates seven manufacturing plants in this country and is affiliated in Canada with the Montreal Locomotive Works. Domestic plants are at Schenectady, Auburn and Dunkirk, N. Y.; Latrobe, Pa.; Chicago Heights, Ill.; Cincinnati, Ohio and Beaumont, Texas. The company employs approximately 10,000 workers.

ALCO diesel engines through the years have been used in nearly all types of applications where reliable, powerful motive force is required. In addition to powering ALCO diesel-electric locomotives in use by nearly every railroad in the United States and many railroads overseas, they have been adopted also for many stationary and marine applications where dependability is a requisite.

IN March, 1957, the Government of India entered into an agreement with ALCO Products, Inc., of New York, N. Y., U. S. A., for the supply of 100 broad gauge main-line diesel-electric locomotives, having an output of 1800 HP to the generator. The first lot of 20 locomotives will be delivered in India in 1957 and the balance of 80 units will be supplied during the second half of 1958.

ALCO Products, Inc., formerly the American Locomotive Company, is a well known firm of locomotive builders whose first plant was established at Schenectady, N. Y., in 1848. Since that date the company has delivered in excess of 80,000 locomotives to railways of the world. ALCO was one of the diesel-locomotive pioneer companies and its first commercial diesel-electric locomotive was sold in 1925. The diesel-electric locomotives put into service by the firm in the thirty years since elapsed have passed the 8,000 mark, most of which were built since the Second World War, when dieselization began its upswing.

One of the noteworthy features of ALCO's diesel-electric locomotive manufacturing program lies in the thoroughgoing standardization which the company employs. ALCO's ten different types of locomotives make use of three different engine sizes, with outputs of 900, 1800 and 2400 HP. Interchangeable parts are used in all three diesel engines, the difference in output being obtained by varying the number of cylinders. The same braking equipment is available in all units and electrical control components are standardized as well. Only two sizes of traction motors are used to

cover the full spread in locomotive size.

In its locomotive roster ALCO differentiates between the heavy domestic type locomotives built for use primarily on U. S. railroads, where the high rail weight enables locomotives to run with axle loadings up to 27.5 tons, and the lighter weight designs intended for use abroad on systems where much lighter rail is employed. The axle loading of the latter units varies from 11 to 18.5 tons.

In addition to being called upon to meet the lower weight limitation of railways outside of the American continent, the company's export units also are built to fit within the international clearance diagram. A further requirement which ALCO has aimed to meet in its design is that the bogie design be conceived to enable satisfactory riding even on track in indifferent or poor condition.

The ALCO "World" locomotive, which is the type ordered by the Indian Government, is ALCO's representative design in the 1800 HP class for use in railways outside of the U. S. A.

DESCRIPTION OF THE LOCOMOTIVE

A view of the first of the locomotives built for India is shown in Figure 1, a photograph taken at the builder's works. Buffers and couplers are not shown, as they will be applied in India.

With the minor modifications required by the Indian

Railways gauge, the basic dimensions of the locomotive are as follows:

Height (Roof)	12' 9-1/2"
Height (Maximum)	13' 1-3/4"
Width (Over Cab Handrails)	9' 4"
Length (Over Body)	55' 7/8"
Length (Overall)	58' 11"
Weight on Driving Wheels	246,000 Lbs.
Weight on Total Locomotive	246,000 Lbs.
Supplies:	
Lubricating Oil Capacity	200 Gallons
Fuel Oil Capacity	1600 Gallons
Engine Cooling Water	260 Gallons
Sand	14 Cu. Ft.

The frame of the locomotive is built of steel sections electrically welded and it consists of a main frame made of two H section beams running the length of the locomotive and two side frames of welded truss construction. The nose of the locomotive is reinforced specially to give additional protection

to the engine crew in case of a collision.

The main transverse members of the locomotives carry the bogie pivot castings. The general arrangement of the components is seen in Figure 2, which is the longitudinal cross section of the locomotive.

The major components identifiable in this Figure 2 are the following:

1. Diesel Engine
2. Main Generator
3. Exciter
4. Auxiliary Generator
5. Bogie
6. Electrical Control Compartment
7. Turbosupercharger
8. Oil Bath Type Air Intake Filters
11. Traction Motor Blowers
13. Radiators
14. Radiator Fan
15. Radiator Fan Drive Magnetic Coupling

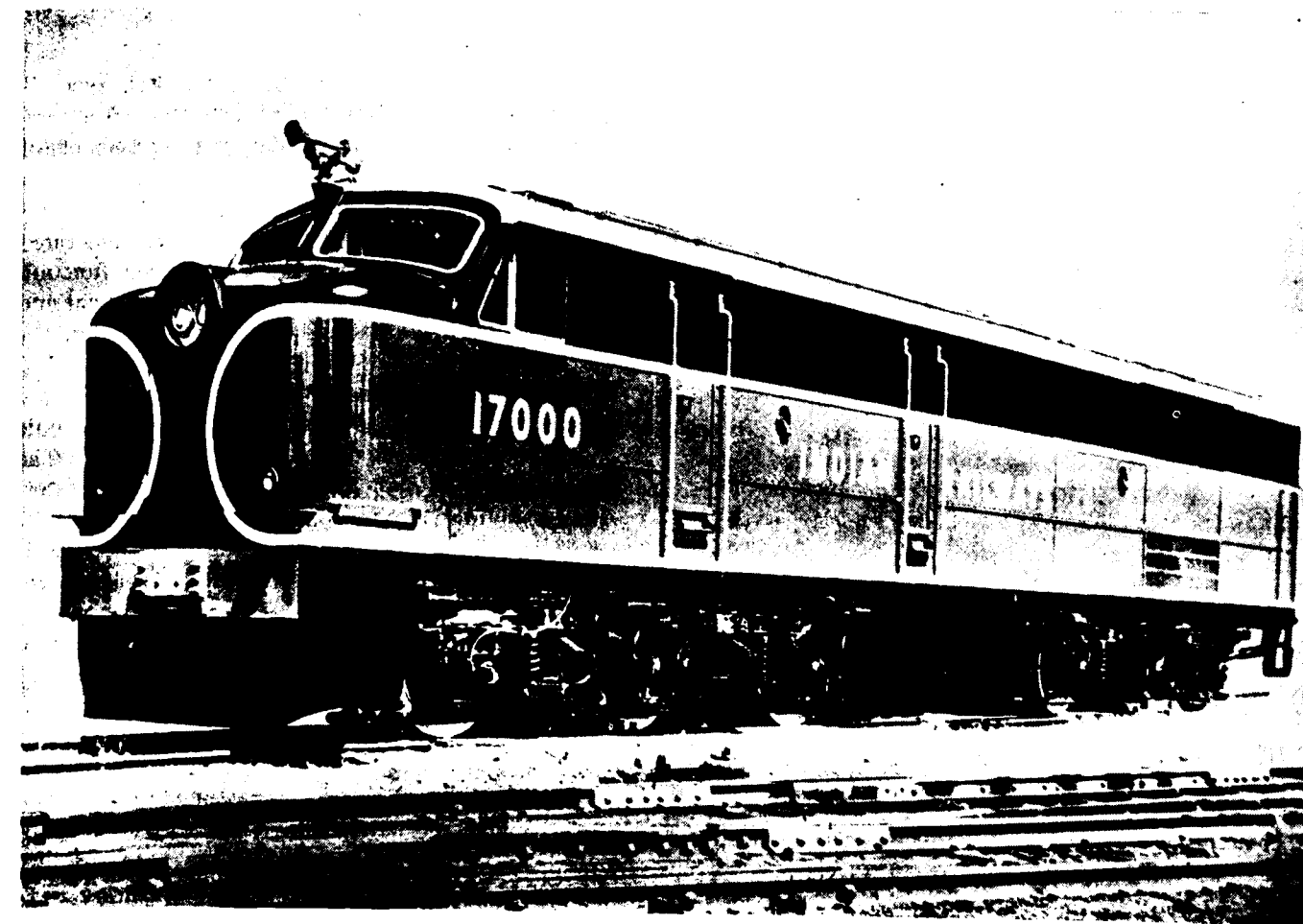


Fig. 1. One of the ALCO "World" DL-500 locomotives built by ALCO Products, Inc. for the Railway Board of India.

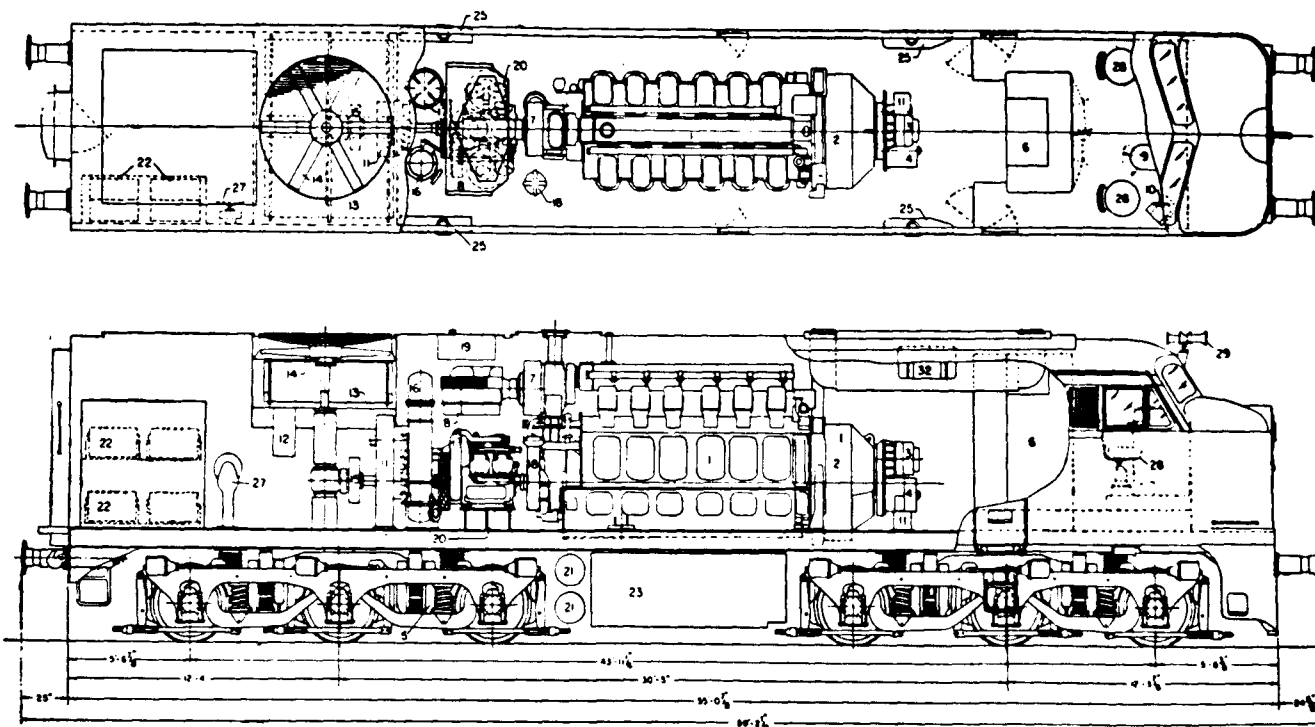


Fig. 2. Cross section of the ALCO DL-500 "World" locomotive.

- 16. Lubricating Oil Cooler
- 17. Lubricating Oil Filters
- 18. Lubricating Oil Strainer
- 21. Main Reservoirs
- 22. Batteries
- 23. Fuel Tanks
- 32. Dynamic Braking Resistors (applied in some locomotives)

POWER PLANT

The power plant consists of an ALCO Model 251-B 12 cylinder, 4 stroke turbo-supercharged diesel engine of 1950 BHP at 1000 RPM. The engine is described elsewhere and it is of ALCO Products design and construction.

The engine is directly coupled to a General Electric Model GT-581 main generator designed specifically for traction purposes.

This is a 10 pole shunt-wound DC generator with commutation poles. It is a single bearing machine with a gear case at the outboard end from which the exciter, the auxiliary generator, and the traction motor blower for the front bogie motors are driven.

All the air brought into the engine room goes through impingement type panel filters. The air

inducted into the engine goes through a bath type oil filter which ensures dust free air and therefore prolongs greatly the life of all the wearing elements of the engine.

The exciter is a GTA AC generator manufactured also by the General Electric Company. The function of this machine is to provide excitation current and excitation control current as well as described later.

Battery charging and other auxiliary loads are operated by a General Electric Model GY 27, 4 pole commutating pole shunt-wound DC generator. The whole assembly of main generator, auxiliary generator, traction motor blower drive and exciter can be removed at once from the engine. This is because it is hung from the engine frame without any independent support on the locomotive. The type of mounting has been traditional with ALCO for a great number of years.

The combination air compressor and vacuum exhaustor, and the radiator fan are driven mechanically from the diesel engine. Between the compressor exhaustor and the right angle drive gear for the radiator fan, a magnetic coupling has been installed for purposes that will be explained later.

Two of the first twenty locomotives for India will

be equipped with dynamic braking. The resistors are located in their standard position, suspended from the roof of the locomotive ahead of the diesel engine.

RUNNING GEAR

The locomotive wheel arrangement is Co—Co.

The pivot pitch is 30' 5" and the rigid wheel base of each bogie 13' 9".

The bogies, Figure 3, are of ALCO design, meant especially to provide the best riding qualities on poor or light-weight track. The locomotive weight is carried by large size bogie pins and transmitted to a bogie bolster, which is a cast steel piece H shaped, that sits astride the center motor. This bolster is carried on two sets of leaf springs that rest on special planks suspended by swing links from the cast steel bogie frame. The bogie frame rests by long deflection helical springs on equalizers which transmit the load to the axle boxes. Timken Standard Roller bearings are used, grease-lubricated and the axle box guides are of manganese steel.

Following standard American practices, the traction motors are nose supported and rest on the axles by large bronze bearings lubricated by means of wick type lubricators, single reduction spur gearing is used and the gear ratio is 94 : 17, giving a maximum track speed of 65 miles per hour.

This type of bogie design is typical of high speed American practice, and has been employed in many thousands of main line ALCO diesel electric locomotives built to this date.

Individual brake cylinders are used which apply clasp type brakes using two shoes per wheel.

A 1600 U. S. gallons (1340 Imperial gallons) capacity fuel tank is suspended from the locomotive frame between the two bogies.

BRAKE SYSTEM

The locomotives are equipped with the Westinghouse 6 SLV—1 brake schedule. This provides for straight air brakes for the locomotives and vacuum brakes for the train actuated from a standard 6 SL automatic brake valve on the engine main stand. This brake equipment is also suitable for handling air brake equipped trains by means of very small additions to the equipment applied to the locomotives.

COOLING SYSTEM

Following ALCO standard practice, the diesel engine cooling is done by a means of two large radiators located near the roof in the rear part of the locomotive.

The large radiator fan is driven from the diesel engine through a magnetic coupling, the excitation whereof is regulated by water temperature.

This system, which has been used by ALCO for a great number of years, allows the fan speed to be kept fairly constant throughout momentary fluctuations of engine speed. It does away with the troubles normally associated with direct fan drives while avoiding most of the complications associated with electrically driven fans.

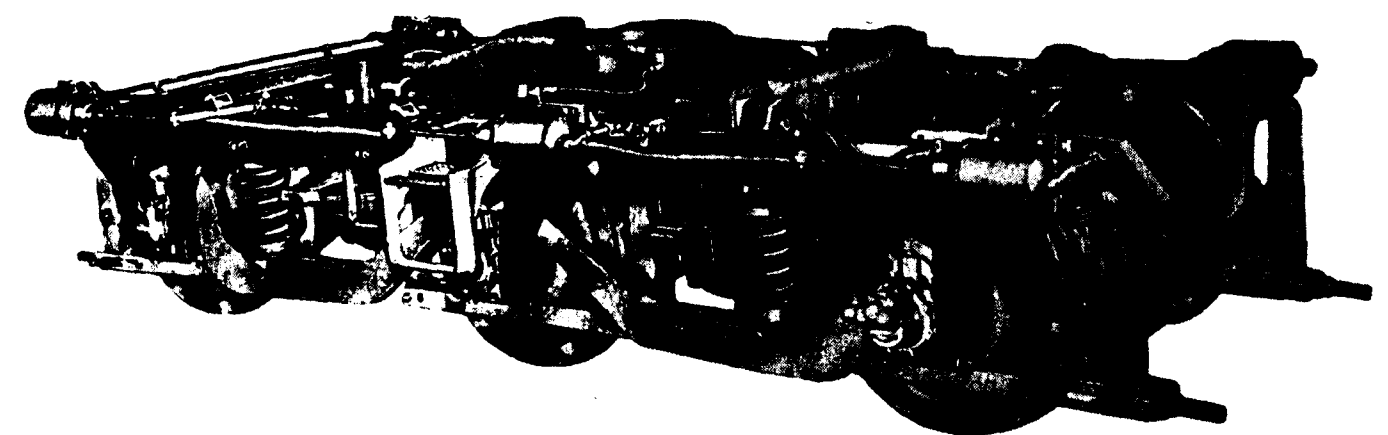


Fig. 3. ALCO-designed bogie, or truck, for the "World" locomotive. These are designed to provide the best riding qualities on poor or light-weight track.

An alarm located in the cooling water system returns the engine idling and lights a warning light on the driver's control stand when the water temperature reaches 195°F.

LUBRICATING OIL SYSTEM

The diesel engine is equipped with a gear type lubricating oil pump driven from the crankshaft with a maximum displacement of 314 U. S. gallons per minute at full engine speed.

The lubricating oil from the engine is forced through a battery of cotton waste packed filters, then through a heat exchanger, where it is cooled by the diesel engine cooling water, and finally through a metallic strainer. After the strainer, it is returned to the engine where it feeds the working parts at pressure as explained in the article covering the diesel engine.

The total capacity of the system is 200 gallons.

FUEL OIL SYSTEM

These locomotives have a capacity of 1600 U. S. gallons of fuel oil (1340 gallons) in a single tank located between the two bogies and suspended from the mail frame.

An electrically driven pump forces fuel oil from this tank through primary and secondary filters and feeds the engine main headers from which the fuel is taken by the individual Bosch type fuel pumps.

Excess fuel oil used to lubricate the moving parts of the pumps and injectors is returned to the main tank by means of drain lines.

CONTROL

The standard control used in ALCO locomotives is installed in these units for India.

The driver controls the operation of the locomotive by two levers located in the engineman's stand.

A throttle lever with eight motor notches and one idle notch regulates engine speed and maximum generator excitation at the same time, thus for each throttle notch, a fixed engine power and fixed horse power are transmitted to the traction motors.

The reverse handle has three positions, forward

neutral and reverse and it is suitable interlocked with the throttle to prevent reversing of the motors with power on.

The traction motors are connected across the generator in two major connections, each of which has a shunted field step. The reconnections or transitions are made automatically according to locomotive speed, the action being governed by an axle driven AC generator and a relay panel.

The transitions are two parallel series of three motors, shunted fields, three parallel series of two motors and shunted fields.

A third handle in the engine man's stand provides supervisory control over these connections and, in the case of the locomotives equipped with dynamic braking, controls the excitation of the traction motors which for these purposes are connected as DC generators against a resistor grid.

Traction motor load is indicated by a colored band meter located at the engine man's position. A green band in this meter indicates the loads under which continuous operation without time limit is permissible.

Time limited operation is shown in yellow with numbers indicating the maximum number of minutes for which the load in question can be held.

With the 65 miles per hour gearing used in the locomotives for India, the continuous tractive effort is 45,900 Lbs. at 12 miles per hour corresponding to a factor of adhesion of 18.6%. This means that the full capacity of the locomotives can be utilized for hauling heavy loads at low track speed.

DYNAMIC BRAKING

Some of the locomotives for the Indian Railways are equipped with Dynamic braking, which consists in reconnecting the traction motors across suitable resistors, as separately excited direct current motors. For this purpose, the traction motor fields are connected in series with the main generator. The driver may control the intensity of the braking effort by regulating the excitation. This is achieved by moving the selector handle across the braking range at the controller. By placing this handle as far forward as possible, self-regulating maximum braking effort is obtained at all locomotive speeds, reaching a peak of 37,500 lbs. at 20 mph.

(Continued on page 10)

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New Diesel-Electric Locomotives for the Indian Railways

THE order for 100 diesel-electric locomotives of 1800 HP which the Railway Board has placed with ALCO Products, Inc., New York, N. Y., has been reported in the previous article. The first lot of locomotives is to be supplied during the fourth quarter of 1957 and the balance will be shipped to India during the second half of 1958. In recording this order, we should take note that this is a new milestone in the modernization of the Indian Railways which is being vigorously carried out by the Railway Board, as these locomotives will be the first main line diesel-electric units to operate in India.

The need for this new type of power arises from the traffic congestions which are developing on the Southeastern Railway and on the Eastern Railway in connection with the enlargement of existing steel mills and the establishment of three new integrated steel mill plants in Rourkela, Durgapur and Bhilai. Plans are going ahead to electrify the railway divisions which will service these various industrial centers, but until these plans materialize it is intended that the diesel-electric locomotives will fill the gap and meet the mounting traffic pressure. After completion of the electrification, the diesel-electric locomotives will be used to alleviate traffic problems in other congested areas of the sub-continent.

The Southeastern Railway will bear the brunt of the traffic created by the erection of three new steel mills, as the plants at Rourkela and Bhilai are situated on its main route from Howrah to Nagpur. In view of this, it is intended by the Railway Board that 80 of the ALCO units be assigned to that Railway. The third steel plant, located at Durgapur, is on the main line of the Eastern Railway but it also will draw most of its supplies of iron ore and limestone from areas served by the Southeastern Railway. However, the Eastern Railway is meeting constantly rising traffic

density on the line to Moghal Sarai and 20 of the ALCO units will be put into service on that section, operating out of Gaya, to assist in speeding up the heavy coal traffic.

The diesel-electric locomotive serves ideally in eliminating traffic congestion due to the outstanding flexibility of the unit. The modern diesel-electric locomotive delivers constant horsepower at all speeds, while the horsepower output of a conventional steam locomotive is quite small at low speeds and rises as the speed increases. As a result, the modern diesel-electric locomotive can haul far heavier trains at the usual operating speeds, or handle the usual trains at higher speeds over the grades that restrict steam operation.

Another favorable characteristic of the diesel-electric locomotive, equally important, is its rapid turn-around time. After delivering a train at a given point of the system, the diesel locomotive is immediately available for coupling to another train and for continuing work twenty-four hours of the day. The steam locomotive, by contrast, will need to take time out at terminals for running maintenance at the running shed and for cleaning of the fires. Also, while enroute, the average steam locomotive is required to stop at intervals of 40 to 50 miles in order to take on fresh water and fuel.

The diesel locomotive does not require watering except for the occasional few gallons which may evaporate from the cooling system of the diesel engine, and its large fuel tank and high efficiency enables it to operate over a distance of 800 to 1,000 miles without taking on new diesel oil. Heavy overhauls on diesel locomotives are likewise performed at longer intervals than for steam locomotives, and the time required to carry out such repairs is greatly reduced.

(Continued from page 8)

This means that a trailing load of 2050 tonnes may be brought down a one in 100 grade by one of these locomotives, at 20 mph, without requiring the use of vacuum or air brakes to hold the speed constant.

This feature is used by a majority of the loco-

motives that must operate in territories with severe grades. It results in longer wheel life, a decreased consumption of brake shoes, and a greater safety in operation. The smooth handling of the train provided by dynamic brake results also in less damage to the goods carried.

All these properties make the diesel locomotive available for actual transport use over a far greater period than the steam locomotive. Experience has shown that the availability of the diesel locomotive can easily be maintained at 90%, while a considerable effort is required to achieve 50% with steam locomotives. The greater availability enables the diesel locomotive to average over 10,000 miles per month hauling trains, while the average for steam locomotives in India currently is around 3,000 miles per month. It is generally found that a modern main line diesel-electric locomotive will perform the same work as 2 or 2.5 steam locomotives.

The high overall efficiency of the diesel locomotive makes it an economic unit to operate. A modern unit, such as the ALCO locomotive purchased by the Railway Board, will easily attain an efficiency of 28% measured at the wheel rims, as against an average efficiency of 5% maximum for steam locomotives. The advantage in fuel economy of the diesel-electric locomotive may not be a significant factor on railways serving the coal fields, as Indian coal is favorably priced. However, freight rates on coal have risen considerably in recent years and the diesel locomotive will show a distinct savings in fuel costs in areas away from the coal fields, such as in central and southern India. Other substantial savings are found in the lower maintenance cost of the diesel-electric locomotive. These savings in repair costs are due primarily to the absence of steam locomotive boiler repairs.

The collaboration agreement which the Railway Board has entered into with ALCO Products, Inc., also covers for the training of railway personnel on the part of ALCO, and engineering assistance in the design and layout of maintenance facilities. The study of the latter facilities, in cooperation with the manufacturer's engineers, has already been completed and running repair sheds are under construction at Gaya on the Eastern Railway and at Anara on the Southeastern Railway. Some items of maintenance

equipment are being imported from the U. S. A.

For the advance training of personnel, the Eastern and the Southeastern Railways have each sent a group of eight men to the U. S. A. for training at builder's plant and for observation of maintenance practices on some of the U. S. railways. The manufacturer operates a special Locomotive School in which crews from all over the world are given courses on the maintenance and operation of the ALCO locomotive. Training periods in the U. S. A. last about three to four months. Other groups will follow the first two sent to the U. S. A. and it is expected that a total of about forty men will have been trained by the time the 100 locomotives are in service.

Training in the U. S. A. is supplemented by instruction imparted in India by ALCO engineers sent out for the purpose and by Railway engineers previously trained in the U. S. A. The manufacturer will send three experienced engineers to India for the instruction of Railway personnel.

The diesel-electric locomotive has been subject to intense development and considerable improvement over the past ten years, notably in the U. S. A., so that it represents a highly reliable machine in its modern form. The high operating efficiency and excellent reliability have combined to make the diesel-electric locomotive a strong economic factor in the modernization of railways around the world.

In the U. S. A. over 90% of all steam locomotives have been replaced by diesel-electric units. Dieselization has progressed in other countries, although at a slower rate. It is not likely that full dieselization will ever be contemplated in India where coal is abundant. However, the Railway Board has decided to embark upon a course of partial dieselization in order to benefit of the advantages of this type power in areas where the Indian Railway system will profit most.

FACTORY TO BE SET UP AT SALEM

Some tentative proposals for extending technical collaboration and the broad terms of deferred payment which were under further negotiations, had been received from a French firm of non-ferrous metals manufacturers to establish an aluminium project at Mettur in Salem, Madras State, said the Union Minister of Industry, Mr. Manubhai Shah, in the Lok Sabha on December 14. Asked by Mr. Raghunath Singh as to the estimated cost of the project and the anticipated output, the Minister said it might be about Rs. 12 crores and the production would be of the order of 10,000 tons of aluminium per annum. Mr. Shah told Mr. Ramanathan Chettiar that a firm in the U. S. A. had also made an offer to put up a plant. The Minister stated in reply to another supplementary that the annual requirements of aluminium in the country were 40,000 tons and the present production was about 12,500 tons.

The ALCO 251-B Diesel Engine

THE hundred 1800 HP main line diesel electric locomotives that ALCO Products, Incorporated, of Schenectady, New York, U. S. A., is delivering to the Indian Railways are powered by the Model 251-B four stroke cycle turbosupercharged 12 cylinder diesel engine of ALCO's own design and manufacture.

Before proceeding to give particulars about this engine, it is interesting to review its history and background.

ALCO Products, Incorporated, formerly the American Locomotive Company, purchased the works of McIntosh and Seymour, Incorporated, of Auburn, New York, U. S. A. in 1929. McIntosh and Seymour had been one of the earliest builders of diesel engines in the United States and their production stretched as far back as 1915.

From this very early date to the late thirties, McIntosh and Seymour and ALCO built a considerable number of engines, most of which were of very large size for stationary and marine purposes.

In between, quicker running, lighter weight engines were being built and developed for some shunting locomotives fabricated for American railroads.

In the late thirties, ALCO put on the market a 12-1/2x13" engine which is still built, and which has powered several thousand shunting and branch line locomotives in the United States and abroad. This engine, even if its design, dimensions and weight no longer reflect the state of the art, still enjoys a considerable reputation for ruggedness and dependability. Its supercharged version developing 1000 BHP at 740 RPM was first built in 1940.

While the 12-1/2x13" line was being developed, ALCO started building a number of engines of 9-1/2x10-1/2". An eight cylinder engine of these dimensions, built in 1935 and developing 600 HP at 1000 RPM, can be considered the fore-runner of the 251-B Diesel Engine.

The trend towards dieselization was becoming more and more apparent in American railroads and the locomotive industry quite naturally borrowed the standard mass production techniques of the automotive and other fields.

At that time, ALCO was building steam locomotives far larger and more powerful than any built before, but in spite of this success, they continued in their quest for a light-weight diesel engine.

In 1943, a 9x10-1/2", two cylinder prototype was run in the experimental laboratory in Schenectady. Experimentation continued during the war years and, as soon as manufacturers were free to resume their normal production, ALCO put in the market the Model 244 engine, 9x10-1/2" carrying its rated load at 1000 RPM.

When the 244 engine yielded its place to the 251, it was being built in two versions. One of 12 cylinders developing 1700 BHP and one of 16 cylinders developing 2350 BHP.

As can be seen, the 251 engine has a very long history and each of its features has been studied in one or many of the preceding models, stretching as far back as the original McIntosh and Seymour engines.

The 251-B engine has the following basic dimensions and characteristics :

Cycle—4 Stroke—Turbosupercharged
Stroke—10-1/2", Bore—9"
Rated Load—162.5 BHP per cylinder
Speed—1000 RPM
Mean piston Speed—1750 fpm
B. M. E. P.—193.5 psi.

The engine is built in 6, 12 and 16 cylinder versions, developing respectively 975, 1950 and 2600 BHP.

The 12 cylinder engine powers the Indian locomotives. Its dry weight is 32,650 lbs., complete, and its length is 157.62", thus being extremely compact and light engine for its power class.

The main structural member of the engine is the main frame or block of welded-steel construction, stress relieved. The main-bearing saddles are drop forged. The crankshaft is carried by seven under-slung bearings of which the center carries the two thrust collars.

The engine base is also of welded-steel construction

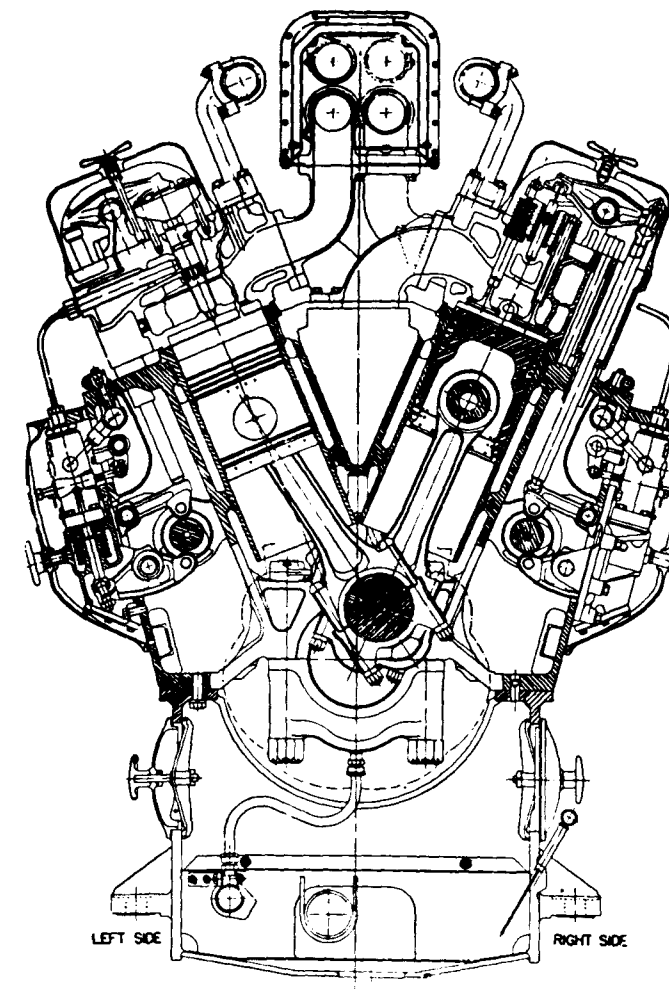


Fig. 1. Cross section of the ALCO Model 251 Vee-type diesel engine.

and carries the four engine mounting pads, the lubricating oil and cooling water pumps, and supports the after-cooler and turbosupercharger.

Figure I shows a cross section of a V Type Engine. It can be seen that the block is very deep and that the sides and top deck form a continuous structure. This results in very high rigidity and, by insuring the proper positioning of the remaining elements of the engine, contributes to their longer life.

The crankshaft is a single piece, hardened steel forging. The camshafts, one per bank, consist of three sections each. Each section contains the air, fuel, and exhaust cams for two cylinders. The bearing and cam surfaces of the camshafts are induction hardened for longer life.

The main and connecting-rod bearings are of a hard-bronze lead alloy. Grooveless construction is used for the top half of the connecting-rod bearings to insure uninterrupted oil film and thus better support the loads. The ALCO engine is of the wet-block type. Cast iron liners, with porous chromium plating are used.

The cylinder heads are of cast iron, with hard valve inserts for longer life. There are four valves, two intake and two exhaust, with hard-steel heads.

Following ALCO's long time practice, the drop-forged, steel-connecting rods are drilled to provide an oil passage from the crank shaft to the piston pin and piston for lubrication and cooling purposes.

The pistons are of aluminum alloy and made in three pieces. A piston body receives a ring carrier. The body and carrier have milled passages to provide for oil circulation for cooling purposes.

There are three compression and two oil rings. The top compression ring is carried in a nickel alloy insert to minimize wear.

The engine is provided with a gear-type, lubricating-oil pump driven from the crank shaft, and providing pressure lubrication to all the working parts.

A centrifugal pump also driven from the crankshaft, is used to insure water circulation.

As said before, all the working parts are pressure lubricated. Oil returning to the engine from the filter is led through a main header from which branches go to each main bearing. The crankshaft is drilled so that oil is allowed to flow to the connecting-rod bearings for lubrication. In the 251 engine, the center main position does not have to supply oil to any connecting-rod bearing. The adjoining connecting rods receive lubricating oil from No. 3 and No. 5 main bearings. This results in a far thicker oil film at the No. 4 main bearing.

The lubricating oil from the connecting-rod bearings is led through the drill passage in the connecting rod to the gudgeon pin, which is of the floating type. Passages drilled in the pin lead the oil to the pistons. The oil falls back to the crankcase from the pistons through a drain hole drilled in the under side of each piston.

The ALCO 251 engine uses individual fuel pumps,

of the Bosch type. These pumps have special features of ALCO design, the most important of which is a snubber valve which minimizes high pressure line vibrations and thus results in longer life of the high pressure line and the injectors.

The high pressure line enters the cylinder heads from the side and reaches the injector by means of passages cored in the head.

As mentioned before, one of the most important features of the ALCO engine is the after cooler. The air, after leaving the turbosupercharger, is led through a fin-tube type heat exchanger and is cooled by water from the engine-cooling system.

CEREMONY MARKS LARGEST SHIPMENT OF DIESEL-ELECTRIC LOCOMOTIVES IN PORT OF NEW YORK HISTORY: ALCO UNITS BOUND FOR INDIA

The growing importance of export markets to American industry was underscored last month at a ceremony marking the largest single shipment of diesel-electric locomotives ever to leave the Port of New York.

The locomotives—20 in all—are the first of 100 streamlined, 1800-horsepower units being built by ALCO Products, Inc. for the Government of India. In addition to comprising the largest shipment of its type from the port, the Schenectady-built locomotives are the first of an order totaling 100 from India, and they will be the first broad-gauge main-line diesels in that country.

The 100-unit order held by ALCO is the largest ever placed from India with any locomotive builder.

B. S. Kalkat, director of the India Supply Mission to the United States, and Arthur C. Mitchell, fuel officer of the Southeastern Railways of India, accepted delivery of the locomotives. Then one of the locomotives in the shipment was hoisted aboard the SS BELKARIN alongside the Erie Railroad's Pier 1. The BELKARIN—a specially designed locomotive transport ship operated by Belships Company—will sail for Calcutta.

The ALCO "World" locomotives making up this shipment represent the first production on orders totaling \$ 56 million that were announced by the manufacturer last May. Those orders were for 100

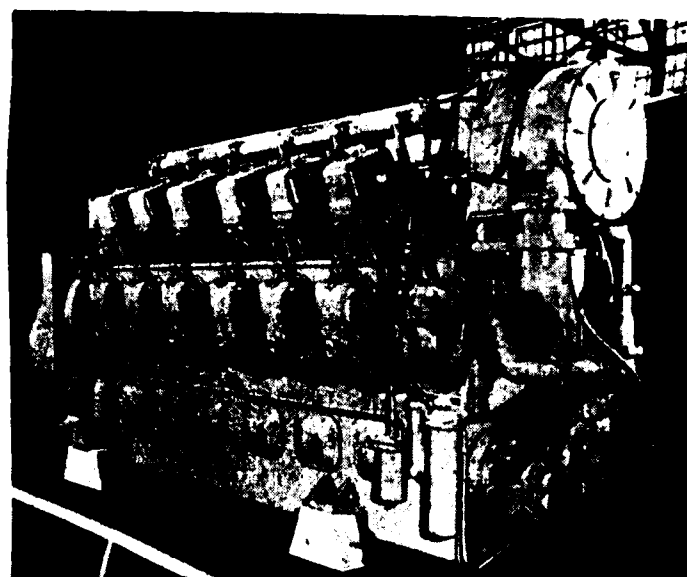


Fig. 2. The 12-cylinder ALCO Model 251 Vee-type diesel engine. This 1800-hp. power plant provides prime power for the ALCO "World" locomotive.

"World" units for India, 18 similar locomotives for Pakistan and 130 road-switching locomotives for Argentina.

The Argentine and India orders are the two largest ever placed with a single locomotive manufacturer by any railroad outside the North American continent.

The "World" locomotive, designed exclusively for export, was introduced by ALCO in 1953 and demonstrated in Spain three years ago. It is now in service in Spain, Pakistan, Peru, Australia and Argentina.

The locomotive provides light axle loading and meets the limitations of the Berne Conference international clearance diagram. With only a change in truck width—a modification provided by the manufacturer—the unit can operate on any gauge track in the world, in either high-speed passenger or freight service.

The locomotive is powered by the ALCO Model 251-B, 12-cylinder turbocharged diesel engine, newest prime power source by a manufacturer with more than 15 million horsepower of its engines in service.

ALCO expects this tailored-for-export locomotive to continue its significant role in helping to dieselize railroads of other nations—most of which are now beginning the volume conversion from steam loco-

motive power undertaken in the United States after World War II.

In addition to Kalkat and Mitchell, India was to be represented at the ceremony by officials of the consul general's office in New York. Top Port of

New York Authority representatives also were expected, headed by C. B. O'Hara, Chief port commerce director, and T. G. Gorman, manager of the authority's trade development office. Anthony Akers, director of the New York City office of the New York State Department of Commerce, also attended.

INDIA'S OUTPUT OF LEAD AND ZINC ORES

The production of lead and zinc ores in India increased to 24,004 tons during the quarter ending September, 1957, from 22,093 tons in the preceding quarter according to the Indian Bureau of Mines.

The production was also higher by 4,318 tons as compared to the corresponding quarter of 1956.

The entire production is reported from the Zawar

mines of Rajasthan.

The lead and zinc concentrates recovered from the ores during the third quarter of 1957 totalled 1,340 and 1,906 tons, respectively, as compared to 1,114 and 1,458 tons in the preceding quarter.

The lead concentrates are sent to the smelting plant at Tundee in Bihar. In the absence of a smelting plant in India, zinc concentrates are sent to Japan for smelting.

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More NOHAB-GM locomotives to the Danish State Railways

NYDQVIST & Holm Aktiebolag (NOHAB), Trollhattan, Sweden, delivered on August 16 the first locomotive of the last order from the Danish State Railways.

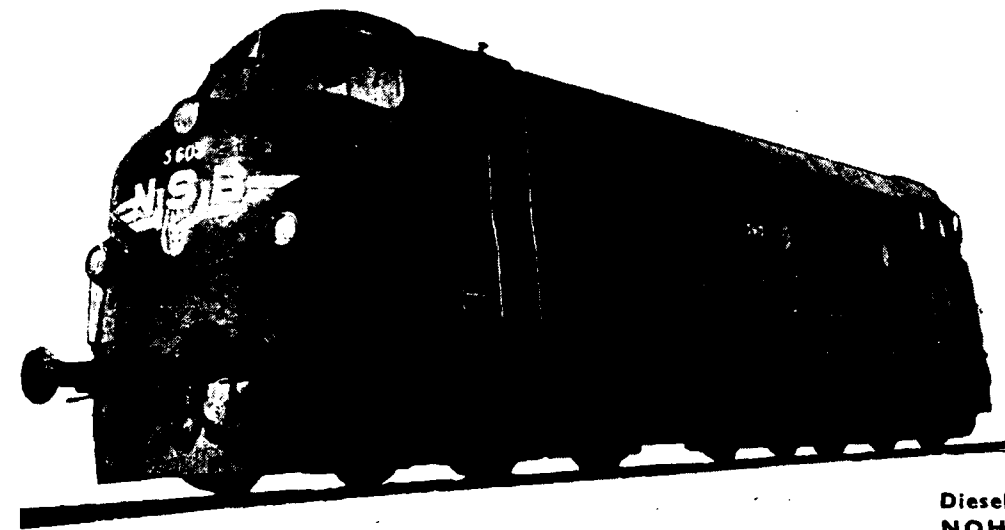
Earlier NOHAB has delivered 24 locomotives of this type to the Danish State Railways (DSB).

The DSB has made a summary of the expenses for the first four locomotives, delivered by NOHAB in 1954 and they registered savings amounting to £ 35,300:- (Danish Crs. 678,000:-) per locomotive per year in comparison with their steam locomotives.

Some months ago the DSB published a summary of the expenses for the second series of 20 locomotives. In this there is stated that only the fuel savings amount to about half a million Danish Crs. per locomotive per year.

The locomotives are diesel-electric and are manufactured by NOHAB in collaboration with General Motors, U.S.A.

They have two driving axles in each bogie. The bogies are made according to the so called flexi-coil principle with the axles displaceable in the journal



Diesel-electric locomotive, type
NOHAB-GM.



NOHAB-GM diesel-electric locomotives to the Norwegian State Railways.

Diesel-electric locomotives are manufactured by NOHAB in collaboration with General Motors, U.S.A.

They are streamlined bogie locomotives with 3 driving axles in each bogie.

The bogies are made according to the so called flexi-coil principle with the axles displaceable in the journal boxes. This gives the locomotive an extremely smooth and even running.

The driving machinery consists of one V-shaped 1900 h. p., 16-cylinder, 2-cycle diesel engine of General Motors well-known make.

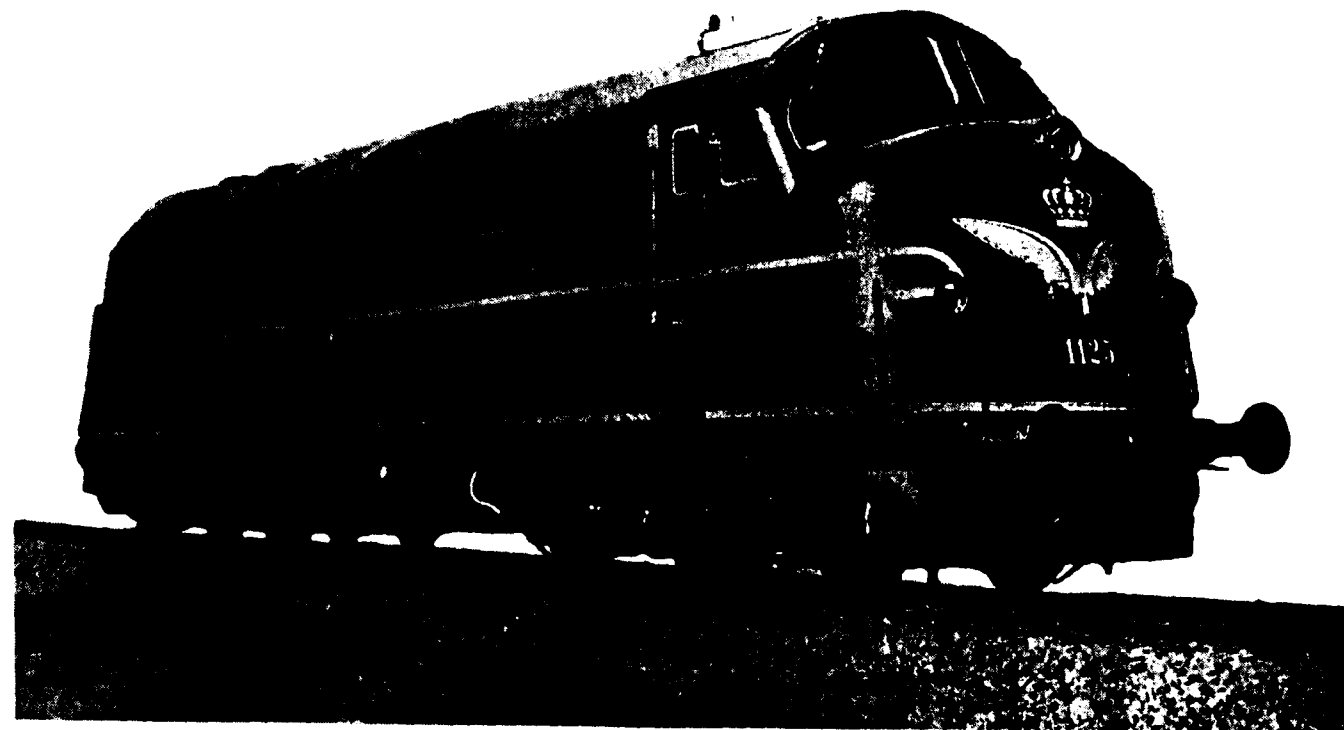
Some technical data:

Max. speed	105 km/h.
Max. tractive effort	25 tons
Length over buffers	18600 mm.
Total wheelbase	14300 "
Bogie wheelbase	4000 "
Wheel diameter	1015 "
Weight in working order	98 tons

NYDQVIST & HOLM AKTIEBOLAG

Trollhattan, Sweden

Cables: NOHAB, Trollhattan - Telex: 5284



boxes which gives the locomotive an extremely smooth and even running.

The driving machinery consists of one V-shaped 1900 hp. 16-cylinder, 2-cycle diesel engine, manufactured by General Motors, U.S.A.

The power transmission is electric and consists of a generator, direct driven from the diesel engine, regulation equipment, and D. C. motors, which by gears transmit the tractive power to the driving wheels.

The principle technical data are

Max. speed	133 km/h
Max. tractive effort	18 tons
Length over buffers	18,900 mm.
Total wheelbase	14,300 "
Bogie "	4,000 "
Wheel diameter	1,015 "
Weight in working order	106 tons

For heating the train, an automatically working steam generator has been installed.

Two Up-to-date Hungarian Railway Vehicles

A Multi-purpose Diesel-electric Locomotive and a New Express Passenger Coach

A MEMORIAL tablet has recently been affixed to the wall of an old house in Budapest. The ancient, weather-beaten single-storey building was the last stagecoach station in an era when airplanes, express trains, automobiles and buses were yet unknown. The traveller of the last century mounted the "fastest" contemporary means of transport, the stagecoach, in front of this house.

The stagecoach has become but a pleasant memory in our days. The passengers of today enjoy truly fast and comfortable transport in the products of Hungary's rolling stock industry including the world-famous MAVAG steam engines and electric locomotives, GANZ railcars and railcar trains, and the latest type diesel-electric locomotives and passenger coaches.

The progress of railway vehicle building in Hungary is best reflected in the history of the locomotives it has produced, from the first steam engine 80 years ago to the well-known phase-converter, 50-cycle Kando electric locomotives, the de-luxe express railcar trains built for the Argentine railways and the latest diesel-electric locomotives.

The purpose of this article is to present two recent products of the industry, the 600 HP. multi-purpose diesel-electric locomotive, and the passenger coach models built to the order of the Egyptian Republic Railways.

One of the experts at the factory has furnished the following information about the 600 HP diesel-electric locomotives.

"The BoBo axle arrangement locomotives had originally been designed for shunting service only. It was found, however, during service tests that by slightly increasing their maximum speed they could be used as single units for the haulage of light passenger trains on secondary lines and, when coupled to one another, for hauling passenger trains weighing 600 to 700 tons on main lines.

Accordingly, two varieties are now manufactured. One is equipped with automatic and remote control,

the other with manual control only. Next to the manner of control, all other items of equipment are similar for both locomotive types.

The main frame is of the box girder type, constructed of steel plate stampings joined by welding. The axles have external journals and are fitted with SKF two-row, self-aligning roller bearings.

To render the driver's job easier all controls in the driver's cab are duplicated so that he can find his controls in their accustomed places when driving in either direction. Conformably, the measuring instruments in the cab are likewise observable from either side.

The locomotives feature a Knorr type quick-acting air brake and an air-operated auxiliary brake. A security device operative with adjustable time lag, which disengages the mechanical equipment and actuates the air brake should the driver lose control, is also supplied.

A 16-cylinder, Vee-type, non-supercharged, four-stroke, high-speed, precombustion-chamber type Ganz—Jendrassik diesel engine is the prime mover. Its equipment incorporates flywheel, hydraulic (torsion) damper, three-step (no-load, normal, safety) centrifugal governor, an injection pump for each bank of cylinders, lubricating oil pump, air filter, lubricating oil and fuel filters, two lubricating oil coolers, two water pumps, decompression equipment, and an automatic stopping device operating on cessation of lubricating oil pressure.

The water cooler equipment is of the finned design. Air is drawn through the coolers and forced out on the top of the locomotive by a vertically arranged blower driven off the engine shaft end via universal joints and a transmission drive. Cooling water may be drained through a small number of cocks to prevent frost hazards.

As to the electrical equipment, the main dynamo is a compensated, anticomound, external and self-excitation eight-pole machine, rated at 680 kW. It is of the single-bearing type and constitutes an integral



These third-class passenger coaches have been built for the Egyptian Republic Railways. Each accommodates 104 passengers, and features an extra door in the middle to facilitate the exchange of passengers at the stations.

unit with the engine. The stator is equipped with a separate series winding for starting the engine. In this event, current is supplied by a storage battery.

The traction motors are of the six-pole, series-wound type, mounted on the bogie axles and facing the centre of the locomotive. The electropneumatically operated main current switchgear comprises reversing control, contactors and overload relays of ordinary

design and a switch for cutting out any of the bogies in case of breakdown of one of the motors. The automatically controlled interlocking contacts provided establish connections to safeguard the pair of traction motors remaining operative against overloads. The master controller incorporates all switches, handles, pilot lights and instruments required for controlling the electrical equipment of the locomotive. When in operation, the locomotive is controlled—

automatically or otherwise—by a single handle. The master controller is furthermore equipped with a reversing handle and a “service” handle, the latter for starting the diesel engine, resetting the overload relay, etc.

The electrical and control equipment of the 600 HP multi-purpose locomotive is designed to contemporary technological standards and meets the highly exacting international requirements in every respect.

In addition, the MAVAG and GANZ factories are now engaged in building 400 HP diesel-hydraulic shunting locomotives for the Egyptian Republic's Railways. These locomotives, too, will be equipped with the well-tried Ganz—Jendrassik diesel engines and Voith hydraulic transmission.”

“No less popular with railway companies all over the world are the passenger coaches, luggage and post vans, and goods wagons of Hungarian make”, continues our informant, introducing the second subject of our conversation.

The metal-framed, steel covered and silver-painted first, second and third-class coaches built for the Egyptian Republic Railways have made a great stir with the public.

The 1435 mm. gauge eight-wheeled first-class coaches seat 48 passengers, weigh 48 tons and have bogies equipped with roller bearings permitting a haulage speed of 140 kmph. Heat and sound insulation is

with Limpet asbestos. The coaches are subdivided into compartments, all seats are covered with moquette. Coach floors are faced with induroleum and covered with rubber matting. Other outstanding features are electric heating and ventilation, latches and locks made of chrome-plated aluminium bronze, ground glass windows securable at any height, and shutters in an external frame for each window. The coaches designed for service between stations with high platforms, are provided with coach doors featuring cowed emergency steps.

Second and third-class coaches are similar in design. Second-class coaches offer comfortable accommodation for 64 passengers. The double, sprung seats in the saloon are covered with leatherette. The 104-passenger third-class coaches are fitted with double seats on one and treble seats on the other side. Doors at the centre of the cars ensure rapid passenger flow.”

This article was introduced by a short historical reminiscence on a tablet commemorating the last stagecoach station in Budapest. Communication in all its branches has undergone immense development since. The most rapid single advance is perhaps that of railway dieselization. A case in point is that hardly completing plans for the serial production of the 600 HP multi-purpose diesel-electric locomotive, the experts of the MAVAG factory are already working on the design of a new, 2000 HP diesel-electric locomotive. Results obtained thus far indicate that their efforts will soon be crowned by success.

TWO FACTORIES TO BE SET UP: GERMAN AID FOR BIRLA PROJECT

Two new aluminium factories, one at Rihand and another near Salem, will be established shortly when the Government implements its scheme for the development of this strategic industry. The National Industrial Development Corporation of Government has been charged with the task of finalising the plans for two smelters each having a capacity of 10,000 to 20,000 tons.

According to present calculations at least one aluminium plant will be established by the end of the Second Plan period and another will be put into operation in the third plan.

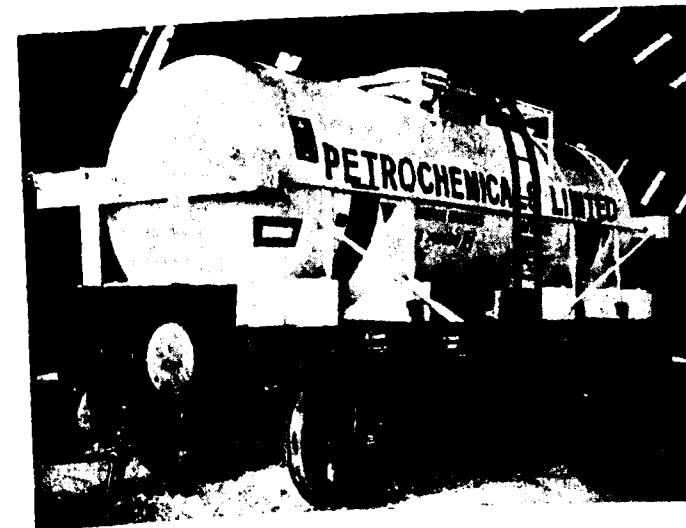
An American company which conducted a survey of the potentialities of aluminium production in India has also promised technical co-operation. In pursuance of Government's policy of a mixed economy, one of the units will be left to be operated by the Private Sector.

The production of aluminium in the country is at present limited to 2,500 tons in Jaykaynagar and 5000 tons in the Indian Aluminium Company's Plant at Alwaye. While the former plant is scheduled to double its production, the Indian Aluminium Company is expected to set up a new 10,000 ton plant at Hirakud with Canadian collaboration.

Arrangements have been finalised between Birla Brothers and a reputed German firm to start an aluminium plant, according to press reports in Calcutta. The plant will be set up at Rihand in Uttar Pradesh. It will have a rated capacity of 10,000 tons of aluminium. The plant is expected to start production before the end of the Second Plan period. The German firm will supply the needed foreign exchange, machinery and technical aid. The Central Ministry of Commerce and Industry has reportedly sanctioned this Birla aluminium project in co-operation with a German firm.

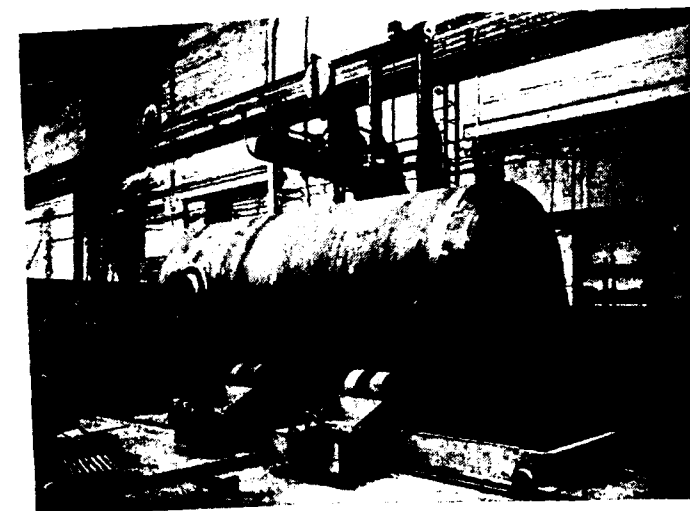
Specific Applications for Automatic Welding

WELDING is extensively used for many classes of fabrication on railway work. Among the more common are tenders, the underframes of carriages and the panel and roof assemblies, locomotive frames and boiler shells and



A typical welded tanker for transporting liquids by rail.

fittings. There are also numerous applications for permanent way points and crossings.



A vessel in the course of fabrication. Here a FUSARC automatic welding head is mounted on a Universal type of cantilever and the vessel is mounted on a traversing roller bed. For welding the circumferential seams, the vessel is rotated. For welding longitudinal seams it is traversed on the roller bed under the welding head.



Internal heating pipes are welded in position.

It is not proposed here to deal with all these applications in detail since most of them are quite usual applications of manual welding that do not essentially differ from other types of fabricated work.

There are, however, certain specific applications where automatic welding is being used to an increasing extent. One is the fabrication of cylindrical vessels which are used principally as the pressure vessels of locomotives themselves and vessels for bulk liquids to be transported by rail.

Such vessels are usually welded with a comprehensive automatic set-up which would usually consist of a roller bed above which is mounted an automatic welding head on a cantilever-type supporting structure, and, where the inside seams of vessels are also to be welded, an internal welder.

The vessel is mounted on the roller bed and can thus be automatically rotated at correct welding speeds for welding the circumferential seams. The rolls are adjustable for vessels of varying diameters. Motorized traverse can also be incorporated so that the roller bed can move at welding speeds along rails set in the shop floor in order to weld the longitudinal seams.

The welding head is mounted on a cantilever welding head manipulator, the platform of which can be raised or lowered for vessels of varying diameters. It may be stationary mounted or, where a stationary roller bed is used, may also have motorized traverse



Wheels are rotated on a manipulator at 45° for fillet welding the discs to the rim. The FUSARC automatic welding machine is stationary, but for other applications may be traversed along the portal beam.

for welding the longitudinal seams. Some models of the cantilever also permit adjustment of the head outwards along the cantilever arm.

For internal welding, a welding head is fixed on the end of a slender boom. For internal circumferential seams the vessel is rotated on a roller bed at the welding speed, while the boom, within the vessel, is stationary. For welding internal longitudinal seams the roller bed may be traversing the vessel at welding speeds or the internal welder itself may be traversing.

There are several variations of this equipment. One is where the operator lies prone in a lay trough and observes the arc and the progress of welding through a dark-glass screen let into the base. In front of him is the control panel from where he has

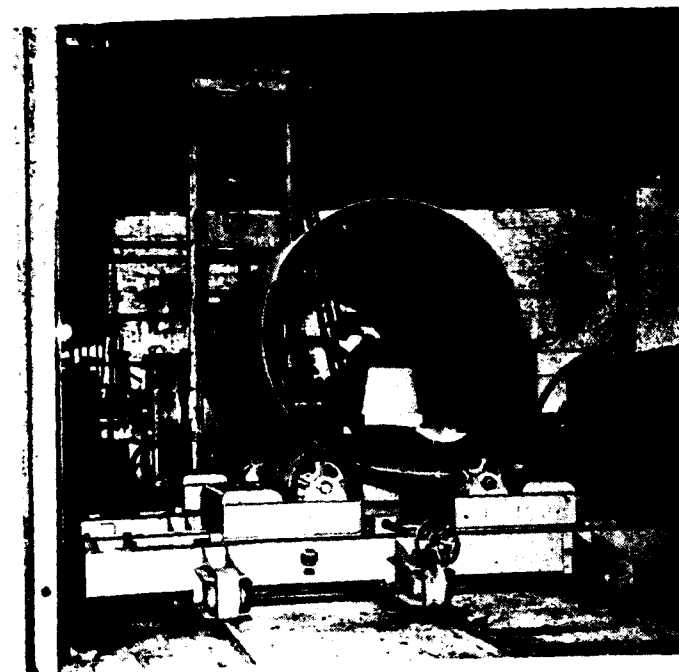


A comprehensive vessel welding installation. A FUSARC automatic welding head is mounted on a cantilever which traverses for welding longitudinal seams. The vessel is rotated on the roller bed for welding circumferential seams. A traversing internal welding boom is used for welding the internal seams.

local control over the welding and the traverse of either the internal welder, or, where this is of a fixed type, of the roller bed. Operator-carrying internal welding apparatus of this type is obviously limited to vessels with a minimum internal diameter of 2ft. Equipment for welding narrower vessels has, however, been developed without the need for an operator to be carried.

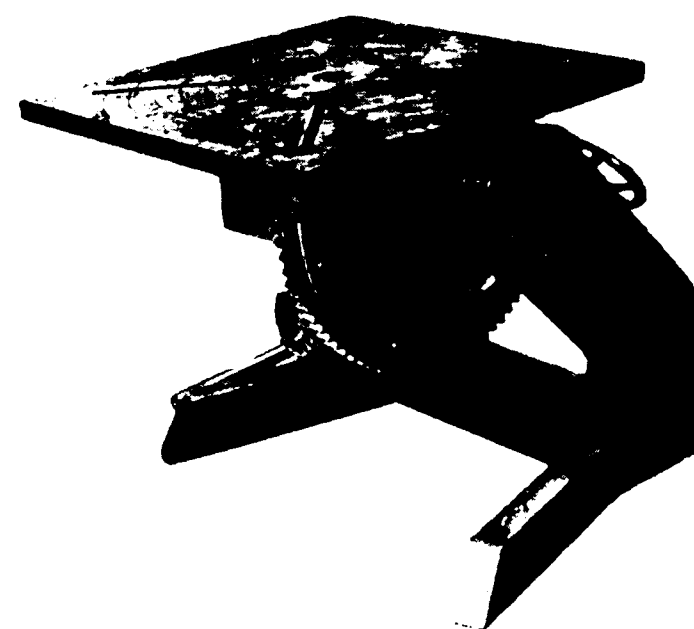


A fixed type of internal welding boom using a FUSARC automatic welding head. Provision is made for raise and lower of a few inches and for cross traverse for centering.

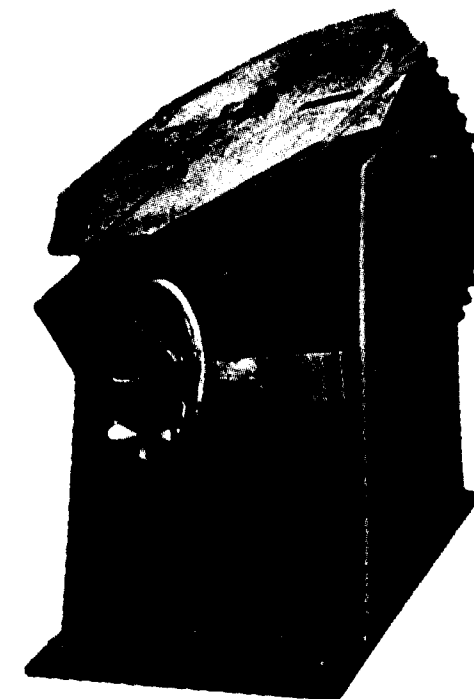


A high lift welding boom. This apparatus may be equally well employed for internal or external seam welding. The vessel is either rotated or traversed on a roller bed.

Another alternative, and one which combines, in some instances, the functions of the cantilever and internal welder is the high lift boom welder. This again comprises an automatic welding head mounted on the end of a slender boom but the boom is arranged for motorized raise up to 12 ft. 6 in. or



A 1 ton manipulator which has motorized rotation. The table can be tilted through 135°.



A 2 cwt. manipulator for positioning smaller fabrications. The table can be tilted through 135° and has motorized rotation.

lower within a vertical support. Here, again, two versions of the boom are available, one in which the operator is carried and the other not, depending on the diameter of work regularly encountered. The principal advantage with this type of equipment is, however, that it can be used both for internal or external welding of cylindrical vessels.

Roller beds are, of course, essential equipment for the welding of circumferential seams on cylindrical work, not only for speedy and efficient handling but especially where a constant speed of rotation is necessary—as it is where automatic welding heads are employed. Where motorized traverse is incorporated they can be equally well used for the longitudinal seam welding. There are three types of roller bed generally available these being light, (for weights up to one ton): medium, (for weights up to 24 tons): heavy, (for weights up to 100 tons). Idler units are also available to give either extra load-carrying capacity or to give additional support to obviate deflections in excessively long vessels. By the combination of either drive or idler units within each series the most flexible and versatile arrangement can be assembled to take vessels of varying weights and sizes.

Other manipulating equipment in use for automatic welding is the range of positioners and manipulators

designed to take loads between 1 cwt. and 6 tons. These are designed to position fabrications in the most convenient way for welding and to rotate them where necessary at welding speeds. A turntable is incorporated which tilts through 135° and which is rotatable. In most models rotation is by electric motor and this can be electronically controlled to give constant rotational speed even with eccentrically balanced loads.

Another useful item of equipment is the radial beam positioner. The beam on which the automatic welding head is located is adjustable in height and reach and can be locked in any required position. The whole beam and the supporting vertical column can also be rotated on its base. Thus it can be used



The radial beam positioner. Most types of automatic welding heads can be mounted on this. The arm may be raised or lowered and can be extended outwards and the whole positioner can be rotated on its base so that the same welding head can be employed at several different adjacent locations.

where several different welding operations are necessary and all that would be usually needed would be to swing the beam carrying the welding head, over the required location.

Specialised welding machines can be built for many purposes. One distinct field for this in railway work are machines for building up worn components by depositing weld metal on the surface so that after final machining, the worn part is restored to its original dimensions. Another use in which the technique is identical in many respects is the depositing of hard surfaces to components that are subject to exceptionally hard wear as is frequently the case with railway stock. The descriptions of such typical installations follow:

WHEEL AND SHAFT REBUILDING INSTALLATION

The machine is used for rebuilding wheels up to 4 ft. diameter and shafts up to 8 ft. long. Typical items of the latter include brake shafts, dip rods, brake cross stays and intermediate buffers. These vary in diameter between $1\frac{1}{2}$ in. and 4 in. and can be mounted between centres using a head and tailstock. The bearing surfaces are first roughly turned, and then built up with weld metal, being finally turned to finished size.

The installation comprises a welding machine



Wheel and shaft rebuilding installation used for items such as brake shafts, dip rods, brake cross stays, intermediate buffers. The turntable rotates the workpiece and the FUSARC automatic welding head traverses the length of the machine so that the weld metal is deposited helically and evenly on the surface of the component.

consisting of a FUSARC automatic welding head on a traversing carriage. This is propelled along the runway of a beam approximately 13 ft. 6 in. long by means of a lead screw. Thus the shaft is being rotated and the welding head traversed at the same time so that the weld metal is deposited helically on the surface of the shaft.

One of the supporting columns carries a tilting turntable suitable for supporting a wheel 4 ft. in diameter. This can be tilted through 90° and also raised and lowered by handwheel for appropriate welding heights.

When this turntable is tilted to the vertical position it forms a headstock which, together with a tailstock at the other end of the machine, is used to support and rotate the shaft. The tailstock is adjustable to accommodate shafts of various lengths.

A change speed gear box is provided so that the rotation of the turntable is locked with the traverse of the welding head to maintain a continuous weld.

General Data for work of this nature, using NORMEC electrode is as follows:—

Diameter (ins.)	Current (amps.)	Electrode Gauge	Forward Travel per rev.	Rotary Speed of job in revs. per. sec.	Arc Voltage
$1\frac{1}{8}'' - 1\frac{1}{2}''$	120	$\frac{1}{8}$	$\frac{1}{8}$	40	25
$1\frac{3}{4}'' - 2''$	120	10	$\frac{3}{8}$	45	25
$2'' - 2\frac{1}{4}''$	150	8	$\frac{1}{2}$	63	25
$2\frac{3}{4}'' - 3''$	200	6	$\frac{1}{2}$	68	25
$3'' - 4''$	200	6	$\frac{1}{2}$	83	25

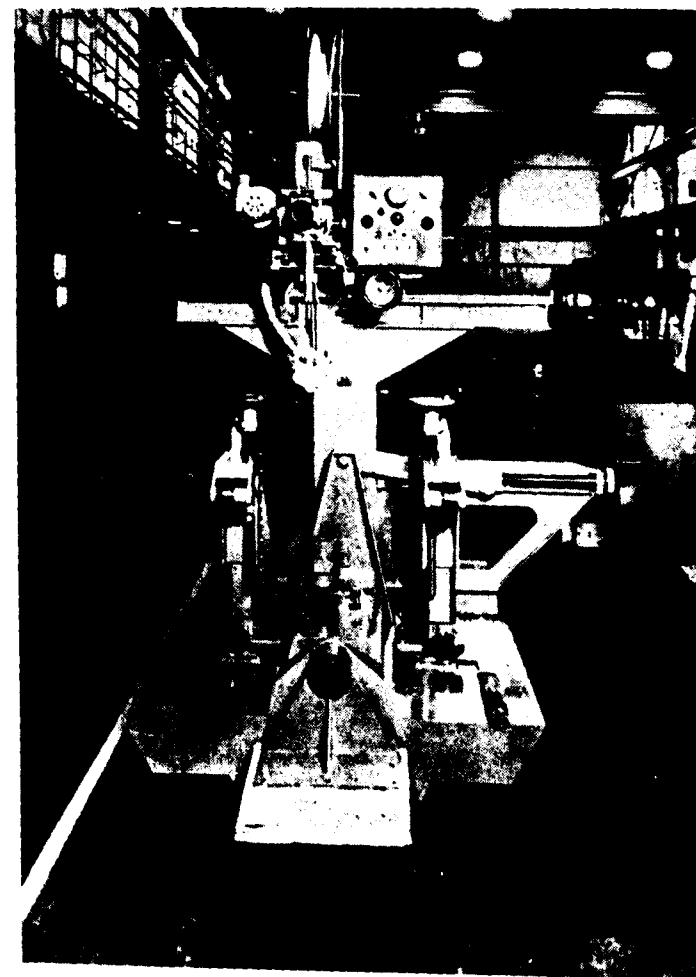
On smaller diameter work the welding current is lower since overheating of the workpiece would occur at higher currents. The speed of rotation is also slower for the smaller diameters since the weld deposit would tend to run away at higher speeds.

The depth of deposit is approximately $\frac{1}{4}$ in. with the first run and $\frac{3}{8}$ in. on succeeding runs. Two runs are, of course, usually sufficient for building-up most classes of work.

The same equipment may also be used for the rebuilding of grooves and edges of piston heads and the rebuilding of the inner faces of bogie wheels.

WHEEL TYRE REBUILDING

The railway wheel tyre rebuilding installation is designed for rebuilding tyres where the wheels remain on the axles throughout the operation. In the U. K. this is used only for welding wagon wheels, where the carbon content is in the order of 0.4% — it is not practicable to weld locomotive wheels since they have a higher carbon content and are prone to cracking. FERROMEC continuous covered electrode is most suitable for welding wagon wheels and the welding speed would be 6 in. per minute at 350 amps. and 20-22 arc volts. The welding time for one layer would thus be 20 minutes. The minimum thickness of tyre



Wheel tyre rebuilding installation. The wheels remain on the axles throughout the operation. The lower part of the machine comprises a bed which may be tilted in either direction so that the welding nozzle may be applied at the correct angle to the flange of the wheel.

(N.B.—The machine here shown is a demonstration set-up on trestles: in practice the tilting bed would be sunk within a pit and the wheels would be rolled onto the bed on rails laid in the workshop floor.)

which can be welded is $1\frac{1}{2}$ in. and, since most tyres take four layers to complete the build-up, the total welding time per tyre would be 1 hr. 20 mins.

The machine illustrated on page 25 is suitable for wheels having a gauge of 3 ft. 6 in. and a range of diameter across the thread from 700 mm. to 1000 mm. It comprises a vertical column carrying a runway along which traverses an automatic welding head. The carriage carrying the head can be traversed by a handwheel for positioning the head correctly in relation to the wheel.

The lower part of the machine comprises a bed which swings by means of pivots. It may be tilted in either direction and the welding head can be applied at the correct angle to the flange of the wheel. The tilting action is operated through a worm and worm-wheel by a handwheel. The tilting bed is provided with two hardened drive rolls which are rotated by a variable speed geared motor unit to give a welding speed range of 5 in. to 20 in. per minute. The speed variation of the rollers is controlled from an instrument panel incorporated with the welding head.

In operation, the wheels on their axles are rolled onto the bed from tracks which would be laid in the workshop floor. After positioning on the tilting bed they are located by adjustable rollers which engage with the axles.

ADVANTAGES OF AUTOMATIC WELDING

There are several automatic welding processes in general use but they all have certain features in common. The principal advantages of automatic welding are, firstly, much faster actual welding speeds are possible since much higher welding currents can be used than is possible with manual welding. Currents up to 2000 amp. are increasingly being used with automatic machines. Secondly these automatic processes all employ continuous electrode which permits a greater duty cycle. Welding for long periods is possible uninterrupted by the changing of electrodes. Thirdly, by the use of higher welding currents, deeper penetration is possible and the number of passes required is greatly reduced. This deep penetration also means that less edge preparation of the plate is usually required. In addition to these major advantages is the reduced distortion due to its speed that is a feature of automatic welding and the smoothness of the welds means that less finishing is required. All these points combine to mean that the ratio of actual welding performed to total time spent on the job is enormously increased.

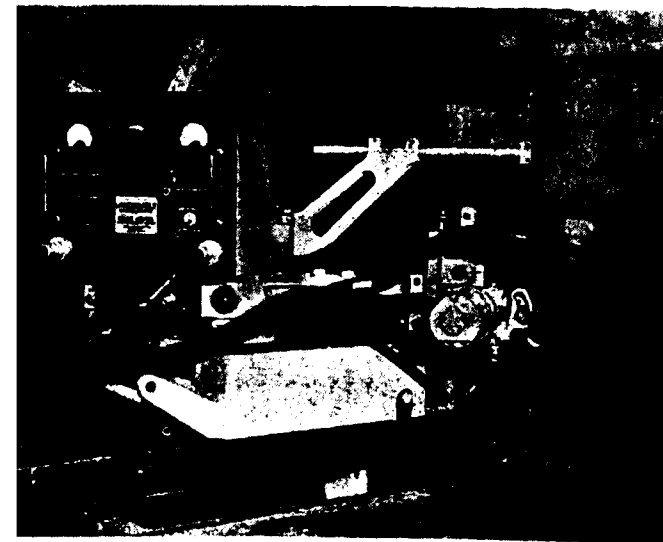
The smoothness of automatic welding is achieved by the way in which the arc length is kept completely constant. The means of this constancy, despite variations in welding current, plate undulations and other irregularities is somewhat complex and differs slightly with the various processes but the result is the same, and smooth, consistent, high quality welding is assured.

In the UNIONMELT process, the submerged arc principle is used whereby weld metal from a continuous bare wire electrode is deposited through a blanket of powder which acts both to protect the molten metal from atmospheric contamination and as a fluxing agent. Some of this powder fuses during welding to form a slag which easily peels off the weld when cool. There are thus no losses by spatter and vaporisation and, as the arc is submerged, no protective accessories are required.

The FUSARC process is an open or visible arc method. The continuous electrode comprises a core wire surrounded by a number of helically opposed auxiliary wires into which the flux is extruded. A recent development is the FUSARC/CO₂ process in which the welding head is basically the same and the same type of covered electrode is used. In conjunction with this, however, a shroud of carbon dioxide gas is used to give additional shielding of the arc. The combination of flux and gas shielding allows further increased welding speeds. An outstanding feature of this process is that high-quality horizontal-vertical fillet welding can be



A FUSARC automatic welding machine making horizontal-vertical fillet welds. The fabrication is positioned at the correct angle and the welding head traverses along the beam.

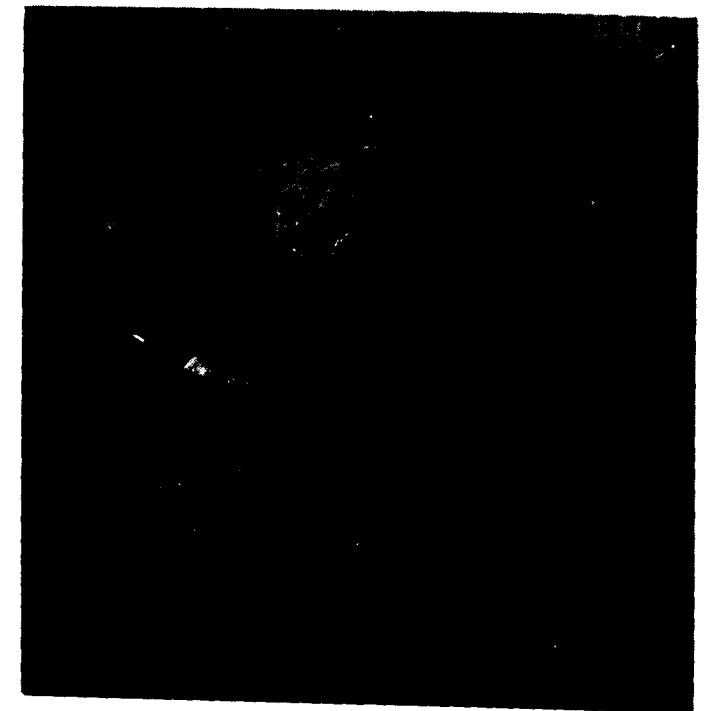


A UNIONMELT self-propelled welding machine. This is particularly useful where long straight lengths of weld deposit are required. For other applications, the machine may also be used stationary and the workpiece manipulated.

performed very rapidly. Great depth of penetration is possible and, just as important, an extreme degree of control can be exercised over the penetration; the process can thus be equally well employed on thick or thin material.

The other principal method of automatic welding is SIGMA where a bare wire electrode of comparatively thin diameter is used. The arc and weld metal are protected from contamination by a shield of inert gas, largely or entirely argon. Extremely fast welding speeds are possible and this results in the minimum of distortion. No fluxing agents are used and de-slagging is thereby eliminated. The welds are to the highest radiographic standards with a clean, smooth appearance and may be painted immediately the metal is cool. Most metals over 16 gauge and aluminium down to 18 gauge can be successfully welded by the SIGMA process.

Automatic welding heads of all the foregoing types, of course, need to be used in conjunction with automatically controlled relative movement between the welding head and the workpiece. This, in fact, provides the welding speed and the movement may be achieved, as was mentioned earlier, by rotating or tra-



A FUSARC self-propelled welding machine. No track is required with this machine, since it is fitted with car-type steering, the operator merely guiding the machine along the joint.

versing the workpiece on some form of mechanical manipulating equipment. Alternatively the work may be kept stationary and the welding head itself may be traversing. Where it is built into a machine it may be propelled at the required speed through a lead screw. It may be preferable for certain applications, particularly where long straight welding runs are required, to have a portable self-propelled welding machine into which the welding head is built. In the case of UNIONMELT welding heads these may be incorporated in a tractor which travels along a length of track which is aligned with the seam. FUSARC and FUSARC/CO₂ welding heads may be built into machines, that require no track, but can have car-type steering so that the operator merely guides the machine along the seam. These too, however, may, if necessary, be adapted for running along a track.

The choice of the type of equipment required will, of course, depend on many factors; a principal one being the amount and frequency of any particular class of work.

"HUNSLET" 637 HP. 0-8-0 Type Diesel-Hydraulic Locomotive for Mufulira Copper Mines Ltd.

THE Hunslet Engine Co., Ltd., have recently shipped a 637 HP. 0—8—0 type diesel-hydraulic locomotive for heavy duties on the 3' 6" gauge railway at Mufulira Copper Mines, Ltd., Northern Rhodesia.

This latest "Hunslet" locomotive has a weight in working order of 56 tons and a maximum axle load of 14½ tons. Maximum tractive effort is 38,000 lbs. the top track speed being slightly under 13 m.p.h. Principle dimensions are:— length over automatic couplers 34' 8"; overall height 12' 6"; overall width 9' 0"; coupled wheelbase 13' 6".

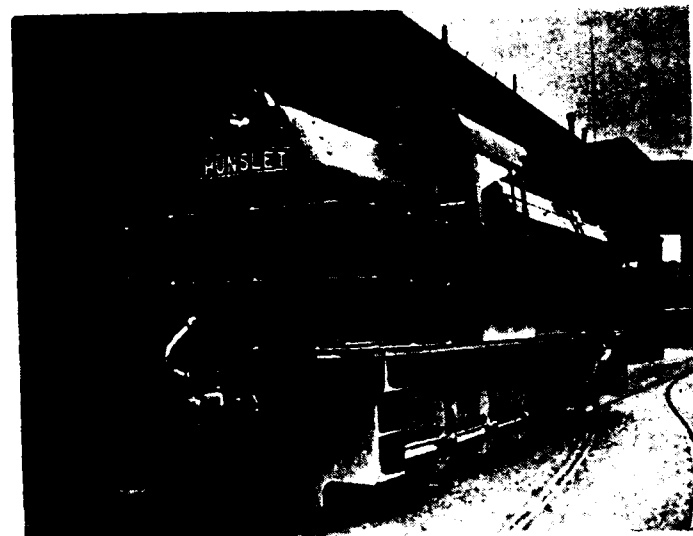
Power is provided by a 562 H.P. Paxman 12 RPHL Series II diesel engine developing 440 HP. at 1,250 r.p.m. under the site conditions of 4,000 feet altitude and temperature of 95 deg. Fah. A separate diesel engine is also incorporated for driving the auxiliaries; this engine being a 75 H.P. Ruston 4YEL developing 60 B.H.P. at 1,500 r.p.m. under the site conditions.

Transmission from the main engine is by Universal Shaft drive to the "Hunslet" Converter Box, followed by a "Hunslet" multi-plate friction clutch coupling the drive to the input shaft of the main gearbox. Final drive is taken from the gearbox jackshaft by coupling rods to the wheels. The gearbox is a "Hunslet" two-speed constant mesh totally enclosed box giving speeds of 7.96 and 12.83 m.p.h. in either direction of travel.

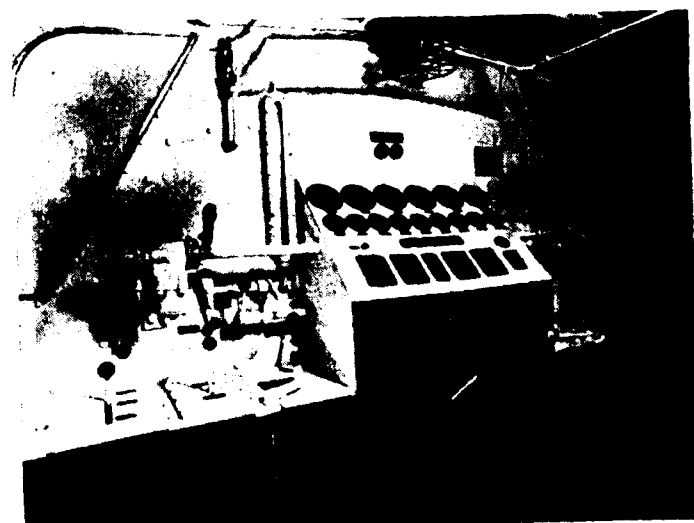
Automatic gear change based on pre-selection and governors is fitted, providing the locomotive with single lever speed control, there being a separate lever to engage forward or reverse direction.

The auxiliary engine is mounted in the front casing compartment, the drive being by "Hunslet" multi-plate friction clutch and flexible coupling to the auxiliary gearbox, from which drives are taken to two compressors, the generator, an exhaustor, and the radiator fans. This auxiliary gearbox also carries a flexibly mounted starting dog which is engaged with a similar dog mounted on the free end of the main engine crankshaft for starting the main engine.

Two main radiators of the sectional type with Serk



Rear view.



Cab & Controls.

elements are fitted. They provide water and oil cooling for the main and auxiliary engines; oil from the "Hunslet" torque converter unit being cooled by means of a separate radiator.

The large totally enclosed cab has two rear doors approached from either side of the locomotive, and features a wood inner roof, sliding and fixed windows providing all-round vision, upholstered swivel seats, a large toolbox, steel cab floor, and also a three

(Continued on page 29)

Manufacture of Railway Tyres, Wheels and Axles

THE company, Taylor Bros. & Co. Ltd., which was founded in Leeds, England, in 1854 for the manufacture of Forgings was transferred to the present site in Trafford Park between 1910 and 1923 when the original works in Leeds was closed. The present works was erected to specialise in the manufacture of railway tyres, wheels and axles and has been reconstructed at various times. A complete new wheel forge was erected in 1951.

The works are situated on a site of 84 acres having excellent transport facilities. These include a private wharf on the Bridgewater Canal, an inland waterway with connection to the Port of Liverpool, and railway sidings connected to the main line. The works themselves are adjacent to the Manchester Ship Canal and the Manchester Docks.

The various production departments include the:—

Steel Melting Dept.	Axle Forge.
Wheel Forge.	Heat Treatment Department.
Tyre Forge.	Machine and Assembly Shop.
together with Testing, Inspection and Research Departments.	

The company is the largest manufacturer of railway tyres, wheels and axles in the British Commonwealth and has an output of over 1,000 pairs of assembled wheels and axles, 2,000 tyres, 1,500 loose wheels and 500 loose axles weekly. These products are despatched to the railway undertakings and private builders



General view of the Works.

throughout the world. Approximately 50 per cent of the material despatched is for overseas orders and for this reason the close proximity of the deep water Manchester Ship Canal is an important asset.

STEEL MELTING DEPARTMENT

The Steel Melting Department has seven open hearth furnaces each of 60 tons capacity and is one of the few shops in the country producing both acid and basic steel. All the furnaces are producer gas fired and are of the Siemens Martin open hearth type fitted with water-cooled gas ports and doors. The cast ingots are of various sections and of weight from 1 to 3 tons.

(Continued from page 28)

speed electric fan mounted at the front of the cab roof. The controls are duplicated on each side of the cab, and the instrument desk, containing all necessary switches, oil and water gauges, etc., is situated between the two driving positions.

Westinghouse straight air brake and screw type hand brake are fitted for locomotive braking, and vacuum braking is provided for the train, it being arranged that the brakes can be applied together or

independently.

Visco-Alliance couplers and coupler operating gear are fitted at each end of the locomotive.

The locomotive has been shipped to the Port of Beira fully erected except for drawgear, coupling rods, and Shunters platforms, and from Beira it is to travel the 1,500 miles to Mufulira on its own wheels as part of a goods train.

At either end of the main building are stock yards for the storing of the raw materials required.

WHEEL FORGE

This new wheel forge was completed in 1951 at a cost in excess of £1,000,000. The development was financed by the English Steel Corporation Group of Companies of which Taylor Bros. is a member.

Special consideration was given in the design to the conditions under which the operators would work. The control rooms housing the operators desks are fed by their own air conditioning plant with temperature controlled filtered air. Working conditions are thus made pleasant and healthy. The wall panels of the control rooms are made of armour plate glass to give protection from heat and steam.

The plant produces wheels ranging from 24" to 50" dia. on tread at a continuous rate of 60 units per hour. This high rate of production has only been achieved by employing automatic handling devices and power operated controls to eliminate normal fatigue.

The blocks of steel from which the wheels are made are cut or broken from octagonal, or duodecagonal ingots of 12.1/2" to 18.1/2" diameter. These are stored in the ingot breaking shop and are taken by gravity roller conveyor to the furnace charging machine in the main forge building. The charger picks the blocks up individually and places them in radial rows on the hearth of the rotary furnace.

The furnace is the largest of its kind in the country and has a rated heating capacity of 40 tons of steel per hour to a maximum temperature of 1280°C. The diameter over the outer backstays is 69 feet and the hearth is 15 feet wide with a mean diameter of 48 feet 3 ins. The furnace has four heating zones and is fitted with 39 atomising burners designed for heavy fuel oil burning. The blocks pass successively through the preheating, heating and soaking zones and are then taken individually by the furnace discharging machine to the transfer bogie which carries the block through a hydraulic descaling machine to the 8,500 ton forging press.

After being upset between flattening tools the slab is transferred to the forging tools which are mounted on sliding tables on the bed and cross head of the press. Under intensified pressure the slab is forged to finish the hub, partially to form the bore and to

prepare a rim section suitable for rolling. The press itself is fitted with four cylinders having a diameter of 33.3/8 ins. and a stroke of 36 ins. The daylight between the sliding tables is 5 feet 7 ins. The lengths of travel of the top and bottom tables are 5 feet and 9 feet 6 ins. respectively.

The completed forging is transferred from the dies to a live roller table by an unloading mechanism and is then conveyed to a 1,000 ton punching press of the upstroke type equipped with hub clamping dies. The punched slug falls through a hole in the lower die to the quenching bin. The wheel then passes on the roller table through a tunnel beneath the main control room to a position from which it is loaded into the mill.

In the mill the rim section is reduced in volume and formed to the required width by driven edging rolls which bear on the front and back faces and on the inside diameters of the rim and by two pressure rolls, mounted in a carriage in the fixed head, which bear on



Machining Railway Wheels in the Wheel Assembly Shop.

the outside diameter forming the flange and tread. The mill has a driven main roll mounted in an adjustable carriage and two guide rolls mounted on the same slides as the main carriage.

After rolling, an unloading mechanism takes the wheel from the mill and the almost completed wheel is carried by means of a transfer car to a 2,000 ton dishing press. Suitably shaped dies clamp the wheel rim in the press and pressure applied to the hub and plate produces the correct hub offsets and plate contour. Finally, after dishing, the wheel is stamped with identification numbers and transferred either to a five station rim chilling machine or direct to the cooling bed.

TYRES

The Tyre Department produces tyres and rings of various sections and is capable of an output of 50 pieces per hour.

Steel ingots of suitable diameters are brought from the stockyard to the parting lathes where they are cut into blocks of suitable lengths to give the required weight. The blocks are then charged into a producer gas fired continuous furnace in which hydraulic rams gradually push the blocks along the furnace hearth into a zone of high temperature.

On arrival at the discharging end of the furnace the blocks are transferred by manipulator to box type furnaces to enable them to be brought to the correct forging temperature. The same manipulator transfers the blocks to the 20 ton steam hammer where they are forged to width, and punched. Subsequently the blooms pass through a series of three mills, becking, roughing and finishing, interconnected by jib cranes.

Each mill is driven by a 1,500 h. p. triple expansion steam engine, the pressure applied on the rolls being hydraulically controlled.

The becking mill rounds up the punched bloom and partially forms the flange of the tyre. The bloom is then transferred to the roughing mill. This mill produces the required contours and increased the diameter of the tyre to slightly less than finished size. From the roughing mill the tyre is transferred to the finishing mill which incorporates a box type main roll and a centre roll. This mill rounds up and rolls the tyre to the required dimensions after allowing for contraction allowances. The tyre is then passed



Rail Tyre Forge.

to a small press for the branding of the necessary identification.

After branding the tyres are placed in bins on the cooling bed and when cold are transferred to the inspection and gauging floor where they are thoroughly examined and removed to the stock yard to await any specified heat treatment, testing and final inspection. The majority of tyres are supplied in the "as rolled" condition, but those tyres which are required in the machined state are bored and turned in the Machine Shop adjacent to the Forge.

HEAT TREATMENT

This department contains a battery of eleven bogie type gas fired furnaces for the treatment of steel ingots, wheels, tyres and axles. Two oil tanks are installed for quenching. The oil is continuously circulated through coolers in order to keep its temperature below the flash point.

AXLES

The axle forge, designed for the forging of straight axles of various diameters and lengths for locomotives, carriages and wagons, has three steam hammers of three, five and seven tons capacity. Each hammer is capable of an output of 15 wagon axles per hour.

The forging of the billets into axles is carried out at one heat in fixed tools having two grooves, one groove being designed for finishing the middle of the axle and the other for forming the wheel seat journals

and end collars. For the manufacture of locomotive axles a single groove tool is used.

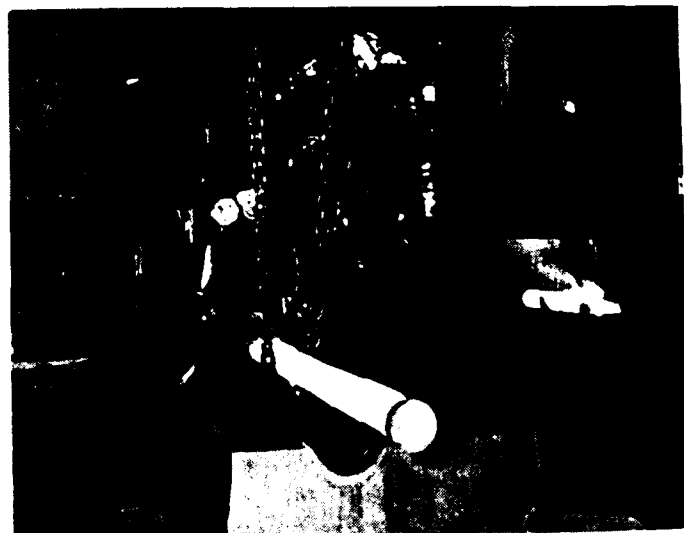
After forging the axles are hot stamped with the necessary branding specified by the customer and are then stacked ready for heat treatment. After treatment and testing the axles are transferred to the machine shop. End collars, journals and set downs are machined on copying lathes and the wheel seats on centre lathes.

MACHINING AND ASSEMBLY

Wheels are machined in a battery of vertical turning and boring machines, each machine having two tables. The machining cycle is so arranged that the first table machines the flange and flange side of a wheel whilst the other table is machining the reverse side and rough boring a second wheel. After machining the wheels are transferred by means of roller conveyers through the trepanning bay to the finish boring machine.

For Built-Up type wheels it is the practice in this shop first to fit the tyres to the centre and then machine the wheel in the same manner as a solid wheel.

The finish machined axles and finish bored wheels are transferred by mono rail crane and travelling conveyor respectively to the oil hydraulic press for



Railway Axle Forge.

assembly into pairs. Wheels are stored in racks in such a way that each rack contains wheels of only one bore size; there is then no risk of choosing an assembly with incorrect interference. The oil hydraulic wheel press of 200-tons capacity has been designed that both wheels can be pressed on to the axle without the wheel pair being reversed. The axle journals are subsequently ground or burnished, according to the individual requirements of the Railway. After inspection, the axle journals are treated with a rust preventative and are protected by wooden lags against possible damage in transit.

HUNGARY'S NEW RAIL COACHES AND SLEEPERS

The prototype of a new 80-seater coach with 8 doors is being manufactured by the Hungarian State Railway Works (MAV). The coaches will be put into service on internal routes.

Trial runs are to be held before the end of the year and mass production of the coach is expected to begin next year.

The extra coach doors—there are four on each side—are designed to cut down waiting time at stations while passengers get in and out.

At the Dunakeszi Railway Works, northern Hungary, international-class coaches are being made. Each coach—with an undercarriage of 100 tons buffer strength—will have nine compartments, seating six passengers in each.

Seats will have adjustable head, arm and foot rests. Tubular lighting will be used in both corridors and compartments.

Outsiders of the coaches will be green, corridor walls will be in cherry-red artificial leather and compartment interiors will be fitted out with buff-coloured artificial leather.

The under-carriages of the coaches, says the magazine *Muszaki Elet*, will be enclosed with aluminium, and aluminium foil is being used for heat insulation.

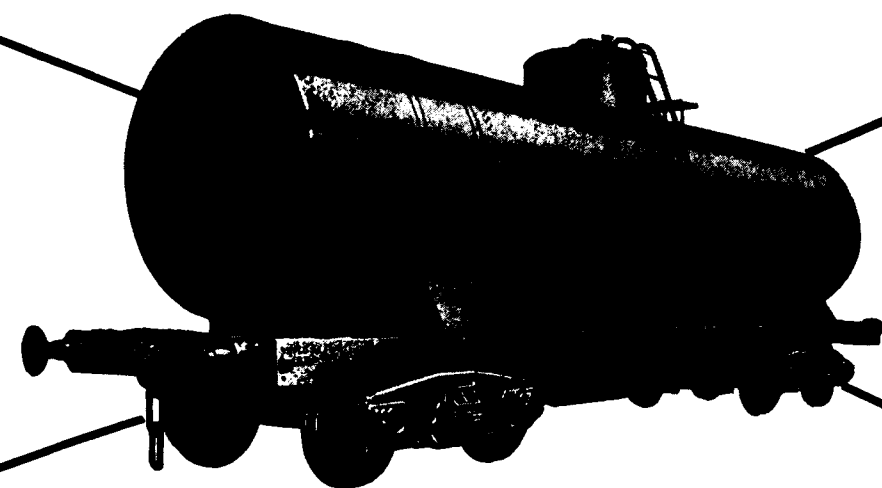
The State Railways Works (MAV) are to send ten light sleeping cars to Yugoslavia by the end of the year, and another ten next year. They weigh 40 tons.

The coaches have 10 two-berth compartments. Walls are of mahogany and corridor floors will be carpeted. The compartments, each with a built-in metal wash basin and aluminium fittings, even have a jewel-box.

One of the end compartments in each coach is to be fitted with a refrigerator and a hot plate.

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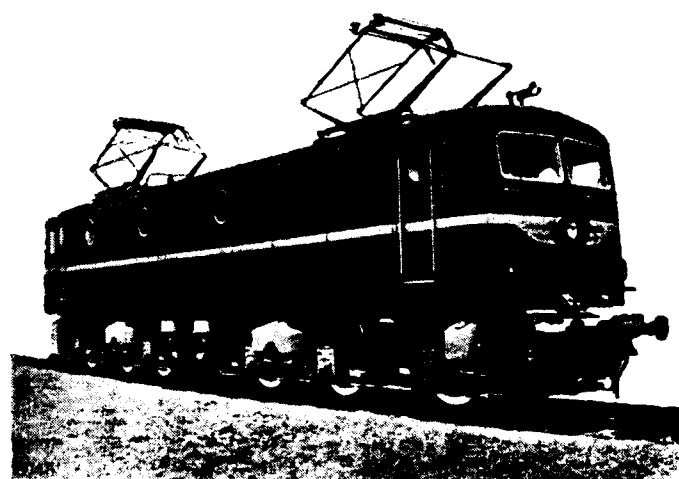
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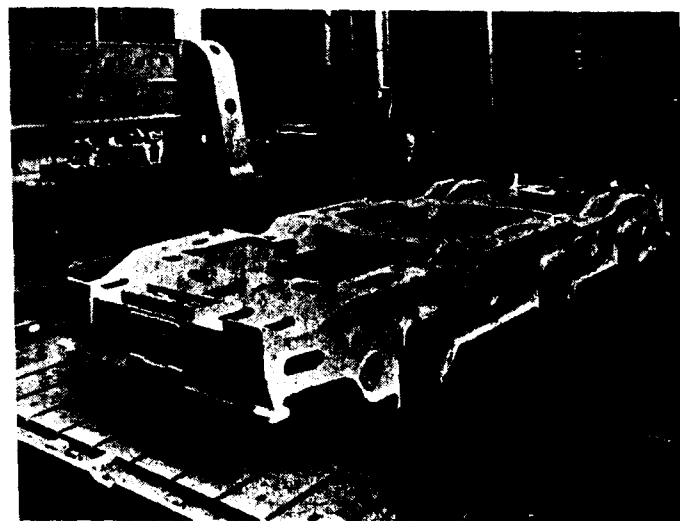
MESSRS. BIRD & CO., (PRIVATE) LTD.
CALCUTTA • DELHI • KANPUR

One-Piece Cast Steel Bogies for Rolling Stock

MORE and more Railways throughout the world are changing over to cast steel one-piece bogies for all types of rolling stock including diesel, diesel electric and straight electric locomotives, passenger and multiple unit stock, and heavy freight-carrying vehicles. English Steel



3820 HP 0-6 6-0 Electric Locomotive built by Metropolitan-Vickers-Beyer Peacock Ltd., England for New South Wales Government Railways fitted with Cast Steel Driving Truck Beds supplied by English Steel Castings Corporation Ltd



6 wheel Cast Steel Driving Truck Bed for New South Wales Government Railways 3820 HP 0-6 6-0 Electric Locomotives
Approximate weight 8 Tons 5 cwt. Length 25' 0"
Width 8' 9"

Castings Corporation Limited of Sheffield, England, are currently producing the world famous 'Commonwealth' bogies designed by General Steel Castings Corporation Limited of Granite City, Illinois, U. S. A. English Steel Castings Corporation have installed at considerable expense, the most modern foundry and machine shop equipment at their Sheffield works, to cope with the ever increasing demands for these specialty Castings.

There are many advantages to be gained by the use of one-piece cast steel bogies, not the least of these being that they are designed to provide exceptional strength with minimum weight. In a one-piece cast steel bogie frame, the design engineers can distribute the metal in a homogeneous structure as desired, changing thickness as required for the loads without abrupt changes of section or sharp projections and thus maintain uniform stresses throughout. In consequence those stress concentrations common in fabricated bogies which frequently result in fatigue failures, are avoided.

Since one-piece cast steel bogies are also completely free from joints, they can be designed of lighter weight than fabricated bogies of comparable strength.

Bogie frames in operation are subjected to many hundreds of stress reversals each day, particularly as all the vital forces for driving and stopping must be transmitted through the bogie frame; it is also the bogie which must absorb the substantial loads imposed by track irregularities and curving forces. All these factors are taken into consideration by the highly skilled and experienced engineers who design 'Commonwealth' one-piece cast steel bogies as manufactured by English Steel Castings Corporation Limited.

The integral horn guides and correct radii at cross members and other points are only practical in a casting, thus ensuring permanent alignment and keeping the bogie frame square at all times. This results in the proper functioning of wheels, axles and roller bearings with improved riding and reduced maintenance.

The cast steel bogies produced by English Steel Castings Corporation Limited are manufactured of a tough ductile steel and are extremely resistant to corrosion and can be expected to outlast the life of the locomotive.



750 HP AIA-AIA Diesel Electric Locomotive built by Robert Stephenson & Hawthorns Ltd., England for New Zealand Government Railways. Fitted with Commonwealth Cast Steel Bogies supplied by English Steel Castings Corporation Ltd.

The frame castings are supplied completely machined and drilled with parts fitted by English Steel Castings Corporation Limited, such as bushings hornguide liners, wearing plates, hornclips, etc., thus requiring only assembly work to be carried out by the builder.

'Commonwealth' bogies as manufactured by English Steel Castings Corporation Limited are usually designed to be of the equalised type by the use of compensating beams which quickly distribute the loads throughout the bogie on rough track, reducing overloads on journal bearings and minimising weight transfer which contributes to wheel slippage, highly undesirable on locomotives. Swing hanger motion improves riding and reduces flange wear.

'Commonwealth' bogies have been supplied either by English Steel Castings Corporation Limited or General Steel Castings Corporation for steam, diesel



"Commonwealth" 6 wheel Cast Steel Bogie Frame for New Zealand Government Railways 750 HP Diesel Electric Locomotives AIA-AIA Type
Approximate weight 2 Tons. 5 cwt. Length 16' 9"
Width 7' 2"

electric, and electric locomotives, also for Multiple Unit and passenger stock in the following countries:—

Eire	New Zealand
South Africa	Great Britain
French North Africa	Mexico
Spain	Uruguay
Algeria	Argentina
Belgium Congo	France
Jamaica	Pakistan
Thailand	Venezuela
East Africa	Brazil
Portugal	America
Australia	Canada
Rhodesia	

INCREASED EXPORT OF INDIAN ORE

The State Trading Corporation during its one year of existence has helped considerably in stepping up export of Indian iron ore to foreign countries. Nearly 8 million tons of iron ore have been contracted to be supplied by the Corporation to foreign firms.

The biggest of this quantity—nearly 7.2 million tons will be sent to the Japanese steel mills under a long term agreement spread over five years, while another half a million ton will be exported to Czechoslovakia. The remaining quantities are contracted to be sold to Poland, Yugoslavia, Hungary and Italy. A virtually new market is reported to have been developed in Europe by the contract for the sale of 1,75,000 tons to Italy.

FIAT Railcars for Venezuela

LAST October four rail cars built by the Fiat Railway Rolling Stock Division in Turin (Italy) to the order of the Venezuela State Railways, were shipped from Genoa to Puerto Cabello (Venezuela).

These rail cars will, on December 2nd 1957, inaugurate the new standard gauge Puerto Cabello—Barquisimeto line, the construction of which has been recently completed.

After opening this new line, the rail cars, together with 8 others now being built for the same Railway Administration, will be put into regular service on the Guanta—Naricual line.

The building of these rail cars meant that the workmen at Fiat's Railway Rolling Stock Division were called upon to make an uncommon effort. In fact, the order was placed on May 20th 1957 and the first of the rail cars made its trial runs on the Italian railways, topping 80 miles an hour, on October 1st of the same year.

The main characteristics of these vehicles are:

Length of body	71' 2"
Width of body	9' 6"
Height above rails	11' 10½"
Height inside passenger compartment	7' 6½"
Distance between boggy pivots	49' 8½"
Distance between boggy axles	7' 6½"
Wheel diameter	2' 11½"
Wheel arrangement	1A+1
Weight in running order	33.7 metric tons
Nett load	7.4 " "
Weight with normal load	41.1 " "
Number of seats	91
Top speed	75 m.p.h.

The equipment of the cars includes:

Mechanical transmission, hydraulic coupling and dry friction clutch.
5-speed synchromesh gearbox.
Free wheel.
Reversing gears on each driving axle.



FIAT

RAILWAY ROLLING STOCK DIVISION

TURIN (Italy) - 15 Via Rivalta



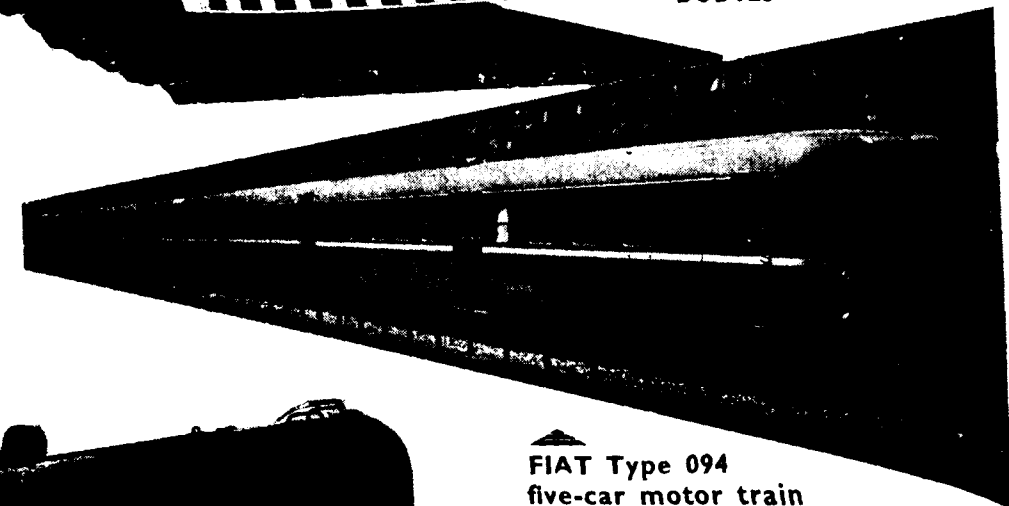
FIAT standard gauge 2-coach railcar sets for Venezuela

Power 2×145 h.p. Fiat Type 203 S engines on each car.

Hydro-mechanical transmission.

Maximum speed 75 m. p. h.

2×91 seats



FIAT Type 094 five-car motor train

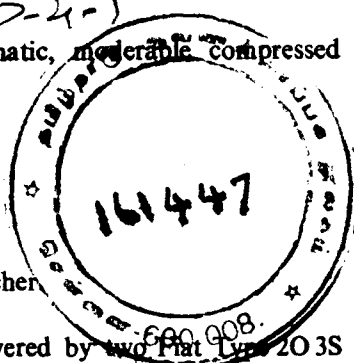
(2 power cars + 3 trailers) for the Italian State Railways. POWER CAR: 2×150 h.p. Fiat Type 203 S engines. Hydro-mechanical transmission. Maximum speed 70 m.p.h. - 68 seats - Luggage Compartment. Couplable in multiples. Tare 32.5 metric tons. TRAILER: 68 seats. Tare 20 metric tons.

Diesel-electric shunting and mixed traffic locomotive. 600 h.p. at 1000 r.p.m. (single Fiat Type 226ES engine). Tractive effort at starting 33,000 lbs. Adhesive weight 45 metric tons. Maximum speed 37 m.p.h.

Manufacturers of

**DIESEL RAILCARS -
ELECTRIC RAILCARS
(mechanical parts) -
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TRAMCARS -
PASSENGER COACHES
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of all types - Special
COMMERCIAL VEHICLE
BODIES**

Westinghouse type automatic, ^{moderately} compressed air brakes.
Hand brake.
Dead man's safety device.
Driving desk
Incandescent lighting.
Alarm signal.
Stone guards and cowcatcher.



The cars are each powered by two Fiat Type 20 3S engines, rated for the climate of Venezuela and the particular contour of the line at 145 h.p. each. Accommodation is one class only. Entry is through a central vestibule. One compartment seats 38 passengers and has a toilet; the other compartment has 53 seats. The interior of the passenger compart-

ments are lined with "Plastiriv" plastic panels, while the seats - facing forward and arranged in two rows on one side of the central aisle and one row on the other side - are upholstered in green imitation leather with a central strip on backrests and seats of golden yellow Nylon fabric.

Although they can run, if needed, in either direction, these rail cars have a driving compartment only at one end. The two coaches communicate at their other ends through a bellows gangway. In regular service the cars are usually run as a single unit, coupled together at their non-driving ends.

The other eight rail cars under construction will be completed early in 1958.

3M COMPANY ANNOUNCES NEW SMALL "P. G." WHEELS

A new line of small "PG" wheels — designed for polishing metal with portable hand tools — has been announced by Minnesota Mining and Manufacturing Co., St. Paul, Minn.

The wheels, which have the same basic design as the company's large polishing and grinding wheels introduced last fall, are composed of die-cut pieces of coated abrasive cloth, bonded with resin and locked into a hub.

The new wheels are particularly suited, the 3M Company believes, for work in the appliance, stainless and sheet steel fabricating, metal polishing, plating, and tool and die industries, replacing small set-up wheels. They are intended for rust or dirt removal, blending patterns left by disc sanders, weld polishing, featheredging for spot painting, and similar polishing operations.

Small "PG" wheels are especially suited for polishing soft metals such as lead and solder because the coated abrasive cannot become filled. The mineral grains and the backing wear away together, presenting an always-new surface to the work. This action assures a constant polishing pattern, since mineral grains never become dull; and the rate of cut is constant through the life of the wheel.

The new coated abrasive wheels are designed for use on portable grinders, flexible shaft equipment or small bench-type grinders. They are available in 6" to 10" diameters, with 1", 1½", 2" and 3" face widths, and in an 11" diameter in 2", 2½" and 3" face widths. The wheels are currently being made with aluminium oxide or silicon carbide mineral on a cloth backing, in grits ranging from 50 through 320.

Small "PG" wheels are being sold nationally through industrial distributors and 3M branch warehouses. Further information is available from the 3M Company, Dept. F6-99, 900 Fauquier Street, St. Paul 6, Minn.

NEW CLEANER CUTS COSTS

A new cleaner, Pyroclean No. 8, recently introduced by the Metal Finishing Division of the Pyrene Co., Ltd., now enables costs of component cleaning to be cut during the manufacturing process, according to The Mining Journal, of London.

Very wide in its range of application, Pyroclean No. 8 is a mild, activated alkali powder that can be used in any kind of spray washing machine, and cleans ferrous and non-ferrous metal parts with equal facility. Its marked economies derive from the extremely low concentration at which the cleaner is used, which is 0.1 to 0.2 per cent (1 to 2 lb. per 100 gallons of water) and its low operating temperature, between 130 and 160° F. according to local production circumstances. Pyroclean No. 8 can be employed in all applications where alkali or emulsion cleaners are ordinarily operated.

The method of operation is simple. The tank of the spray equipment is filled with tap water to the correct level and then raised to a temperature of 160° F. Pyroclean No. 8 powder is added at the initial rate of 1 lb. per 100 gallons and the solution is thoroughly mixed by operating the spray. The cleaner is then normally ready for use. To secure the maximum operating efficiency with economy, it may be found desirable to regulate the strength and temperature within their approximate ranges.



VOITH

There is a good reason for the popularity of VOITH TURBO TRANSMISSIONS in DIESEL SHUNTING LOCOMOTIVES

Thousands of diesel-hydraulic shunting locomotives performing well year by year under most arduous service conditions, both at home and abroad, attest to the superior features of the Voith Turbo Transmission for heavy marshalling and general shunting duties, setting new standards in simplicity of operation and all-round economy.

As a result of many years' experience with Voith Turbo Transmissions, the German Federal Railway has equipped its new fleet of 300 diesel-hydraulic shunters V 60 exclusively with Voith Turbo Transmissions Type L 37z.

All such facts are convincing evidence that all the world over the qualities of the Voith Turbo Transmission are widely appreciated by discriminating users not only for branch-line and main-line applications, but also for the specific requirements of diesel shunting work.

The basic principle of the Voith Turbo Transmission — the filling and emptying of independent fluid circuits to energize the different transmission ratios — provides such desirable features as:

Simplicity of operation

Precision-controlled shunting

Smooth taking up of the load

Vigorous pushing off of the wagons

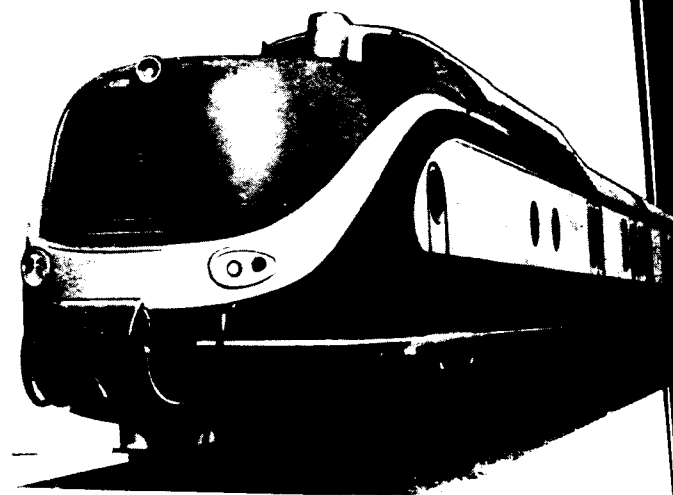
And the dissipation of heat — always a major problem with any equipment operating under conditions as are peculiar to heavy shunting duties — constitutes no challenging problem with the Voith Turbo Transmission because of its large inherent heat-absorbing capacity and the efficient means provided to dispose of any amount of heat. Thus a diesel-hydraulic shunter fitted with a Voith Turbo Transmission is admirably equipped to master effectively hardest shunting jobs, such as starting and pushing heaviest trains over the "hump".

To this day we have delivered or on order about 6,000 Turbo Transmissions with an aggregate output of 2.0 million HP.

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