

Indian Railways Workshop Magazine

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Indian Railways Workshop Magazine

LOCO. CARRIAGE & WAGON SHOPS SUPPLEMENT

Vol. V No. 4

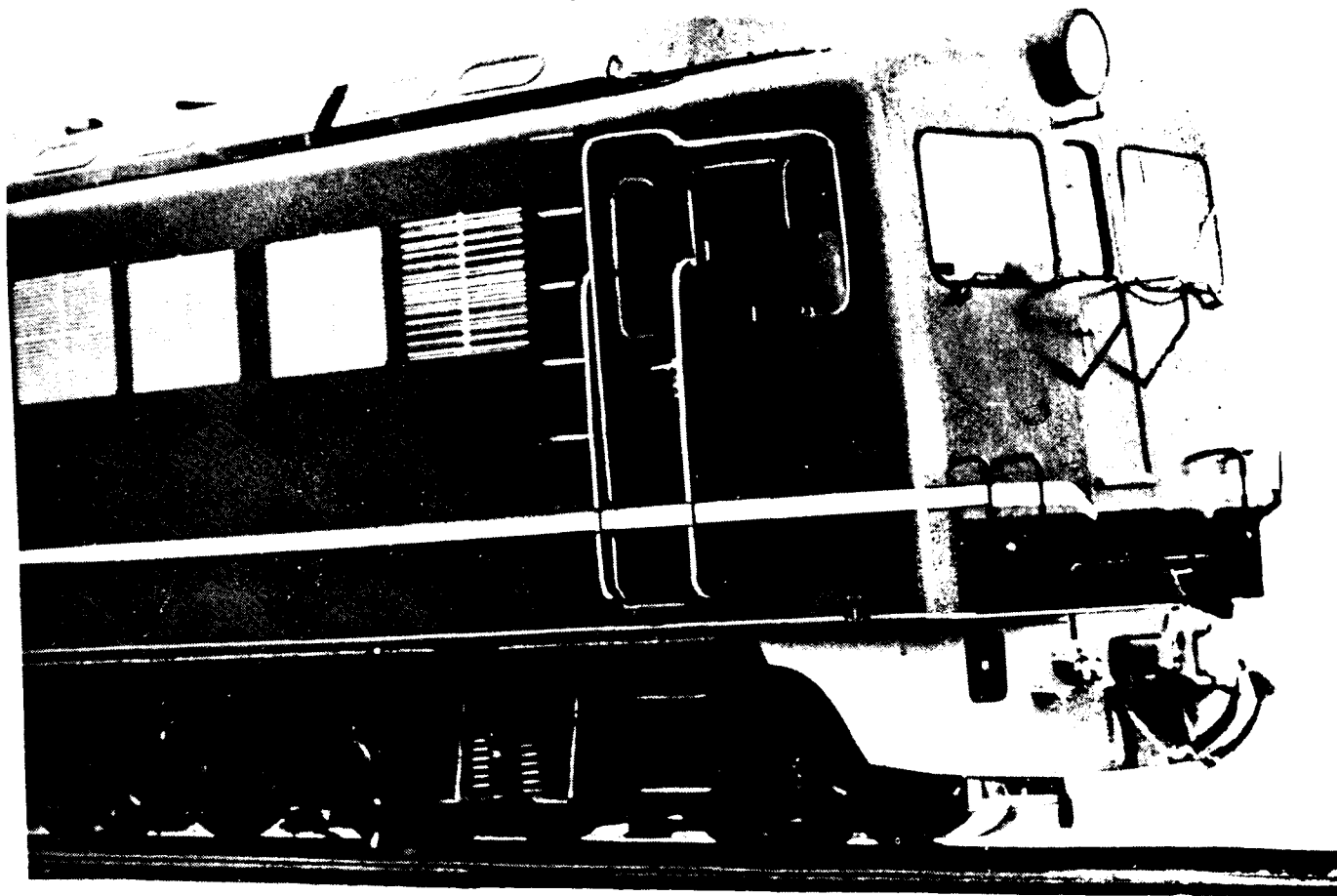


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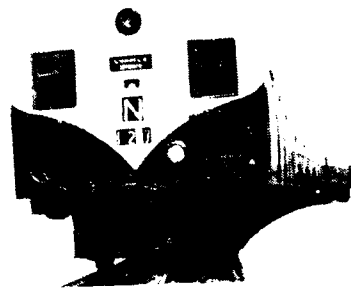
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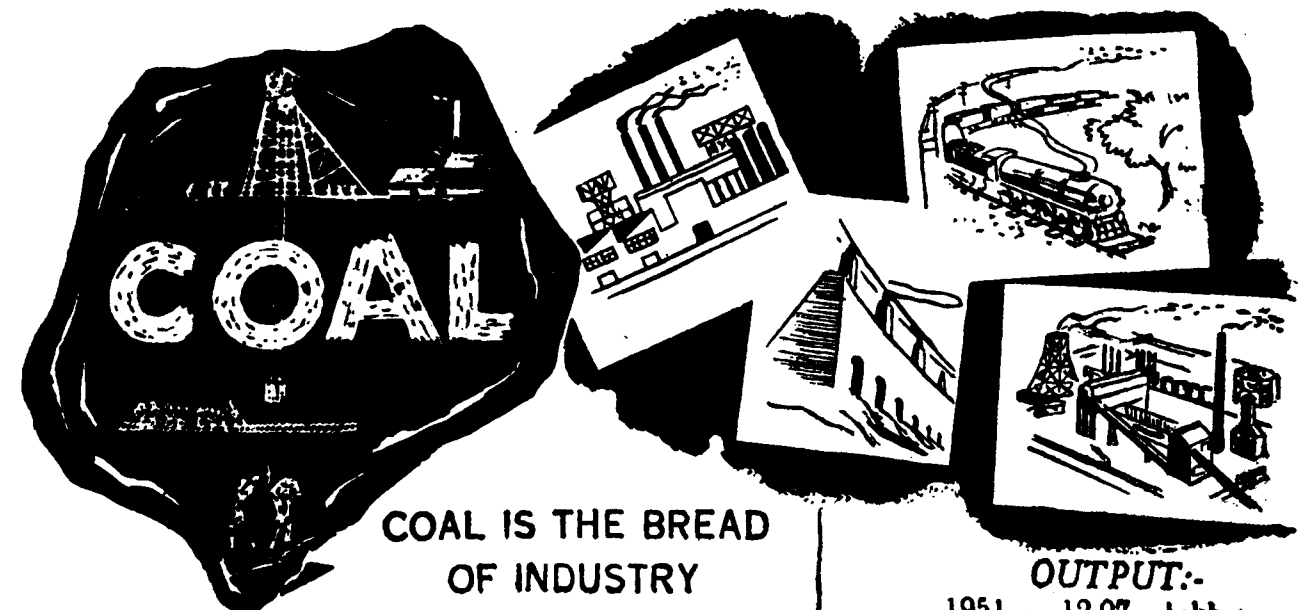
The Editor invites contributions from the Engineers and Works Managers of Railway Workshops as well as company-managed Engineering Workshops in the form of original articles, research write-up, production technique etc. relating to Workshop practices in India and abroad. Besides, suggestions for the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

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

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

All published contributions are paid for at our usual rates.

Editor



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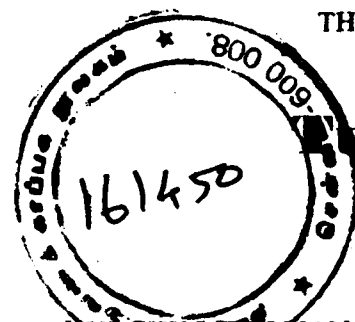
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Turning Machine Tools

By An Engineering Correspondent

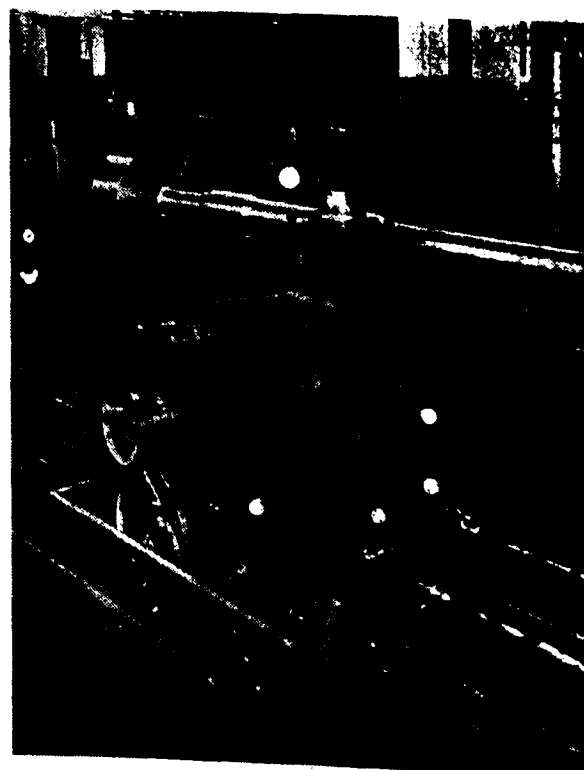
CHURCHILL-REDMAN are specialists in the manufacture of Turning Machine Tools. It is natural, therefore, that machines of their design have been used in the machining of components for railway equipment. In addition to the supplying of standard Machine Tools for Railway Workshops, the Company manufacture Special Purpose or Production Machine Tools to meet specific turning problems, an example of this being a number of machines recently delivered for the turning of railway axles. Two of these were installed at the Axle Works of Taylor Bros. Ltd., Manchester, and a further five were sent to their subsidiary Company in South Africa.

The specification of the machines had to be such that a wide range of different types of axle could be turned, but in such a way that versatility did not prevent the achievement of low production times. The following specification was, therefore, decided upon.

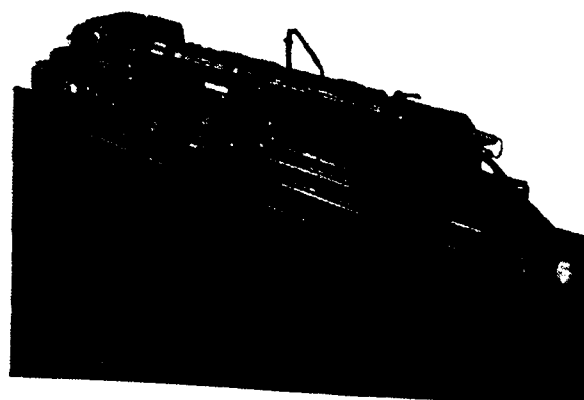
The basic machine was a 28" Swing Churchill-Redman 'L' Series Heavy Duty Centre Lathe on a 15'-9" bed arranged to admit 9'-0" between centres. The saddle was constructed with an integral hydraulic profile turning slide located at 45° and with the tracer valve in stylus mounted at the rear. At the back of the machine a template slide and supports were provided for mounting the axle shaft template which we used for copying. To ensure maximum rigidity, the normal swivel slide was eliminated and a fixed top slide was fitted, mounted centrally. This also had the advantage of limiting the overhang of the tailstock ram, an important point with heavy cutting on large components. On the top slide was mounted a steel square turret of the self-indexing type.

With a profiling slide set at 45°, it is essential to control the feed rate when the tool is turning from a larger to a smaller diameter. The apron was fitted with a special 2:1 ratio feed reduction control for this purpose and this was operated from a shaft which replaced the leadscrew normally fitted to this type of machine.

Since the machine was to be used exclusively for turning axle shafts, a special gearbox was provided



28L Series Profiling Lathe



28L Profiler

which gave 10 changes of feed from 0.010" to 0.019" per rev., it being possible to halve these with the control previously mentioned. In order to ensure adequate power, the headstock was fitted with a 25 H. P. main drive motor and given a range of spindle speeds from 12 to 800 R. P. M.

Positive driving of the components was vital, in view of the heavy cuts, and this had to be achieved without an excessive loading time. To do this, a special version of the Churchill-Redman patented self-compensating Chuck was developed which was capable of gripping rough work up to 10" diameter. An adjustable built in centre was used, so that it was possible to position the centre by means of a gauge, after the depth of centre in the forging to be machined had been checked. Since the Chuck was operated automatically by a hydraulic rotating cylinder mounted at the rear of the spindle, loading proved exceptionally simple. To further assist this, the

tailstock which had a 6" dia. ram was also hydraulically controlled.

The machines were used for both the roughing and finish turning of axles, covering a wide range of types and sizes, the method proving economical for smaller or large batches. Obviously production times vary from job to job, but on a typical axle of 7½" maximum diameter the roughing speed was 220 R. P. M. with 0.010" per rev. feed and ¼" depth of cut.

An example of the machines referred to is shown in the illustrations which accompany this article.

(Courtesy: "IRE")

Zonal Railway Users' Consultative Committee Meets

The Sixteenth Meeting of the Zonal Railway Users' Consultative Committee of the Central Railway, was held on the 18th May 1959 at Victoria Terminus, under the Chairmanship of Shri Bhishma Arora, General Manager. Members of Parliament, Members of Legislative Assemblies from the States, representatives of the State Governments and non-official Members drawn from trade and industry and public life were present.

In accordance with the recent decision of the Railway Board to associate one Member of the Zonal Railway Users' Consultative Committee with the Claims Prevention Campaign in the Railway, Shri M. A. Karim was unanimously elected as the Committee's representative and Shri Devji Rattansey was elected to serve on the Suburban Railway Users' Consultative Committee of the Central Railway.

The General Manager announced at the meeting that with a view to providing reserved Third Class accommodation and also additional Third Class accommodation in the through coaches between Bombay and Lucknow by 5 Down/6 Up Punjab Mails, the First, Second and Third class composite bogies of the old type now running between Bombay and Lucknow by these trains would be replaced by the newly built First and Second complete coaches.

A Member suggested tightening up of ticket checking arrangements in First Class of Deccan Queen trains and there was a general discussion on this subject.

On the question of providing the public address system and mechanical contrivances at Agra Cantonment station for issue of tickets, the General Manager

said that in view of the limited funds available for passenger amenities and the difficult foreign exchange position, it will not be possible to implement these suggestions immediately. A general discussion followed on improvement of the standards of the departmental catering service. In reply to a query as to when the Metre Gauge line now under construction between Akola and Kanhergaon would be thrown open for traffic, the General Manager explained that according to present indications this line may be available for traffic by the end of the year and that a clear indication could be given only after the work has been completed. On a suggestion that an additional Express train should be run between Bombay and Calcutta, the General Manager indicated that owing to heavy engineering works between Howrah and Nagpur on the South-Eastern Railway, and capacity limitations on the Central Railway by the Jabalpur route, it would not be possible to implement this suggestion for sometime to come.

The General Manager also announced that Hindi/English composite forms will be brought into use as early as possible on this Railway for the issue of Way Bills, Luggage Tickets, Parcel Way Bills, Goods Invoices indemnity notes and forwarding notes for general merchandise.

Other Among subjects discussed were: the opening of an Out-Agency at Chhatrapur (in Madhya Pradesh) to be served by Harpalpur station, amenities to passengers at Bhopal station, a separate quota for reservation of First class berths from Bhopal to Delhi, the punctuality performance and traffic operation on the Central Railway and the claims and financial position.

Role of Polish Machine Tools in Railway Workshops

By An Engineering Correspondent

TOOLS are fundamental means, indispensable in any production as well as in keeping up efficiency of ready products and equipment. Therefore increasing industrialisation and development of railroads caused great increase in tools production and their high specialization for various purposes.

The Polish tool production having many years of tradition and a rich experience, has been after World War II remarkably extended and modernized. This made it possible not only to supply home market with necessary tools but also to start export in a wide range of assortments. Nowadays it would be really hard to find a country to which Poland does not export its tools. This fact that Polish tools succeeded in getting on such numerous markets prevailed by the world greatest producers of tools—is the best proof of their superior quality.

The assortment is being constantly extended in order to meet all the needs and requirements. Besides constructional offices by the particular manufacturing plants, there are also special institutions working upon development of tools industry, construction of new kinds of tools and implements and improvement and modernization of traditional tools.

Due to systematic efforts of Polish scientists, constructors and producers, Polish tools enjoy the satisfaction of their users at home and abroad and they are often higher appreciated, than those of the many well-known trade marks.

One of the many branches where nearly all our assortment of tools is being applied—are the railroads. The building-up of steady railroad equipments, tracks, rolling stock and signalization and the keeping-up of necessary background warranting normal and economical exploitation of these sets of equipment require great amounts of various tools. Railroad workshops are little factories equipped with an adequate machine tool park and full set of tools. Machine tools require great amounts of turning tools—cutters, twist drills, reamers, taps, dies, die heads, saws

(Continued on page 10)

and grinding and polishing wheels. For holding fast vices, turning chucks, drill chucks, lathe centers, milling mandrills etc., are being used. To get the proper dimensions of the details being worked at, various measuring tools are used such as pocket and workshop vernier calipers, micrometers and passameters, tail gauges and comparators, parallel and angle slip gauges, edges and squares, measuring plates, various patterns, surface gauges and many others.

Such workshop tools as hand saws of all kinds, circular saws, bit bracers and augers, chisels, planes, plane irons, end spanners, ring spanners, socket wrenches, adjustable wrenches for screws, nuts and tubes, tube expanders, various pliers and nippers, tin shears and screw drivers, drills and grinders etc., are applied in assembling work and in joiner's workshops.

Besides, assembling work requires also electrically driven tool such as electrical drills and grinders of hand and bench type. Bigger workshops are usually equipped with the most efficient and most economical of all tools, namely with pneumatic tools.

The fitting of workshop with central pneumatic installation is of course connected with some capital outlay, but it gives in effect substantial exploitation advantages. Pneumatic installation allows the use of numerous types of pneumatic tools highly comfortable and economical and absolutely secure. There is no electric cable getting in the way, no damage in electric motorinsulation, no danger in working on wet places,—none of these dangers that threaten the life and health of a man working with electrical tools. And yet the wide range of pneumatic tools makes possible mechanization of many hard and time-eating jobs.

Polish manufacture of pneumatic tools is producing a wide assortment of types that have passed their examination and proved to be good at home and abroad.

No foundry can get along without pneumatic sand

Refrigerator trains from the German Democratic Republic

THE fact that big multitudes of the population show an upward trend in their standards of life necessitates the construction of modern means of transport for the refrigeration traffic, in order to place the goods to be exported by countries producing agricultural products and meat at the disposal of the consumers in a qualitatively irreproachable state in summer as in winter. Therefore, the problem of transport of easily perishable and temperature-dependent goods was set about in many countries aiming at creating possibilities of transport on rail and road which offer the guarantee that the goods forwarded by these vehicles in fresh or frozen state go from the producer to the consumer without any deterioration of their qualities.

The development of such special rail vehicles was also tackled anew about 10 years ago in the VEB Waggonbau Dessau, and that for the time being by the manufacture of four-axle refrigerator wagons of welded steel construction with water-ice-refrigeration.

However, in order to meet all requirements which must be made towards means of transport, regarding climate and technique of transport, during the forwarding on long distances, the development and construction of trains cooled mechanically was necessary in bigger units. Thus in Dessau the production of refrigerator trains consisting of 23 wagons each for long-distance traffic in the Soviet Union began. These trains dispose of a central Diesel and refrigerating machine plant. By means of the Diesel plant all consumers of energy of the train are supplied with current. The cold produced in the refrigerating machine plant (refrigerating means: ammonia) is transferred to the ribbed pipe systems arranged at the ceiling of each refrigerator wagon by the refrigerating means (refrigerating brine) through a main pipe extending all over the whole train and comprising operation there and back; thus the loading rooms are refrigerated.

The regulation of temperatures in the loading rooms

is made by a magnetic valve with distant control in each refrigerator wagon. For regulating the temperatures desired in the refrigerator wagon serve thermostats in each loading room which switch the magnetic valves automatically on or off on demand and regulate the temperatures by the brine supply. The adjustment of the electric heaters is also made analogously at low outside temperatures.

The temperatures are measured by double contact thermometers. The result is transferred to the wagon with the Diesel plant electrically and read there at the test desk for temperatures. Electric fans care for the air circulation in the loading rooms. One wagon each for placing the Diesel-electro-station, the refrigerating machine plant, and the staff rooms is arranged in the middle of the train. These three special wagons are connected one with another by communicating gangway-bellows, 10 four-axle refrigerator wagons each of 49.2' length serving for the transport of the goods to be loaded are added on both sides of the 3 special wagons. They have a weight of load of about 590 British t altogether.

Trains of the same construction are also in service in the PR of China. The refrigerating machine plants of these trains, however, are equipped with cold compressors operating in two stages, in order to obtain yet a liquefaction of the refrigerating means according to the prevailing higher temperatures in China. By these plants adjustable temperatures of the loading rooms can be attained from + 10°F to + 53.6°F at outside temperatures from + 104°F to —49°F. In case of low outside temperatures the loading rooms can be heated electrically, as mentioned already above. The installed Diesel power amounts to 395 HP altogether

From these types of trains originated the refrigerator train of 12 wagons for the Soviet Union as a variant. These trains also operate according to the principle of the refrigerator trains of 23 wagons. The regulation of the temperatures in the loading rooms is also made

entirely automatically by adjustable thermostats. The train consists of one wagon with Diesel-electro-station and staff rooms, one wagon with the refrigerating machine plant and 10 four-axle refrigerator wagons of 55,8' length each. Here also the two special wagons are placed in the middle of the train; 5 four-axle refrigerator wagons each follow on both sides.

In the interior the refrigerator wagons are equipped with self-supporting walls of galvanized steel plate. Upward-tilting hot-galvanized floor gratings serve for storing the goods to be loaded. This type of refrigerator train has a loading capacity of about 395 Bt.

A further development led to the construction of refrigerator trains of 5 wagons. On principle, these are different from the construction of the trains described hitherto. The supplying of the individual refrigerator wagons with "cold" is not made here by a centrally arranged refrigerating machine plant used for long trains described in the beginning, but by individual refrigerating machine plants in each of the refrigerator wagons of the refrigerator train consisting of 5 wagons being supplied with electric current by a central Diesel-electro-station of 177,5 HP altogether.

The refrigerating machine plant in each wagon consists of two single stage 2-cylinder cold compressors each functioning independently from each other. The refrigeration is made by means of direct evaporation (refrigerating means: Freon 12). All wagons have foreign current connection to supply the refrigeration plants with current from local networks and to be able to refrigerate also without the central power station on demand.

By these plants temperatures in the loading rooms are attained within the limits of $+10^{\circ}\text{F}$ resp. $+53,6^{\circ}\text{F}$ at outside temperatures of 86°F resp. -49°F . Also fruits not precooled can be cooled down from $+77^{\circ}\text{F}$ to $+39,2^{\circ}\text{F}$ at an outside temperature of $+86^{\circ}\text{F}$ in the course of 72 hours.

The regulation of the temperatures in the loading rooms is made by thermostats effecting automatically the switching of the refrigerating machines or heaters dependent on the temperatures in the loading rooms.

An installation for the supply of fresh air can be regulated from outside for summer and winter service on demand; this air flowing in is precooled in summer before the entrance in the loading rooms and preheated in winter. This train of 5 wagons consists of the following parts:

- 1 wagon with refrigerating machine compartment, Diesel compartment and loading room
- 1 wagon with refrigerating machine compartment, stay-room for the train staff and loading room as well as
- 3 wagons with refrigerating machine compartment and loading room.

The length of each wagon amounts to 55,8', the carrying capacity of the train to ab. 175 Bt.

As a further task the development of individual refrigerator wagons mechanically cooled and working fully automatically was well to the fore of which also series were manufactured and delivered to the Soviet Union. With the same type of wagons, suitable for the transit-traffic on the European network of railways with standard gauge at a length of wagon of 55,8', a many-sided test was finished successfully ere long. This wagon is equipped with two Diesel aggregates of a continuous output of 22,6 HP each and with two 4-cylinder refrigerating means compressors operating in two stages.

Power and refrigerating machine plant as well as temperature regulation work also fully automatically at refrigerating and heating. The regulation of the refrigerating plants is made by thermostats being arranged in the loading room.

Loading room temperatures of $+3,2^{\circ}\text{F}$ resp. $+53,6^{\circ}\text{F}$ at a max. outside temperature of $+95^{\circ}\text{F}$ resp. -22°F can be attained. Also fruits can be cooled down from $+86^{\circ}\text{F}$ to $39,2^{\circ}\text{F}$ in about 24 hours during the transport at a max. outside temperature of $+95^{\circ}\text{F}$.

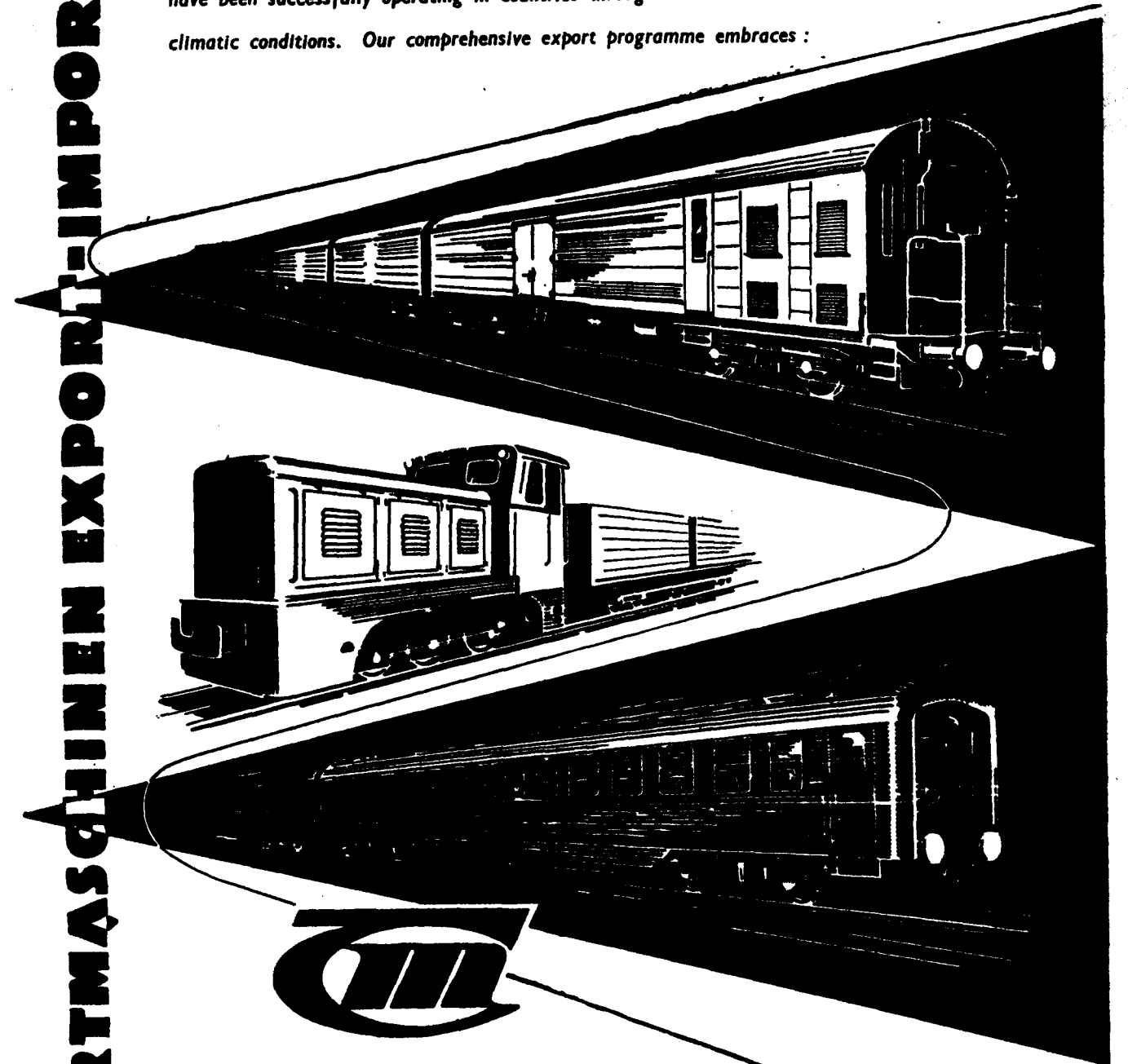
The interior equipment of the wagon contains self-supporting crimped walls of oxidized light metal sheets, adjustable air supply for freezing and refrigerating transports and upward-tilting light metal floor gratings. For protection against heat penetration high-quality insulating materials were used of corresponding strengths for the walls of the wagon bodies to obtain a K-value (co-efficient) below $0,3 \text{ kcal/m}^2\text{h}^{\circ}\text{C}$.

According to the admitted axle pressure this type of refrigerator wagon has a loading capacity of 23,6—39,4 Bt.

On the strength of experiences learnt from the refrigerator trains as a further new construction of a "Movable Freezing Station" was set about and

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finished with much success. Such stations shall complete the capacity of stationary freezing plants and load the goods to be frozen in immediately at the place of production. Such plants are used for the freezing in of fishes, fruits, and vegetables. The freezing capacity amounts to 20 Bt per day approximately for fishes at a working time of 21 hours and 10—18 Bt daily for fruits and vegetables according to the sort of the product. The power of the Diesel-electro-aggregates installed in the Diesel wagon amounts to altogether 485 HP.

This movable freezing station consists of:

1 Diesel-electro-wagon	}	each 55,8'	long
1 refrigerating machine wagon			
1 freezing wagon	}	each 62,5'	long
1 supply wagon with staff compartment			

In the refrigerating machine wagon two vertical 4-cylinder ammonia-compressors are mounted working, on demand, in single stage or two stages according to the degrees of outside temperatures.

The freezing wagon is subdivided in:

- A preparation room where the goods to be frozen in are put in layers in basins and then set in freezing trestles.
- Two freezing tunnels through which the goods to be frozen in are transported to the freezing trestles by means of a mechanic conveying device and are frozen in at a temperature of -31°F . Between the two freezing tunnels a further tunnel is placed serving for the return of empty freezing trestles to the preparation room. Furthermore, the freezing wagon contains
- an unloading room in which the frozen goods are taken out of the freezing trestles and forwarded through insulated communicating gangway-bellows over a slide to the supply wagon which has an own refrigerating machine plant. There the frozen goods are packed in boxes or cardboard boxes and stored in this wagon up to their carrying off at $+5^{\circ}\text{F}$. The first series of such movable freezing plants are actually to be found in service in the south of the Soviet Union.

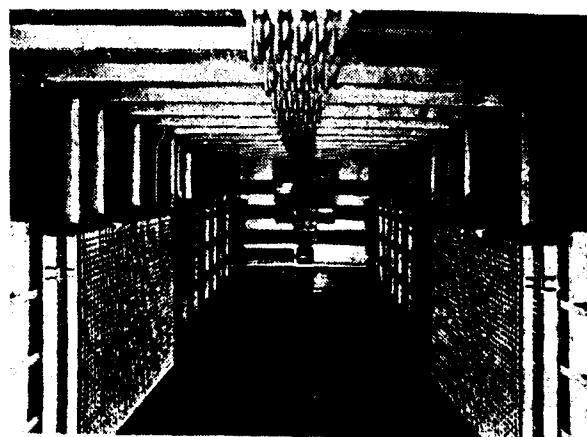
Due to the experiences made with refrigerator trains

being in operation in the Soviet Union and in China, the development and the construction of refrigerator trains were carried out for the European transit-traffic by units of 11 or 12 wagons—one combined Diesel and refrigerating machine wagon and one staff wagon or one combined Diesel refrigerating machine and staff wagon as well as 10 refrigerator wagons. These are also in service in a considerable number since years.

According to the claims towards these trains regarding climate, the installation of refrigerating machine plants with one or two stages was effected. These trains, as indicated already, were delivered in two constructions. Each of the refrigerating wagons is 49,2' long. The capacity of these types of trains amounts to about 246 t to 315 t. The attainable temperatures of the loading rooms are about $+9^{\circ}\text{F}$ to $+53,6^{\circ}\text{F}$ according to the sort of goods at outside temperatures between $+95^{\circ}\text{F}$ and -31°F .



Total view of the refrigerator train of 11 wagons.



Refrigerator train of 11 wagons Loading room with upward-tilted floor grates.



Refrigerator train of 11 wagons, engine room.

Bogies without axle guards with roller bearings, double spring mounting, and cradle suspended in pendulum fashion are used as running gear for wagons of all types of refrigerator trains and mechanical refri-

gerator wagons, in order to be able to admit high driving speeds on long distances run by these vehicles and to spare sensible goods to be loaded as far as possible.

The big number of refrigerator trains being in service in the Soviet Union, the PR of China, and in some States of South Europe since years, took the goods forwarded by them practically without losses and of excellent quality to their places of destination. Their profitableness was proved unobjectionably; there is no more any doubt about their excellence. Only by their services there was the possibility to take certain fruits from the south, as e. g. in the PR of China from southern parts of the country to northern regions, where such fruits were entirely unknown to that date.

The works for further improvements of the construction and modernization of plants and installations of mechanically cooled rail vehicles are indefatigably continued in Dessau.

SIZES OF METAL STRIP, SHEET, BARS, FLATS AND PLATE

The decision of the Government of India to adopt the metric system as the only recognised system of weights and measures has made it necessary that the preferred sizes of metal product should be standardized in metric units to serve as a guide for evolving standard metric sizes.

With this aim in view the ISI has issued an Indian Standard for Sizes of Metal Strip Sheet, Bar (Round and Square), Flats and Plate (IS: 1138-1958), specifying nominal sizes for metal strip, sheet, bars (round and square), flats and plate, in millimetres, for structural and general engineering purposes.

In the standardization of preferred sizes in metric units, the following aspects have been kept in view:

- Taking maximum possible advantage of the inherent qualities of the metric system,
- Keeping the range and gradation of sizes sufficient to meet consumer requirements efficiently and economically,
- Making the changeover of Indian Industry to the metric system as early as possible,

(d) Achieving international co-ordination to as great an extent as possible, and

(e) Ensuring that the standard does not impose difficulties on the producers by prescribing too many standardized sizes.

* * * * *

SPECIFICATION FOR ANTIMONIAL LEAD

An Indian Standard Specification for Antimonial Lead [Doc: SMDC 12 (108)], prescribing the requirements for four grades of antimonial lead for use in accumulator batteries, has been drafted by the Indian Standards Institution.

The utilization of antimonial lead in storage battery manufacture serves the largest single market for lead in the country. These alloys are used for making grids, posts and connecting lugs in the battery. Repeated charging and discharging of a battery cause prohibitive corrosion of grids, if the alloy is of inadequate purity.

This Standard lays down the detailed chemical composition of four grades of antimonial lead and the requirements for sampling, freedom from defects and marking.

(Continued from page 4)

rammers. Our types MU10a, MU16a and UA18 are comfortable and efficient tools that enable the quick, easy and even beating down of moulding mass in cases, making thus the work more efficient.

For cleaning of casts, equalling of jointings and cutting off of unnecessary constructional details our chipping and caulking hammers of MS series are being used, and their weight ranges from 4 kos for MS-8 type up to 6,7 kos for MS-19 type. These hammers can be also applied when riveting is concerned, though rather special riveting hammers of various efficiency are here recommended.

The smallest riveting hammer NA4 of only 1 kg weight is used for hot rivets of 4 mm. diameter; whilst the greatest, NA34 one, weighing 11,5 kos can deal with hot rivets of 34 mm. diameter.

To get the proper pressing on the rivet head during riveting, PP-series holders-on are being used while scalling hammers MR22 and MR25/one and five finger/are recommended for cleaning of steam boilers and rusty sheets.

Almost unlimited application have pneumatic rotary drills of various shapes and sizes. For instance W6 type—straight, drilling capacity in steel up to 6 mm, W10 type with the gun handle, drilling capacity up to 10 mm, WZ10 type with the closed handle, drilling capacity up to 10 mm, WK15 angle type for drilling holes of the diameter up to 15 mm in places hard to reach etc.

For casts and jointing cleaning, assembling of bodies and many other works our S65, S100 and S150 type grinders of respective wheel's diameter of 65 mm. 100 mm. and 150 mm. are indispensable.

The application of pneumatic tools in railroads is not only limited to railroad workshops. They are

used also in building up and maintenance of rails.

Especially recommended is here MK-8 type plug drill designed for plugging and hewing of stone lumps. It is highly useful because of its small weight of 8,3 kos and high efficiency of 1500 blows per minute. Nearly the same advantages can be obtained by using PK-1 type track tamping machine weighing 18 kos and giving 1500 blows/min while air consumption is as low as 0,45m³/min. Rail brigades equipped with such tamping machines are able to speed up their work several times and the rails are laid very accurate and well tamped allowing thus to enlarge axle pressure and speed of the trains.

In building up of railbed there are very important such pneumatic tools as paving breaker MP-26A type weighing 27 kos and having 3,5 kgm power of blow and 800 blows per minute, and rotary rock drill WUP-28 of 3,2 HP strength, 29,5 kos weight and 1400 blows per minute.

All these pneumatic tools can be connected with rolling compressors composing thus very motionable setups of tools that can be transported and set in motion in every point of the rails varranting high efficiency of the work of brigades that are building and maintaining the rails as well as of collision brigades for which quick moving is very important.

As the same compressors are also used for supplying with energy the spray-guns, produced in Poland in several types—it is quite clear that application of pneumatic tools becomes just necessary and unavoidable.

Railroads are but one of the economical branches where substantial quantities of tools are used.

But anywhere where something is being produced used or maintained—tools are indispensable—and there Polish tools can be found.

New Rail line in West Bengal

The Railway Board has ordered the final location survey for a 3.6-mile long broad gauge line between Tildanga and Farakka in West Bengal on the Northeast Frontier Railway.

The Tildanga-Farakka connection would be a part of the Khajuriaghat-Malda rail project. It is expected to reduce the distance from South Bengal to Malda and centres beyond in North Bengal and Assam by about 100 miles.

The link has been considered an operational necessity as it would help in reducing congestion on the Eastern Railway main line to Howrah.

Richards Machine Tools for Railway Workshops

By An Engineering Correspondent

FOR many years Richards Machine Tools have proved themselves invaluable in Railway Workshops throughout the world both in the machining of new components and the reconditioning of used parts to fine precision limits.

"Electrabore" Horizontal Boring and Facing Machines, embodying great rigidity of construction and producing work to a high degree of accuracy, are used on a wide variety of work in railway shops.

The adaptability of this type of machine, which in addition to boring and facing, is capable of milling, drilling and tapping, enables several operations to be carried out at one setting, without loss of operational time and with complete accuracy.

Probably one of the most important functions which Richards Horizontal Borers perform in railway workshops is the machining of locomotive cylinders and the machine generally supplied for this and other railway work is the No. 5. size machine illustrated in

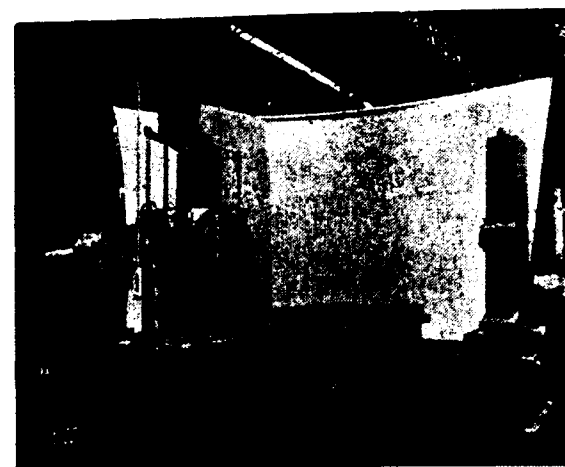


Fig. 1
Richards No. 5 Size "ELECTRABORE" Universal Boring, Facing, Milling, Drilling and tapping Machine, with traversing spindle and Automatic facing head.

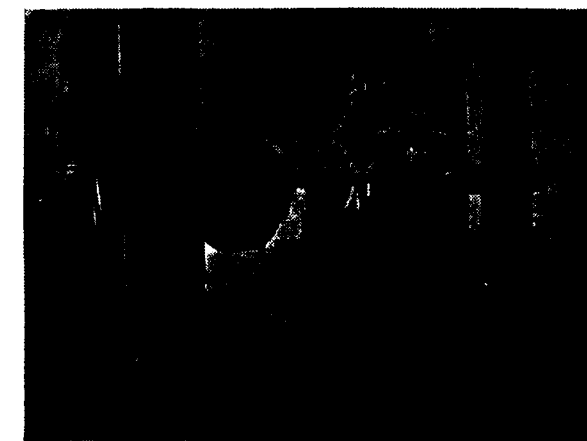


fig. 1. This machine has a 5" diameter traversing spindle and automatic facing head with a capacity of 54" diameter.

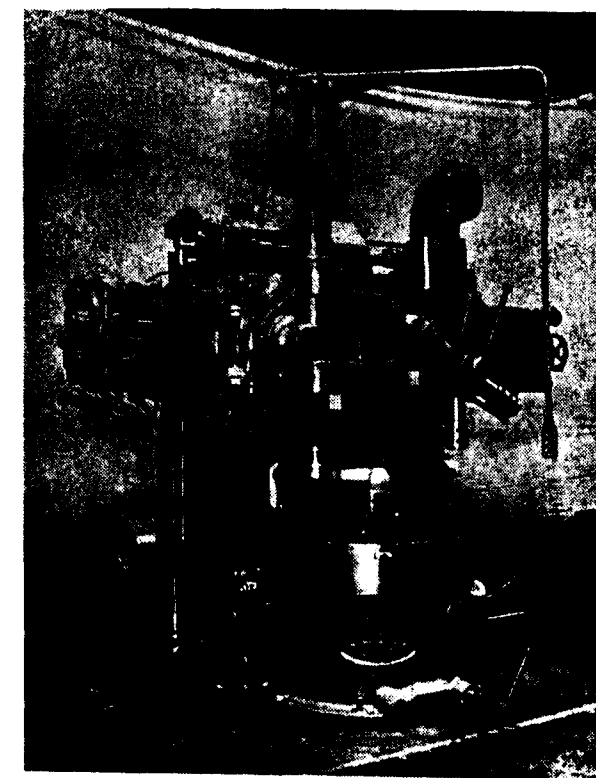


Fig. 2

Richards Vertical Boring and Turning Mills are in popular demand for operating upon railway tyres, wheel centres, etc., and a 4 ft. machine specially arranged for machining tyres is shown in Fig. 2.

This machine has a 4-jaw independent chuck table which runs on a white metal bearing, the spindle being mounted on roller bearings. Twelve table speeds are available ranging from 6.16 to 130.35 r. p. m., and the table jaws are provided with special swivel clamps for holding the tyre.

The left-hand head is of the standard swivelling type, which can be swivelled to any angle up to 30 degrees from the vertical for taper work, when required. The right-hand six-sided turret head is released, revolved and indexed, then relocked by a single lever, thus greatly facilitating tool positioning.

The mill is illustrated with a tool set-up for the machining of carriage tyres. The left-hand ram has a tool bar for finish boring, whilst the turret head is loaded with tool-bars for carrying out rough boring and rough and finish grooving operations.

The "AB" type Patent Axle Box Boring, Facing and Radiusing Machine illustrated in Fig. 3 is specially designed for dealing with axle boxes and has been supplied in large numbers to the Railway Workshops of the world and in particular to India.



Fig. 3. RICHARDS No. 2 size "AB" type, Patent Axle Box Boring, Facing & Radiusing Machine.

The machine is fitted with a main table, having hand cross movement, and this is mounted on two inclined saddles which provide vertical and horizontal adjustment to accommodate different sizes of axle boxes. On top of the main table a square revolving table is

fitted, incorporating Richards Patent Squaring Lock, by means of which the table can be set square to the spindle with absolute accuracy. The axle box is held on the revolving table by a specially designed fixture.

With adjustments provided in the longitudinal, transverse and vertical directions the machine is fully capable of dealing with new and repair boxes of various sizes and furthermore, by simply extending the length of the bed, the machine can be used with equal success on radial axle boxes.

A very valuable feature of the machine however, is that with these various adjustments and the range of speeds and feeds provided, it can be adapted for use on other work should the whole of its time not be occupied on the production of axle boxes.

In Great Britain to-day the electrification of the railways is one of the major undertakings, and to this end many works are engaged in the manufacture of diesel and diesel electric locomotives.

On some of the drives the motors are mounted adjacent to the axle housing. The Richards TH2 machine shown in Fig. 4 has been specially designed for the purpose of machining the axle bores of these motor casings.

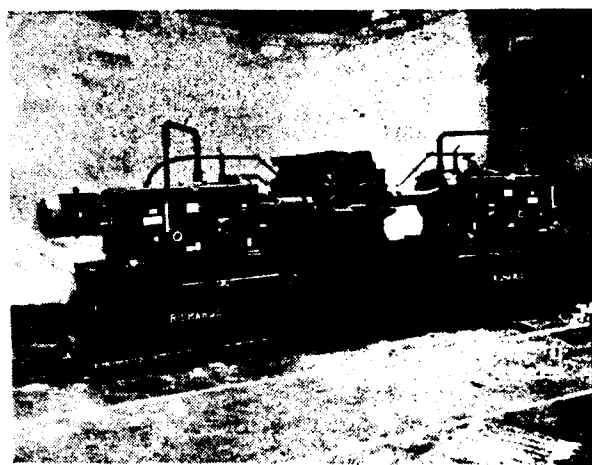


Fig. 4

The machine has been supplied to a world known electrical concern to their requirements, and it consists of three separate bed castings two supporting the facing and boring heads and the centre section is used to support the work which is mounted in a suitable fixture.

Each head is arranged to bore the axle bore approximately half way through, the tool running out into a cast relief in the centre.

The end faces of the axle bore are machined by means of a tool suitably mounted on the facing slide.

The workpiece is stationary and is set on the fixture in order to obtain the correct centre distance between the main and axle bores.

Twelve speeds are provided to the main spindle in geometrical progression, the speed range being 5/160 r. p. m., obtained through a change gearbox by means of a flange mounted motor situated at the rear of the traversing heads. Both motors are controlled by means of pendants, the buttons provided being "forward", "reverse", "inch forward", "inch reverse", and "stop"; in addition the forward and reverse push buttons control the rapid power traverse motor.

Six feeds are provided and these are common to the longitudinal traverse of the head, and the radial traverse of the facing slide. The feeds are obtained through a change gearbox manipulated by two levers, the feed range being 0.005 to 0.050 inches per revolution of the main spindle. Rules and verniers are fitted to the head and facing slide in order to bore or face to a set dimension, "knock offs" are also provided.

For boring operations, a 6" diameter boring bar, suitably mounted on the facing head, is provided, and to the bar interchangeable boring heads are secured.

Two heads are supplied to bore from 6.1/2" to 9.1/2" diameter, and they are arranged to carry three roughing tools and one finishing tool all of 3/4" square section. The three roughing tools are stepped both radially and longitudinally, so allowing a complete roughing operation to be completed in one pass. The finishing tool which is provided with a fine screw adjustment allowing settings of 0.001 to be made is then inserted for the finishing cut.

Extra large bores up to 24" diameter can be machined with special tool holders.



Fig. 5. RICHARDS No. 2 Size "VK" Type Vertical Slot, Drilling and Keyway Cutting Machine.

In the production of keyways the Richards Keyseater is well known and finds favour in many railway workshops. Fig. 5 shows the VK2 model which has a range of speeds suitable for most conditions, namely 155—1055 r. p. m. in nine steps. The machine illustrated will cut a maximum keyway of 30" long $\times$ 2" wide but may be obtained as a larger model with a capacity of 54" long $\times$ 2.3/4" wide. Hand feed vertically and horizontally is provided also rapid power motion, the machine being gear driven throughout. No previous drilling is required during operation, the cutter sinks to depth and is automatically changed to horizontal feed in one motion.

New C. L. W. Engines for Suburban Traffic

It is a fact that Chittaranjan Locomotive Works have started manufacturing a new type of engine for heavy suburban passenger service. Cost of a WT Loco is expected to be about Rs. 4 lakhs. Shri Shah Nawaz Khan, Deputy Minister of Railways gave this information in the Lok Sabha on 1st May, 1959, in

reply to a question by Shri Raghunath Singh.

The Deputy Minister added that the performance of this proto-type locomotive would be known after the dynamometer car tests had been conducted and the results were available.

Integral Coach Factory produces a coach every six working hours

TREMENDOUS SUCCESS AS AN INDUSTRIAL ENTERPRISE

THE most vital and decisive element in any organisation, whether it is business or government, is neither the machines nor the amount of capital, nor again the quality of material used—but the men.

This has been the basic approach of the management of the State-owned Integral Coach Factory at Perambur from the day it started in October 1955—even earlier, since the day the construction of plant started in 1952.

Most of the skilled workmen in the Factory were taken as apprentices after careful selection and trained at the staff technical training school. The standard of training imparted is high which fits them very well for high quality work in the Coach Factory. Provision of avenues for promotion, a large number of amenities and a general attitude of sympathy and interest shown by the supervisory staff towards the workmen make it very worthwhile for them to serve the institution with skill and loyalty.

Add to this a well-equipped and beautifully laid-out plant and sound leadership, and the result is a number of remarkable achievements.

From the very first year of production the Factory has been consistently exceeding stiff targets. In the first year it produced 43 unfurnished coaches against the original target of 20 and the increased target of 40. In the second year, against the increased target of 120, 150 shells were produced. In the third production year, ending October 1, 1958, 308 shells were produced against the target of 240. In the fourth year till March 1959, the target was 170; production went up to 201. From May this year the Factory is producing 35 coaches every month—one every six working hours—at the rate of 420 per year.

Secondly, the planning of production has been carried out with all the restraint and economic forethought necessary to make full use of every rupee

spent on the plant. Though the Factory was planned to manufacture 350 unfurnished coaches a year, working single shift, as a matter of financial prudence machinery just sufficient to manufacture 250 unfurnished coaches only was ordered in the first instance. The intention was to assess the capacity of the machinery and plant already ordered, and based on their performance, to order the inescapable balance that would be required for stepping up the out-turn to 350 unfurnished coaches a year. Now the 350 shell-capacity plant, by careful planning and the skill of the workers, is producing at the rate of 420.

Third, in addition to exceeding the target, the Factory has been able to reduce the cost of the shell to nearly half of the landed cost of the imported shell. The cost of the shell manufactured now at the Integral Coach Factory including overheads is about Rs. 85 thousands, while cost of a similar shell in design and equipment ex-works from Switzerland is about Rs. 1.07 lakhs, and according to the Swiss experts, the quality of the coach produced at the Integral Coach Factory is as good as that of the imported one.

Fourth, manhours needed for manufacturing a shell—a shell consists of about 1,200 components—have been gradually brought down from 19,600 to about 9,000. With the incentive system shortly to be introduced, the manhours needed would be brought down further to 7,500. For a similar shell manufactured in a Swiss factory manhours needed are 7,500.

Fifth, because of increased and satisfactory production the Factory has been able to wipe off the initial development expenditure of Rs. 79 lakhs within the first 2½ years of operation. Now the credit side shows over Rs. 50 lakhs. This development suspense account was created to absorb a portion of the development expenditure and to accommodate the excess in production costs in the initial stages over the fixed selling price of Rs. 1.75 lakhs per shell.

Sixth, whereas in the earlier batches raw material and fittings worth Rs. 37,000 per coach had to be imported (including steels of requisite weldable quality costing Rs. 19,000), in the latest batches the imported

items have been cut down to Rs. 18,000 only per coach. This is the result of vigorous efforts at locating and developing indigenous capacity of various items through 'educational tenders' by providing necessary incentives and technical guidance to Indian manufacturers.

With steel plates and sheets available within the country in 1960-61, the coach will be 95 per cent indigenous in its raw material content. So far, except for roller bearings, capacity for all the other finished and semi-finished items has been developed within the country.

Lastly, with 6,400 workers on its pay rolls, the Factory has had no labour trouble since it started. A sense of partnership—in fact, a sense of belonging to one family—prevails.

WORKERS' PRIDE IN THE FACTORY

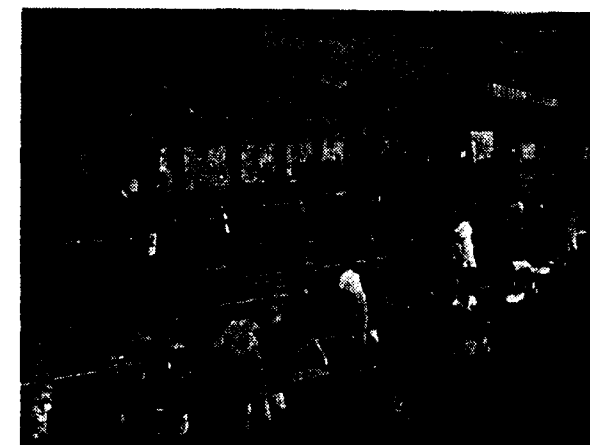
So, quite understandably, people at the Factory take great pride in taking a visitor around. On what was barren stretch of wasteland in 1952, you find, as you enter, well laid-out concrete roads bordered with flower-beds, flowering trees and creepers. The huge Factory sheds are laid out in a regular geometrical pattern. The Factory has the finest industrial gardens in the region.

Spotlessly clean workshop sheds, airy and well-lighted, have placed in them machines, big and small, in neat rows. All service lines, such as compressed air, water-supply and electricity, are taken through underground channels, neatly covered with chequered plates flush with floor.

The design of foremen's offices is a unique one, of cantilever construction, with glass shuttering all round, and commanding full view of the shops. Tools are stored in neat and attractive looking tool cribs designed for efficient storage and easy accountal. Tea trolleys noiselessly move about, providing tea on the work spot to workmen. Canteens are neat and cheerful places.

The Factory produces a new type of coach now adopted as standard for all broad-gauge coaches in future. This coach combines three major factors—smooth running, light weight and strength—ensuring comfort and safety of the travelling public.

The design of the coach incorporates an all-welded trough floor, integral with the body, enabling the



At the Integral Coach Factory, spotlessly clean workshop sheds, airy and well-lighted, have placed in them machines, big and small, in neat rows. Photo shows a view of the Machine Shop.

forces sustained by the coach to be borne by the entire body including the skin. It is this feature of the coach that gives it the name 'Integral Coach'.

The Integral coach also incorporates what is known as the anti-telescopic end construction. This reduces the possibilities of the coaches telescoping when an accident takes place. The coach incorporates several new features such as window frames and shutters of aluminium fitted as complete windows. They do not get jammed like the old wooden ones. Further, shutters and doors are fitted with rubber sealing at the edges—just like those in modern motor cars—to prevent dust and rain from seeping into the compartments.

The operating costs of hauling of such a light-weight coach are much less, its weight being 35 tons against 42 tons of the conventional type. This means economy in use of steel and economy in motive power, with the result that more passengers can be hauled with the same power—a factor for reduction of overcrowding. As the unsprung weights have been reduced to the minimum, the wear and tear on the track is also much less than in the case of the conventional coach.

STEADY EXPANSION

The Integral Coach Factory, which was initially producing only third-class coaches, has already started manufacturing third-class-cum-luggage vans and will soon be starting manufacture of complete first-class coaches.

In the remaining two years of the Second Plan the programme is to produce 355 third-class-cum-luggage coaches, 305 first-class coaches, besides 460 third-class ones. By the end of the Second Plan the Factory will have produced 1,822 coaches against the original target of 1,137. Production is likely to be doubled when the second shift which is being gradually introduced, gets into full swing.

The first third-class-cum-luggage van was launched early this year. Soon the manufacture of the first-class coach will be taken in hand too. By the end of the current year, the Factory plans to turn out a first-class coach. The Factory has been entrusted with the manufacture of four prototype all-welded bogie wagons for the movement of iron ore for export. These are now under construction. Later, the Factory will be designing postal vans and air-conditioned coaches. An all-coiled bogie for the power cars of deluxe trains has also been designed. And this design has made possible a great reduction in the weight of bogies.

Though the permanent furnishing annexe, costing Rs. 3.7 crores, is in its early construction stage, furnishing of the shells has been started at the Factory with temporary arrangements and 20 coaches are now being turned out per month. When the permanent furnishing unit is ready, production will be stepped up to 350 per year and it has been decided that all the 305 first class coaches produced will be furnished at the Factory by 1960-61.

Paying a tribute to the Factory at the tremendous success achieved in the manufacture of broad-gauge integral coaches, the Ministry of Railways have now decided not to seek foreign technical collaboration in the establishment of the meter-gauge coach factory and that the Integral Coach Factory should act as the technical consultants.

A. I. R. to train Railway Announcers

Announcers of the Indian railways are to be trained at the Bombay, Calcutta, Madras and Delhi stations of All India Radio.

The railways employ announcers at all major stations to make announcements relating to train arrivals and departures. They also make announcements calculated

With steady expansion in volume and range of production, specially after the introduction of the second shift, large potentialities of employment will open up at the Factory for engineering graduates, engineering diploma holders and other technical and non-technical personnel.

Training facilities are being rapidly expanded at the technical training school. Apart from training skilled workers and graduate apprentices, a new foundation course has been started for unskilled staff to open avenues of promotion to them. There is a refresher course for supervisors where lectures are arranged on production-planning and control, time and motion study, and principles of supervision.

To attract good workers and to keep up their enthusiasm and loyalty as happy members of the Integral Coach Factory family, amenities are being expanded too. The housing colony is being expanded. Two thousand of the workers have been confirmed on the 15th August, Independence Day, this year giving them security of service.

There is a staff council with elected members for suggesting improvements in working conditions and production methods. There is a suggestions and inventions scheme by which workers are encouraged to put up practical ideas for better production. There is a guardianship scheme by which supervisory staff take personal interest in batches of workers after working hours. To encourage team spirit and camaraderie, playgrounds have been provided at the Factory and there is a regular sports coach. The Factory has already first class hockey, football and athletics teams.

Taken all round, the Integral Coach Factory has conclusively proved that given sound training, equal opportunities and facilities, our workmen in India are second to none.

to develop civic consciousness amongst passengers. The object of the training is to ensure that these announcements are really effective. General Managers of all the Zonal Railways have been asked by the Railway Board to contact the A.I.R. authorities for starting the training of railway announcers early.

CONVERSION OF COAL-FIRED STEAM LOCOMOTIVES INTO HENSCHEL-GILLI HIGH-PRESSURE FIRELESS LOCOMOTIVES

PRESENT trends in boiler and power-house construction tend towards utilization of the advantages of high steam pressures and high superheating. The Henschel-Gilli high-pressure fireless locomotive has therefore special claims to be regarded as modern motive power of that type.

Owing to the storage of large quantities of energy and the low specific steam consumption, the operating range of a high-pressure fireless locomotive is about three times as long as that of a low-pressure fireless locomotive. The low specific steam consumption is due, firstly, to the superheating of the steam after the reduction of its pressure from that of the reservoir to the working pressure of the locomotive; and, secondly, to the lower inlet condensation losses. This reduction in losses is due to the fact that, with high-pressure fireless locomotives, the normal working pressure is limited to 10—13 kg./cm.², so that, in contrast to low-pressure fireless locomotives, the uneconomic utilization of the residual steam of lower pressure is abandoned. Even so, the size of the steam cylinders is no greater than with normal steam locomotive having the same weight in working order. The heat-emitting surface is therefore smaller than with the "over-rated" steam cylinders of low-pressure fireless locomotives.

On the strength of these principles, which have also been confirmed by practical experience, we were commissioned by Essener Steinkohlenbergwerke A. G. to convert two of their coal-fired steam locomotives into high-pressure fireless locomotives, although these steamers were still in a condition permitting another 20 years of life expectancy.

It was specified that it should be possible for the locomotives to be operated from either side of the cab, and that they should be fitted with a steam-actuated deadman device in order to make sure that permission for oneman operation would be forth-coming.

The two locomotives assigned for the conversion are of our "Minister Stein" class which has been found satisfactory for many years.

In accordance with the working pressure of the boiler plant at Consolidation colliery, the high-pressure fireless locomotive was designed for 50 kg./cm.², and the size of the steam reservoir was so chosen that the weight of the locomotive in working order would not exceed approximately 56 tons. The working pressure in the steam cylinders, 13 kg./cm.², remained the same, so that the converted locomotives are able to take over the full duties of the coal-fired locomotives.

Frame, running mechanism and brake gear have been re-used complete. The locomotive controls have only been modified to the extent required for the provision of control from either side of the cab.

In order to spread the axle loads as evenly as possible, the new driving cab has been arranged not, as before, at the back end of the locomotive, but above the cylinders. The driving cab is so designed that regulator, valve motion, cylinder valves, steam brake and deadman device can be operated from either side of the cab, and that accessibility to these control and distribution organs is ensured by adequate openings or removable partitions.

The Henschel deadman device for steam operation, approved for one-man operation by the Government Inspector of Railways of the Essen Region of the German Federal Railways, was also used in this case. The working of this deadman device, for which Henschel-Werke holds the patent rights, will be described in greater detail in a forthcoming issue of our Journal. In the present case, however, it was necessary to carry out certain structural modifications since steam was the only means of exercising the indispensable control over the brakes and the steam supply to the cylinders. In contrast, diesel or electric motive power units are generally equipped with an hydraulic or electric control circuit which need only be interrupted to bring the vehicle to a standstill.

With these Henschel-Gilli high-pressure fireless locomotives, Essener Steinkohlenbergwerke now have

(Continued on page 18)

Diesel-Electric Locomotive J 12 for the Austrian Federal Railways

THE Henschel Works has completed the construction of a series of ten diesel-electric locomotives for the Austrian Federal Railways. These units are four-axled bogie locomotives with a power of 1,425 b. h. p. and a weight in working order of 72 tons.

The external appearance of the locomotive has been adapted to that of the modern electric locomotives of the Austrian Federal Railways. There is a driving cab at each end, and a large enclosed engine compartment in the centre. The engine set consists of the well-known 12-cylinder General Motors diesel engine which is mechanically coupled to the main generator, and to the auxiliary generator, cooler fan, and the two blowers for the traction motors. The compressed air required for the braking system is provided by a Jenbach 2-cylinder diesel-compressor set so that the air supply is independent of the speed of the main diesel engine, and the power otherwise allocated for the operation of the compressor remains available for

the traction purposes. Between main generator and compressor space is provided for a train-heating boiler, which is to be installed later.

A walkway connecting the two driving cabs is left open along the right-hand side of the engine room, but the one on the left-hand side is a cul-de-sac which can only be entered from the rear, its front end being blocked by the air trunking of the cooling system.

The bogies as well as the underframe members carrying the vehicle body are largely welded. The side walls are stress bearing and make a major contribution to the bracing of the side walls. Non-stress-bearing structural parts are made of light alloys. The bogies are of the well-known Flexicoil type, in which the bolster springs have been placed as far apart transversely as possible. This has resulted in very quiet and soft running and in very good transverse stability. The traction motors are nose-suspended and have a gear ratio of 14 to 63, permitting

(Continued from page 17)

at their disposal motive power units offering the following special advantages :

1. Savings in capital costs
2. Savings in maintenance and repair costs
3. Savings in labour
4. Savings in fuel

The reduction in the cost of fuel is due mainly to

the fact that the high-pressure steam is generated in the colliery's own existing plant.

The management of Consolidation colliery has quoted the following satisfactory working results :

Three reservoir chargings in one 8-hour shift, covering 40 km. per shift under load. Maximum output from one filling: 354 tons over a distance of 12.2 km.

TECHNICAL DATA

Prior to Conversion

Gauge	1435 mm
Cylinder diameter	540 mm
Driving wheel diameter	1100 mm
Total wheelbase	3100 mm
Boiler heating surface	136 sq. m.
Grate area	2.1 sq. m.
Working pressure	13 kg./cm ²
Tractive effort (0.75 p) =	14250 kg.
Empty weight	42500 kg.
Weight in working order	51000 kg.

After Conversion

Gauge	1435 mm
Cylinder diameter	540 mm
Driving wheel diameter	1100 mm
Total wheelbase	3100 mm
Water space	12.51 cub. m.
Steam space	1.4 cub. m.
Steam storage pressure	50 kg./cm ²
Working pressure	13 kg./cm ²
Tractive effort	14250 kg.
Empty weight	46620 kg.
Weight in working order	56215 kg.

a maximum speed of 100 km. p. h. The ground clearance of 100 mm, stipulated by the ORE gauge for worn tyres is observed by choosing a driving wheel diameter of 1,040 mm, conventionally used in Austria.

In the construction of the locomotives, Austrian industry, subject to economic considerations arising from the cost of transport, has also played a part, especially where the observance of Austrian Standards was involved. Thus, the complete bogies, the fuel and feed-water tanks and the draw and buffing gear were supplied by the Vienna Locomotive Works of Simmering-Graz-Pauker A. G., the compressors by the Jenbacher-Werke; the complete compressed-air equipment for brakes, sanders and windscreen wipers by Stabeg; the deadman safety devices by the Austrian Brown Boveri Company, and the Baren battery for starting the diesel engine and other minor components by other Austrian firms.

It can be seen, by the side of the door of the driver's cab, the two air inlets for the cooling system. These are automatically controlled by shutters according to the cooling-water temperature. Behind the louvres in the top part of the side wall are the filters for the combustion air. Further filters are provided at the engine inlet so that the air sucked in by the engine is filtered twice.

The interior of the driving cab with the desk, conveys an impression of the wide field of vision

obtained with the aid of the corner windows.

The right-hand side corridor is viewed from the rear towards the front. In the foreground are the main generator and, above it, the blower for the rear traction motors; in the centre the diesel engine with a Roots blower and, above it the suction filters; in the background the air duct for the cooling system and the door leading to the front driving cab. On the side-wall on the right are mounted the flat air filters and the hand rail ensuring the safe use of the walkway when the locomotive is running.

It is easy to recognize the flat bearing pivots; the beams destined to carry the supply tanks, which are inserted from the side; the almost square apertures for the air inlets to the traction motors; the round openings in the transoms for the air ducts; and the lateral supports and the lifting blocks near the pivots.

The switchgear rack is mounted on the partition between the engine compartment and the rear driving cab. Particularly interesting are the cable loops visible which pass through the wheel-slip relays. Each cable carries the current of two traction motors in the opposite direction through each relay. The relay is energized as soon as the magnetic equilibrium is disturbed by the slipping of an axle. In that case, the main generator is automatically relieved and the sander operated until the wheel-slip has ceased, and the load is then gradually raised to its previous value.

Road Bridges at Rail Level Crossings—Countrywide Plan to be prepared

All State Governments have been requested to indicate to the Railway Board their requirements of road over-bridges and under-bridges during the remaining two years of the Second Plan and also during the Third Five Year Plan period. The State Government have also been requested to indicate the relative priorities of these bridges.

Normally, the railways consider the provision of a road over-bridge or under-bridge only on receipt of a specific request from the State Government concerned. The Government of India recently advised the State Governments that all schemes relating to over and under-bridges in replacement of level crossings should

form part of the State Plans, and that after obtaining the prior approval of the Planning Commission the road authorities' share of the cost may be met from the loans which State Governments receive from the Centre for their development schemes. The cost of these bridges can also be met by the State Governments, now from the proceeds of the tax on railway passenger fares, which accrue to State Governments.

The State Governments have accordingly been requested to draw up the necessary proposals and provide funds in their Plans, so that railway administrations can prepare co-ordinated programme for the whole country.

DIESEL LOCOMOTIVES BRING BIG FUEL SAVINGS

COAL burning steam locomotives may be fun to watch as they come chugging down the mainline track trailing long plumes of smoke and clatter to a stop amidst clouds of hissing steam, but according to one railroad expert this is unusually high priced entertainment.

As a matter of fact, steam locomotives may be up to seven times more expensive to run than diesel-electric units with an equal amount of horsepower, the expert, G. T. Bevan, an application engineer with General Electric's (U. S. A.) Locomotive & Car Equipment Department, told Globe Press Service.

Bevan said he based his statement on analyses of the comparative cost and efficiency of coal and diesel fuel. The seven times more expensive figure for steam operation, he said, applied specifically to certain areas of Brazil. He cited an instance in which a major railroad, the Central of Brazil, had justified the purchase of a fleet of diesel-electrics in only six months solely on the basis of savings in fuel costs.

The explanation for the reduced cost of diesel-electric operation lies in the higher thermal efficiency of diesel fuel, Bevan said. In Brazil, for instance, local low grade coal has been used successfully in steam locomotives but only when mixed with expensive, imported high grade coal. A ton of this mixture has an over-all thermal efficiency of only about five per cent. On the other hand, a ton of diesel fuel, costing about the same, has an over-all thermal efficiency of almost 25 per cent.

Thermal efficiency refers to the amount of potentially useful energy in a fuel that can be converted into actual power. Some fuels can, so to speak, do much more work per pound than others, Bevan explained.

The G-E expert noted that while diesel fuel may cost more than coal in some areas of the world, its net cost, based on useful work done, is often substantially lower because of the high thermal efficiency of the diesel-electric locomotive.

Bevan said that the lack of satisfactory coal is not the only factor influencing the choice of diesel-electric locomotives in many parts of the world.

In Southwest Africa, for instance, it is not so much

the lack of coal that is prompting a wholesale change-over to diesels, but rather the lack of plentiful water. "A steam locomotive," we were reminded, "is a very thirsty piece of machinery." A diesel-electric, on the other hand, needs no water at all—except a little to satisfy the thirst of its engineer and trainman.

A similar situation exists in the central area of Turkey. Recognizing this, the Turkish Government has embarked on a long-range program of replacing existing steam powered locomotives with diesels. It has already purchased five 1980 horsepower universal-type diesel-electrics from General Electric as a part of this program. The plans of the Turkish State Railways call for the ultimate purchase of a total of 90 locomotives of this type. It is expected that they will replace 163 steam locomotives now in use. A fuel saving equivalent to 200,000 tons of coal per year will be one of the results of this move.

Bevan pointed out that universal-type diesel-electrics, such as those ordered by the Turkish State Railways, the South African Railways and a large number of Brazilian, Argentine and other South American railway systems, also have a much higher operating efficiency than steam units. Universal-locomotives, he explained, are designed for use in passenger, freight and switching service. Thus it is possible for a single diesel-electric to replace two steam locomotives one of which would have been suitable only for mainline service and the other for switching.

The situation with railroad locomotives is similar to that which exists with modern commercial jet airliners, according to G-E's application engineer. Jets, he said, can be economically justified only by keeping them in the air as much as possible. In other words, airlines can afford to use them only if they are producing income.

Locomotives too must be kept working. But because of the highly specialized, functional design of the different types, this is practically impossible with steam locomotives. On the other hand, universal-type diesel-electrics, because of their versatility, can be kept in income producing service almost all of the time. Their availability is recognized as being twice that of the steam locomotive; or, in terms of total investment, only half as many locomotives are required when diesel-electrics are used.

TEMPLE MILLS MARSHALLING YARD

Hump classification yard with two stages of retardation and two subsidiary yards

TEMPLE Mills Marshalling Yard, British Railways, Eastern Region, is situated between Stratford and Lea Bridge Stations on the former Cambridge main line from Liverpool Street via Stratford. During the latter part of the last century several yards were added to accommodate an increasing volume of freight wagons.

When, in 1954, it was decided to reconstruct Temple Mills as a new freight marshalling centre there were 10 yards at Temple Mills itself, and some five satellite yards in the outer London area. Reconstruction had become essential because the old layout caused a great deal of trip working between yards; many wagons having to be shunted several times before eventually leaving the final yard on the correct trains. The new layout was expressly designed to eliminate this and thus speed up the movement of freight wagons.

TWO-DIRECTIONAL WORKING

The new hump yard is designed for two-directional working and equipped with Westdair primary and secondary retarders. It consists of one main yard and two subsidiary ones. In the old layout the main lines ran through the middle of the existing yards, and to make room for the new layout they had to be diverted onto a new alignment on the south side of the site.

Towards the middle of the site the new main lines pass through the area which was occupied by the Temple Mills wagon repair shops. To clear the area for the realignment of the running lines the wagon repair shop had to be reconstructed on a new site. The wagon and lifting shop is built on piles and is 455 ft. long and consists of two low roof bays, each 75 ft. wide for the repair of wagons and one high-roof bay 50 ft. wide which serves the lifting shop. The building is constructed with side glass curtain walling and corrugated asbestos roof insulation. Roller shutter doors are fitted with air curtains which operate automatically when the doors are open. The shop is equipped with two wheel lathes, two journal lathes, an axlebar washing machine, an axle-journal turning and grinding machine, and a layout for the repair of vacuum cylinders.

RECEPTION SIDINGS

At the Lea Bridge or western end of the site there are 12 reception sidings on a straight alignment with wagon capacities varying between 42 and 75 wagons, giving a total standage capacity of 680 wagons. The sidings are laid at 12 ft. 2 in. centres to give an interval of 7 ft. 5½ in. between running edges, with a wide space of 14 ft. 5½ in. between the upper and lower groups for the installation of lighting masts.

The gradients of the sidings are rising at 1 in 1,615 for the first third of the length, rising at 1 in 460 for the middle third, and 1 in 40 up to the summit of the hump. Seven of the southernmost sidings can be entered from either direction.

Trains entering from the down direction come into the reception sidings on a special arrival road along side the main hump, but at a lower level. The 13th siding on the south side serves as an engine line so that the hump shunting engine can return to the Lea Bridge end of the yard where there is a hump engine spur.

The arrangement of the connections at this end of the yard is such that the hump engine can return to its spur without interrupting the flow of trains from the running lines into the reception sidings. All these connections are power operated from Temple Mills West Signalbox.

SORTING SIDINGS

The sorting sidings are arranged in eight groups each of six sidings with a brake siding on the two outermost groups and a transfer road on the northernmost group. The groups are lettered A, B, C, D, E, F, G and H, from south to north, and the sorting sidings in each group are numbered from one to six in the same direction. The shortest siding accommodates 51 wagons, and the longest 82. The total standage capacity of the 47 sidings is 3,044 wagons.

The sidings are laid at 12 ft. 2 in. centres giving a 7 ft. 5½ in. clearance between running edges with 14 ft. 5½ in. spaces between the fans for lighting masts.

The hump cabin and its associated relay room are situated at the summit of the hump on the right hand side, and the control tower is on the centre line of the yard between the primary and secondary retarders.

DEPARTURE SIDINGS

At the Stratford end of the yard there is a group of eight departure sidings with capacities ranging between 55 and 71 wagons, and with a total standing capacity of 499 wagons. Departure is possible from all eight departure sidings in both the up and down directions.

The two subsidiary yards are known as the West and East Yards. The West Yard is situated to the north of the hump area and sorting sidings. It consists of 16 dead end sidings with a wagon standage capacity of 1,024 wagons and two reception lines accommodating 60 and 63 wagons. The yard has a small gravity hump 5 ft. high. The point assembly is connected to a ground frame housed in a building at the summit of the hump. This yard is used for secondary sorting and as a reservoir. The East Yard is situated to the north of the departure sidings and like the West Yard is used for secondary sorting and as a reservoir.

RETARDERS

The two stages of retardation are provided by two primary retarders and eight group retarders. The hump layout comprises a king turnout followed by the two primary retarders, two queen turnouts and four jack turnouts, immediately followed by the eight secondary retarders.

The retarders are Westinghouse electro-pneumatically operated Westardairs. The primary retarders are 75 ft. long overall, they have 22 operating cylinders each, and are automatically controlled. The group retarders are 49 ft. long overall, with 16 cylinders each. They are manually controlled.

Westardairs are of unit construction. The beams extend from one cylinder unit to the next, and are built together to form an articulated and flexible retarder. The brake shoes are arranged with their joints in the centre of each beam, so that when the retarder flexes at the beam joints, the shoes, which are continuous over these joints, allow the wagon wheels to pass the joints smoothly without any variation in braking effort. The shoes are of special steel to provide flexibility and a good co-efficient of friction with durability.

The retarders operate on the nut-cracker principle. A pair of levers are mounted on a fulcrum below the rail, the levers extending outside the track, with the cylinder attached to the upper lever and the piston rod to the lower lever. The upper lever carries the outer beam and the lower lever the inner beam. When the cylinder operates the upper lever is raised and the lower is depressed so that the beams are thrust towards each other and the shoes grip the wheels of the wagons as they pass through.

Should a wagon be rocking from side to side there is no variation in grip on the wheel, for the whole lever assembly can swing on the fulcrum to follow the sideways motion of the wheel. Because of the articulated construction any variation in wheel width in a cut of wagons does not affect the grip on individual wheels.

CONTROL OF RETARDERS

Control of the primary retarders is automatic with overriding manual control. Each of the retarders is divided for control purposes; the first five pairs of cylinders are controlled by one valve unit and the remaining six pairs of cylinders are controlled by a second valve unit. These valve units are specially developed for use with the automatic control.

The track through the primary retarders is divided into three rail circuits; the first controls the application of the automatic control to the first valve unit, and the last two perform the same function for the second valve unit. Two rail circuits are used in the second part because the queen points are immediately after the retarders, and point protection must start in the retarder to be adequate. The last rail circuit of the retarder, therefore, performs two functions. First, in conjunction with the second retarder rail circuit it controls the retarder; secondly, in conjunction with the rail circuit over the switches of the queen points it forms the point protection rail circuit and thus controls the route setting over these points.

The automatic control of the retarders is effected by making use of the Doppler effect to measure the speed of the cuts by three R. F. units, the first measuring speed to give the rolling resistance of the cuts. The cuts are classified accordingly and each classification has a leaving speed allotted to it. The remaining two R. F. units are used to measure the speed of the cuts in the first and second parts of the retarder respectively, and take part in controlling the retarder application.

These speed measurements determine the leaving speed from the retarder so that cuts arrive at the group retarder correctly spaced, that is the better running cuts are so retarded that they do not close up on preceding poorer running cuts between the primary and group retarders and so prevent correct routing nor do the cuts enter the group retarders before a preceding cut has left the retarder, unless the preceding cut had been stopped due to some emergency.

In addition, for each primary retarder there is a "weigh rail" which classifies the cuts into three categories: light, medium, and heavy. This information is passed to the automatic control gear and selects the maximum pressure to be applied to the retarder for the cut concerned. The leaving speed having been selected, pressure is applied should the speed be in excess of this. When the cut speed has fallen to the required value the retarder is released, so that the cut leaves at the correct speed. Should the cut accelerate whilst still in the retarder after being released, then the pressure will be reapplied to correct the speed of the cut. By this means the leaving speed of the cut is controlled to within very small limits.

SECONDARY RETARDERS

The group retarders are controlled as one unit, although there are two standard simplex valves per retarder which operate in parallel under the control of push buttons on the control desks in the control tower. There are five push-buttons for each group retarder: off, 1st pressure, 2nd pressure, 3rd pressure, and 4th pressure. Also on the control desks there are similar sets of push-buttons for each valve unit of the primary retarders. On each control desk in the control tower there are therefore, two sets of five push-buttons above a primary retarder and four sets of five push-buttons along the lower edge of the desk directly below each group of sidings, one for each group retarder. In addition each primary retarder has an auto/manual switch mounted above its control buttons, to select automatic or manual control.

Indications of weight and rolling resistance are shown on the desks, in illuminated panels adjacent to the primary and group retarders. These indications are incorporated in the cut indication panels. For the weight, "H" indicates heavy and "L" indicates light, and "HL" indicates medium, similarly for rolling resistance, "G" indicates a good roller, "B" a bad roller, "BG" an average roller. The combinations "HL" and "BG" were used because of space considerations, as this arrangement avoids the use of

separate indicating lamps for medium weight and average roller.

The retarders are powered by compressed air at a maximum pressure of 120 lb. per sq. in. which is produced by three electrically driven air-compressors housed within the control tower building. Two of these compressors are selected as duty compressors at any one time whilst the third acts as a stand-by.

Lighting for night working in the yard is by colour-corrected mercury-vapour lamps mounted on 72 50-ft. tubular steel towers installed throughout the yard.

SIGNALLING

The signalboxes have been equipped with panel keys for operating signals on the entrance exit principle. The control panel at Temple Mills East signalbox has an illuminated operating panel showing the layout of the lines and connections located within the control area of the box. Rotary keys for each signal or group of signals are located on the diagram. These are the "entrance" keys. At the remote end of each signal route on the panel layout is a push-button key, known as an exit key. The method of operation is similar in the Temple Mills West box, although a different type of electro-magnetic "point set" indications are provided.

TELECOMMUNICATIONS

The telecommunications network throughout the yard comprises a 100-line private automatic branch exchange. All signalboxes and offices have an automatic telephone. There is also a two-way radio network which provides constant radio communication between shunting engines and the hump cabin and control tower. A loudspeaker system has also been installed to enable the control tower operators to speak to shunters and other staff in the yard or departure areas by throwing the appropriate keys on the control panel. Construction of the yard was under the general direction of Mr. A. K. Terris, Chief Civil Engineer, Eastern Region. Mr. K. J. Cook, Chief Mechanical & Electrical Engineer, was responsible for the supply and installation of mechanical and electrical equipment, and Mr. R. A. Green, Signal Engineer, for the resignalling and telecommunications. Earthworks and track laying was carried out under the direct supervision of the District Engineer, Stratford, whose labour forces were augmented by those of Tersons Limited.

The principal sub-contractors are :—

Retarder and signalling equipment associated with the hump cabin and control tower, wagon counting equipment, and the wagon description system

The Westinghouse Brake & Signal Co. Ltd.

Domino panel indications for the control tower

Tyer & Co. Ltd.

Signalling equipment associated with the Temple Mills West and Copper Mills Signal-boxes

Metropolitan—Vickers G.R.S. Limited

Signalling equipment associated with Temple Mills East and Manor Yard Signal-boxes

The Siemens & General Electric Railway Signal Co. Ltd.

P. A. B. X. telephone equipment	The Reliance Telephone Co. Ltd.
V.H.F. radio telephone equipment	Marconi's Wireless Telegraph Co. Ltd.
50-ft. lighting towers	Tubewrights Limited
Yard lighting equipment	General Electric Co. Ltd.
Transformers	Metropolitan—Vickers Electrical Co. Ltd.
High-voltage switchgear	British Thomson-Houston Co. Ltd.
High-voltage cables	Johnson & Phillips Limited
Yard lighting installations	Clough Smith & Co. Ltd. Johnson & Phillips Limited
Control tower and main buildings	Kirk & Kirk Limited
Shunters' cabins, etc.	J. & J. Dean Limited
General engineering	W. & C. French Limited
Piles	Holmpress Piles Limited

KEW

Steel Castings Manganese & Carbon

KUMARDHUBI ENGINEERING WORKS LTD.

Managing Agents:

BIRD & CO. (PRIVATE) LTD.

Chartered Bank Buildings, Calcutta-1

Diesel-Electric Mixed-Traffic Locomotive for Overseas Service

Prototype 1,100-h.p. Co-Co design to meet a wide range of specification requirements

INTENDED primarily to meet the light axle loading requirements of many railways overseas, a prototype diesel-electric mixed-traffic Co-Co locomotive, named "Explorer," has been produced as a joint venture by the British Thomson-Houston Co. Ltd. and Lister-Blackstone Rail Traction Limited. It will be shipped shortly to Kenya for service testing on East African Railways & Harbours, including some steeply graded lines.

The power equipment is a turbo-charged 12-cylinder Blackstone Type ERS 12T. diesel engine, driving, through a speed increasing gear, a B. T. H. 675-kW. generator. At the B. S. rating of 1,100 b. h. p. at 800 r. p. m. an ample power reserve is available to meet the operating altitude and tropical temperature conditions. Separate motors are fitted to each axle of the two six-wheel bogies.

Leading particulars of the prototype recently completed are as follow :—

Gauge	Metre
Wheel arrangement	Co-Co
Maximum speed	55 m. p. h.
Weight	72 tons
Tractive effort—maximum	42,000 lb.
Tractive effort—continuous	24,000 lb.
Fuel tank capacity	500 gal.
	ft. in.
Length over headstocks	49 0
Height overall	12 9
Width overall	9 9
Bogie wheelbase	12 0
Bogie pivot centres	30 0
Wheel dia.	3 0½
Minimum radius of curve	300 0

The design allows of simple modification to meet alternative specification requirements. The gauges for which the basic design is intended range from metre to 5 ft. 6 in. with a standard frame. Provision is made for multiple-unit working, right-hand or left-hand driving positions, reductions in overall width or height, alternative braking equipment, and different axle loadings. The maximum speed is 55 m. p. h. and continuous tractive effort 24,000 lb. The

"Explorer" is intended for mixed traffic working on main and branch lines. The bonnet type of construction was chosen to facilitate servicing in tropical conditions.

MAIN AND AUXILIARY EQUIPMENT

The main bonnet, forward of the cab, is divided into three compartments. In the leading compartment are the cooling group, one traction motor blower, one motor-driven exhaust, and two forced-draught cooled dynamic brake resistor units. In the central compartment are the engine, two shaft-driven air compressors, two air receivers, and the engine coolant header tank. The engine inlet air filters are in the bonnet sides and the twin exhausts discharge through the roof. In the generator compartment, adjacent to the cab, is an air receiver.

At the rear of the cab is a short bonneted compartment which houses the main electrical control panel, dynamic brake control panel, one traction motor blower, one exhaust, and one air receiver. This compartment and the engine compartment are slightly pressurised with filtered air to prevent the entry of dust.

The bonnet casings are carried on a welded structure of steel angles. A considerable area of each side is occupied by removable louvred panels covering the panel type air intake filters. Access to the main equipment for servicing is by hinged doors. Inspection hatch covers are fitted over the engine, and also give access to auxiliary equipment. At each corner of the frame are steps, with a continuous handrail between the steps and the cab.

CAB

The cab is over the centre of the rear bogie. It contains duplicate driving controls and instruments for travel in either direction. The driving seats are upholstered and adjustable. At the left of the seat is the power handle of the master controller, with the reverser handle immediately below. These two controls are interlocked to prevent movement of the reverser when the power is switched on. The straight

air brake control is on the right. In front of the seat are the dynamic brake, vacuum brake, and automatic air brake controls.

Above the controls is a panel carrying the ammeter, speedometer, and the air brake and vacuum gauges. The engine instrument panel is fitted in the centre of the front bulkhead above the handbrake. Laycock pneumatic wipers are fitted to the driving screens.

The cab also includes a warming plate, lockers for food and clothing, and a ventilating fan. The cab roof and sides are insulated with glass wool. There are access doors from the front and rear platforms behind each seat, and Beclawat sliding windows at each side of the cab.

POWER UNIT

The Lister-Blackstone 12-cylinder engine is rated at 1,100 b. h. p. at 800 r. p. m. It is a double-bank version of the makers' six-cylinder unit. The two vertical banks are bolted back-to-back on a common base, with an output gear on each crankshaft meshing with a main drive gear.

This construction facilitates acceleration from 800 r. p. m. to 1,125 r. p. m., which allows a lighter generator to be used. The bore is 8.75 in. and stroke 11.5 in. Each bank has a Napier turbo-charger.

Each set of six cylinders is a self-contained unit, with fuel injection equipment, governor, oil and water circulating pumps, and valve gear camshaft. This makes possible a considerable degree of standardisation in manufacture. In an emergency, the drive from one crankshaft can be disconnected and the locomotive run on reduced power.

The cylinder block is a welded steel fabrication fitted with cast-iron wet liners. In servicing the aluminium alloy pistons may be withdrawn upwards through the bore or downwards through the crankcase side covers.

The ensure even loading and a smooth drive from the two crankshafts to a common output gear, the drive from each shaft is taken through a Blackstone flexible coupling and nodal damper. The latter is a grease-filled multi-plate clutch arranged to impose a viscous drag on the oscillation of the flexible coupling. Rubber, bonded to the input and output members, ensures a high degree of twist under load. This

prevents any torque reversal from being transmitted to the gear teeth. At the front end of each crankshaft is a hydraulic type torsional vibration damper.

Protection equipment stops the engine if the oil pressure drops in the engine or gearbox and if overspeeding occurs.

The combined engine-generator set is flexibly mounted on eight rubber mountings.

COOLING

The cooling group at the forward end of the bonnet is a twin fan unit, drawing air through radiator side panels and discharging through the roof. Each panel is built in sections, which are mounted on Silentbloc rubber bushes.

Two-speed electric motors with thermostatic regulation drive the axial flow fan. Coolant circulation, under thermostatic control, is by two engine-driven centrifugal pumps. Separate sections are provided in the radiator for the cooling of the engine lubricating oil and the output gear oil. The total coolant capacity, including the header tank, is 50 gal.

In the construction of the Alsthom bogie rubber cone pivots are used for body suspension. The bogie frame members are welded steel fabrications of box form, with fixed bolsters. There are four spring-loaded side bearers and two rubber cone pivots. The pivots are supported on the fixed bolsters on rubber pads, which allow side movement in shear.

To permit maximum articulation the inner pivot assembly of each bogie is free to slide as a unit. The periodicity and lateral damping of the suspension can be varied by adjustment of the side bearer springs. Primary springing is by underhung equalising beams and coil springs.

The guideless Skefko roller bearing axleboxes are carried on rubber bushed radius rods, so eliminating horn guide wear.

The main underframe is a welded structure of rolled sections and plate, with diagonal bracing in the end panels to transfer the loading of the central buffers. Extensive lightening holes are cut in the vertical webs of the main longitudines and cross-members.

BRAKING

Equipment is provided for the brake operation of

both vacuum and air-braked stock. In addition, an electro-dynamic brake is fitted on the locomotive. The mechanical braking is Westinghouse equipment. Two brake cylinders fitted on each bogie operate single shoes on each wheel. When hauling unbraked stock braking is controlled by a self-lapping straight air brake valve. With vacuum-braked stock the locomotive air brakes are controlled through the vacuum brake valve. The hand brake, operates on four wheels of one bogie.

DYNAMIC BRAKE

The dynamic brake is a non-friction brake applied to the axles instead of the wheels. When it is applied, by a normal type of control in the cab, the six traction motors are switched to act as generators driven by the wheels. The control is not interlocked with the mechanical brakes, and both systems may be used together if required. Further details of this equipment are given below.

ELECTRICAL EQUIPMENT

The B. T. H. Type RTB 14440 main generator is single-bearing and self-ventilated, flange mounted to the engine. The continuous ratings at 1,125 r. p. m. are 675 kW, 1,310 A, 515 V. and 670 kW, 2,310 A, 290 V. The generator is 10-pole with class "B" insulation. It incorporates a starting winding for motoring the engine.

At the frame end the field windings are retained by leaf springs. The armature spider, on which the laminated core is assembled, is bolted direct to the engine drive, and at the rear end is supported by a self-aligning roller bearing.

Through cooling ducts in the spider a steel fan draws filtered cooling air over the commutator and brush gear. This air is discharged through a division bulkhead into the engine compartment. A feature of B. T. H. machines is the use of B. T. H. Pollack type commutators, in which each segment is retained by a locking key giving a continuous support over the full length.

AUXILIARY GENERATOR

The auxiliary generator is a B. T. H. machine type RTB 7428 with a continuous rating of 48 kW., 110 V., 700-1,125 r. p. m. Voltage control is by a Brown Boveri automatic voltage regulator. This generator is flange-mounted to the main generator. A belt-driven exciter is saddle mounted on the auxiliary generator.

The traction motors have a continuous rating of

385 A, 290 V. at 440 r. p. m. These are of the B. T. H. Type 138, force-ventilated, and axle-hung on plain bearings. The reduction gear is cushioned by a torsionally resilient gear in the drive. Class B insulation is used and the motor bearing arrangement is designed to facilitate armature removal.

CONTROL OF BRAKING

When the electro-dynamic brake is used the motors are switched to act as generators driven by the wheels. The current produced is dissipated through banks of resistances. Control of the braking is by varying the field current in the motor, which is performed by pilot contacts and a rheostat on the brake control in the cab. Switching is effected by contactors on the control panel in the compartment behind the cab. The resistors are force cooled by a motor-driven fan.

In the control cubicle electro-magnetic contactors are used for the auxiliary and control circuits and electro-pneumatic contactors for the motor circuits. One step of field weakening is automatically introduced, dependent upon the speed and load.

Contractors include :—

Joint main contractors	
Electrical equipment	British Thomson-Houston Co. Ltd.
Diesel engine	Lister Blackstone Rail Traction Limited
Principal Sub-contractor	
Mechanical parts including bogies	Clayton Equipment Co. Ltd.
Other sub-contractors	
Axle boxes	Skefko Ball Bearing Co. Ltd.
Battery	Chloride Batteries Limited
Bogie pivots and axlebox links	S. G. de Constructions Electriques & Mecaniques Alsthom
Brakes, compressors and exhausters	Westinghouse Brake & Signal Co. Ltd.
Cable	Siemens Edison Swan Limited
Conduit	Simplex Electric Limited
Engine cooling equipment	J. W. Lawrence Limited
Filters	Air-Maze Limited
Oil and fuel pumps	Varley-F. M. C. Limited
Fuel injection equipment	C. A. V. Limited
Traction motor blowers	Aerex Limited
Voltage regulator	Brown, Boveri & Co. Ltd.
Wheels and axles	Taylor Bros. & Co. Ltd.

India Big Market for Refrigeration and Air Conditioning

A continuously expanding market for industrial air conditioning and refrigeration equipment in India was forecast recently by Ram D. Malani of Blue Star Engineering Co. (Bombay) Pvt., Ltd.

Refrigeration and air conditioning sales for industrial uses could well double over the next five to ten year period, according to Malani, Managing Director and Chief Engineer of the Air Conditioning and Refrigeration Division of Blue Star.

The Indian executive made this prediction while attending Worthington Corporation's (U. S. A.) second international air conditioning conference in San Juan, May 14-16. The affair was attended by Worthington distributors and representatives from 14 countries.

The representative from Worthington's Indian distributor based his prediction on the fact that many of the industrial plants presently under construction in the country will require air conditioning or refrigeration because of the nature of the various production processes and the products involved.

The drug, textile and food industries were all cited as examples of growing industries that require process air conditioning or refrigeration.

The future of comfort air conditioning for office buildings and the like was described by Malani as being uncertain at this time because of foreign exchange problems and government policies regarding the importation of products regarded as luxuries.

Malani noted, however, that India's own air conditioning industry is undergoing an expansion. In 1955, only 4,000 room units were assembled and manufactured in India. This production has since risen to more than 12,000 units.

Blue Star's executive noted that imports of all of air conditioning and refrigeration equipment

from the U. S. have gained close to 50 per cent in the past five years and now stand at about 1.6 million dollars (US). This, he said, attests to the vitality and the potential of the Indian market for these products.

He went on to say that any industrial expansion helps to make India more self-sufficient and that industrial air conditioning and refrigeration equipment is making an important contribution to such expansion.

"One can hardly find a more vital industry from a local point of view than Alembic Chemical's Baroda penicillin plant where two Worthington centrifugal compressors installed by Blue Star are supplying 600 tons of process air conditioning," Malani said, emphasizing the fact that without the air conditioning equipment the plant "just could not exist at all."

During his stay in San Juan here in the Caribbean, Malani attended a number of engineering discussions and exchanged views and marketing information with Worthington distributors from points as far apart as Santiago (Chile) and Karachi. He also heard talks by Worthington board chairman Hobart C. Ramsey and S. Riley Williams, Worthington vice president in charge of international operations.

Chairman Ramsey's speech in itself had important implications for India. At one point he said: "...the time is within sight when we can contract for a major installation in such a nation as India, for example, and the compressor would be built at a Worthington plant in the United States, the condenser would be built by our Italian affiliate and the air handling unit would be made in Brazil by our associated company there. All of this would be co-ordinated by the sales, design, installation and service know-how of our distributor in India, Blue Star."

This, chairman Ramsey said, would result in a product priced in a currency that "makes most practical sense in a given international market."

Kashmir-born Brij M. Chharbra, Worthington specialist in industrial refrigeration who works in the Worthington international operations department, also addressed the conference—speaking about commercial and industrial refrigeration. Chharbra, a graduate of the universities of the Punjab and Kashmir and the University of Washington (Seattle), went to the U. S.

about eight years ago and joined Worthington in 1955. Since then, he has been an instructor in the Worthington Air Conditioning & Refrigeration Student Training Program.

After he leaves Puerto Rico, Malani will spend some time in the United States before returning to Bombay.

Bombay Divisional Railway Users' Consultative Committee Meets

The 7th meeting of the Divisional Railway Users' Consultative Committee of the Bombay Division of the Western Railway was held in the Office of the Divisional Superintendent, Western Railway, Bombay Central on Tuesday, the 7th July, 1956 under the Chairmanship of Shri R. N. Chaudharie, Divisional Superintendent, Western Railway, Bombay Central. Members representing the various Chambers of Commerce and Industries at Surat, Amalner and also representatives of Passenger and Traffic Relief

Association were present.

Among the items discussed were the reservation of 3rd class seats on various trains, strengthening of Trains, need for additional facilities for handling traffic at Udhna and the work of Conductors on trains. Statements in respect of provision of passenger amenities, punctuality of passenger trains and inspection of food-stuffs of sale at stations for the quarter ending 30-6-59 were also taken up for discussion.



Hon'ble Shri Jagjivan Ram, Railway Minister, addressing a meeting of the Chief Operating Superintendents of Indian Railways in New Delhi.

HIGH SPEED MACHINING OF HIGH ALLOY & STAINLESS STEELS

BIRMINGHAM Tool & Gauge Co. Ltd., Birmingham, England, have advised us of a continued demand for the Gun Reamers which they have developed over the past two years, and introduced in 1958 for the reaming of high strength alloys.

These Gun Reamers now furnish a solution to the problem of producing holes to extremely exacting standards of size, ovality and finish.

The Reamer is manufactured from 4% Nickel-Chrome-Molybdenum Steel, Heat Treated to 100 ton tensile and is provided with a robust Tungsten Carbide cutting blade and Tungsten Carbide rubbing pads. These latter execute a burnishing action giving extremely high finish and permitting deep holes to be reamed without loss of alignment or size. The use of large carbide tips facilitates maintenance and reduces the tendency of the edge to chip when used on high tensile steels, a common source of trouble when using standard type reamers with their very fragile tips.

When used on High Tensile or Stainless Steels, Gun Reamers give production rates approximately 50/60 times greater than by normal methods of reaming whilst on non-ferrous materials rates 10/20 times faster can be achieved. They are truly end cutting and have no tendency to follow the drilled hole.

A range of B. T. G. Gun Reamers is available but they can also be supplied with Straight Shanks or to customers requirements, whilst intermediate sizes can be manufactured to any diameter or length.

NEW RAILWAY LINES

The Railway Board has approved of the construction of new railway lines at a cost of Rs. 4.2 crores in Bihar. The new lines will link Bakhtiarpur and Rajgir, covering 33 miles, and Ranchi and Hatia section in Chotanagpur where the heavy machinery plant of the Government of India is being built. Necessary steps have already been taken by the Eastern Railway to start construction of these new lines. The Bakhtiarpur and Rajgir link will, obviously, render greater facilities to tourists who visit Nalanda, Rajgir, etc. It will also serve the subdivisional town of Bihar sharif in Patna district.



Adcock & Shipley's range of production

By An Engineering Correspondent

AD COCK & Shipley Ltd. who have been Machine Tool manufacturers since July, 1914, type manufacture a range of Knee and Column Milling Machines from table sizes of 300 x 130 mm. up to 1830 x 430 mm. with horse powers ranging from 1 to 25.

In addition they also manufacture a 1' capacity Radial Drill and Special Purpose Machine Tools including Cotter Slot and Keyway Cutting Machines for railway locomotive work, Centring and Facing Machines and Deep Hole Drilling Machines.

The smallest machines in their range are the No. 0 size as shown on the illustration '1'. These machines can be provided with speeds as low as 150 r. p. m. or as high as 4,000 r. p. m. They can be provided with lever or screw hand feed, automatic feed, semi-automatic cycle or fully automatic cycle.



Fig. 1

The fully automatic cycle machine, as shown on illustration '2', can be arranged with an air vice to give automatic clamping and unclamping in the machine cycle. These very small automatic cycle machines have made a tremendous impression at exhibitions all over the world, being demonstrated on machine cycle times as low as 1½ seconds.

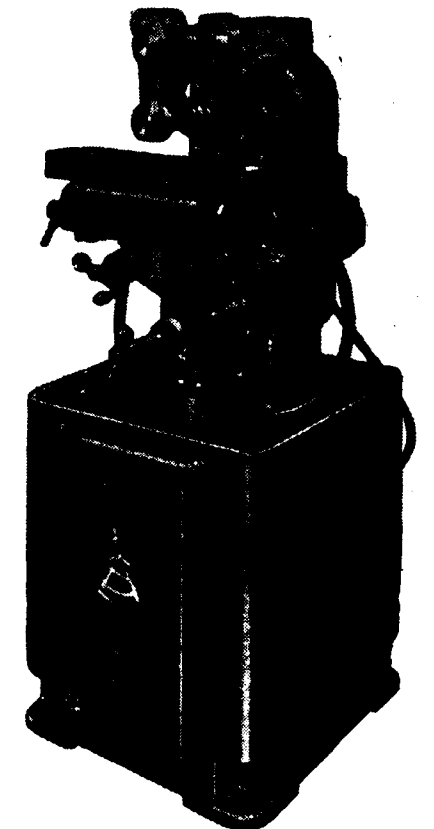


Fig. 2

The No. 1 size machines are extremely sturdy for their size and are available with the same range of feed mechanisms as the No. 0.

In the No. 2 size both universal and plain millers are available of simple types or with rapid traverse all ways, backlash eliminators with hardened table screws, push button oiling, etc.

The illustration '3' shows the model 2JUR which is the latest and most sophisticated machine in this size.

In this size there are also available fully automatic cycle machines for batch and series production equipped with a very wide range of speeds and feeds.

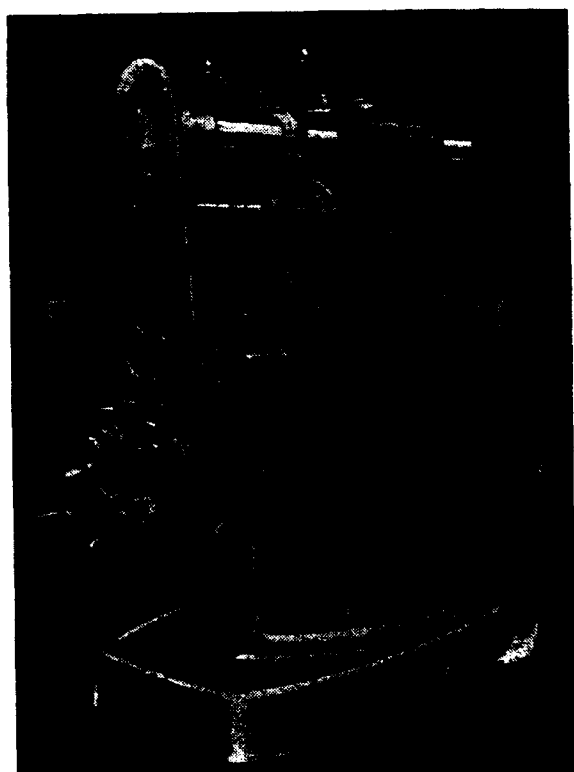


Fig. 3

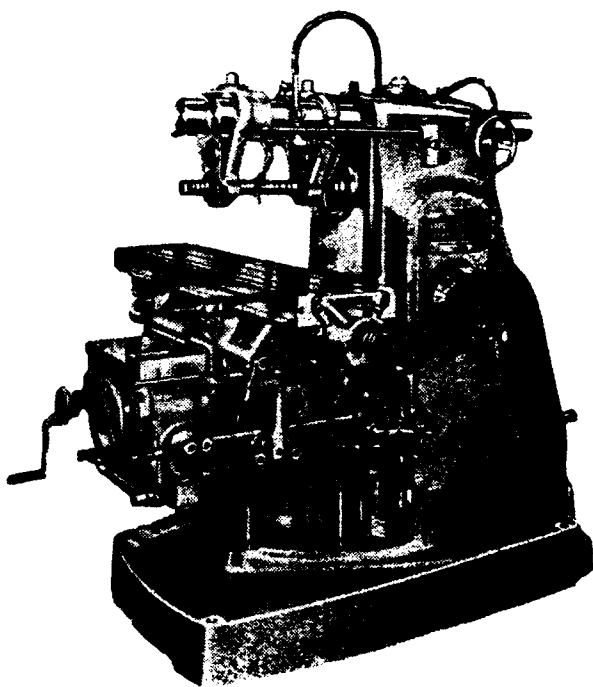


Fig. 4

Illustration No. '4' shows a model 3HG machine which is typical of the No. 3 and 4HG range of Adcock & Shipley. The No. 4 machine weighs 6,650 kilograms and is equipped with a 25 horse power motor, automatic lubrication to all slides and screws, positive backlash eliminator incorporating hardened table screws, five spindle bearings and all hardened and ground speed gears. These machines are suitable for tungsten carbide milling using negative, zero or positive rakes and, in addition, they have been very successfully used on the latest high speed milling techniques using very high positive rake angles.

The No. 3 size machine was demonstrated in 1958 at the American Society of Tool Engineers' Exhibition in Philadelphia at feed rates of 30" per minute climb milling mild steel.

These machines can be fitted with a Heavy Duty Vertical Milling Attachment, as shown on illustration No. '5', this attachment being capable of transmitting the full horse power of the horizontal spindle. This attachment readily converts a horizontal machine into a heavy duty vertical capable of extremely high rates of metal removal.

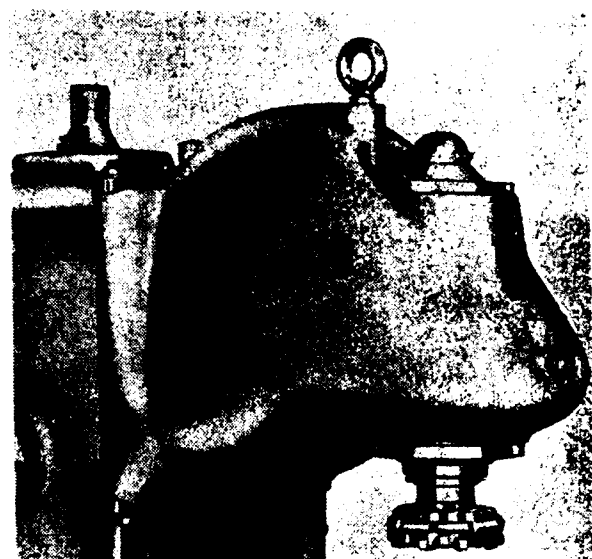


Fig. 5

Adcock & Shipley have recently announced the signing of a licence agreement with Bridgeport Machines Inc. of Bridgeport, Connecticut, U. S. A., whereby they will manufacture the Bridgeport Milling Machine for sale in all parts of the world except the Americas and Japan. The Bridgeport was the orig

Turret Milling Machine and its popularity has grown so much that from a small beginning in 1938 production finally reached the rate of 125 machines *PER WEEK* in 1958.

Over 43,000 Bridgeport Milling Machines are in use and they are an ideal machine for any machine shop.

The basic machine is shown on illustration No. '6', but a full range of attachments are available including shaping and slotting attachment, high speed heads, hydraulic duplicating, equipment for co-ordinate drilling and boring using measuring bars or optical methods.

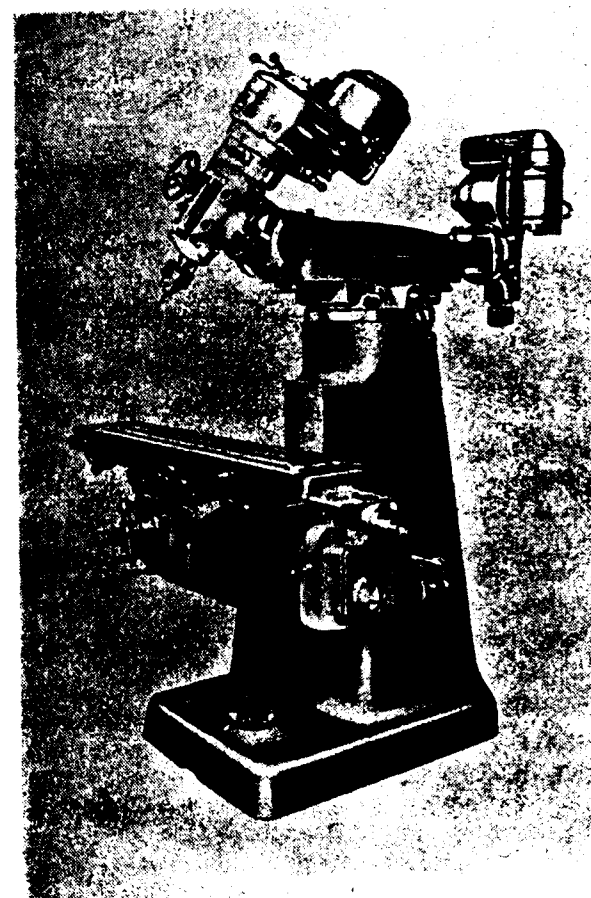


Fig. 6

Adcock & Shipley's Model SV Radial Drilling Machine has been made by them now for many years but has been the subject of continual development. The latest model produces horse powers up to 3 and, as will be seen from illustration No. '7' is equipped with a box table to give maximum rigidity. Although a 36" machine with 1" drilling capacity, it is designed on the lines of a big radial incorporating most of the features desirable on such machines.

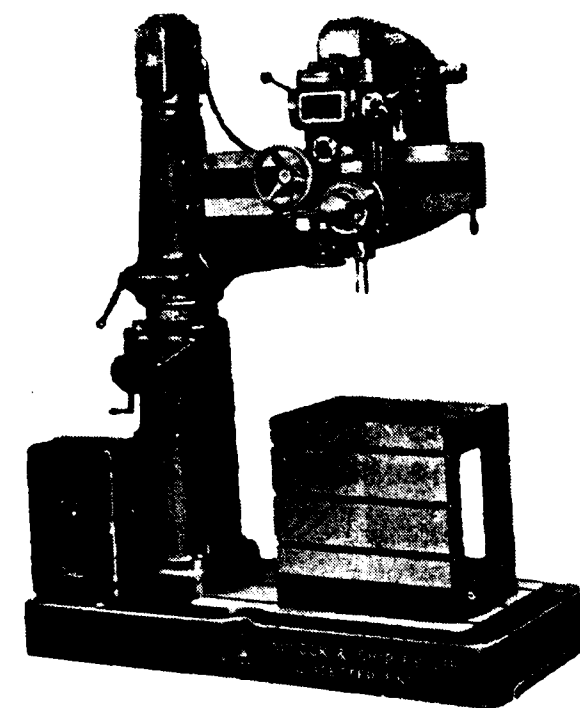


Fig. 7

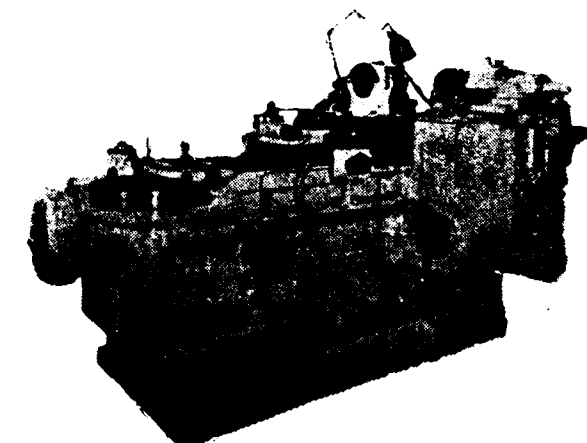


Fig. 8

Adcock & Shipley's range of Special Purpose Machine Tools is well exemplified by the illustration No. '8' of the size 1 Cotter Slot and Keyway Cutting Machine. This machine is intended for cutting parallel or taper cotter slots and keyways in heavy components such as are used in the railway industry. A large size No. 2 machine is also available.

Adcock & Shipley's range of manufacture is completed by a range of glass working machines which they make. These machines are used by well-known optical lens manufacturing companies in all parts of the world.

Production methods and uses of rubber-based adhesives

By H. J. Northeast

Sales Manager, Dunlop Rubber Co., Ltd., Compositions Division.

THE growing importance of adhesives in modern industry can be gauged from the production figures which one authoritative estimate has put at a total of 2,000,000 gallons a year in the U. K. alone. Of this, the lion's share goes to the motor industry which absorbs in the region of 500,000 gallons. A large part of this total figure is represented by natural rubber which, because of its versatility, is used more widely than any other single constituent. It has been estimated that as much as 5% of the total world rubber production is used in adhesives.

Not only the volume, but the range of rubber-based adhesives has been increasing and it is hoped that the following review of their characteristics, manufacture and properties will prove a useful reference guide to manufacturers and others interested in the subject.

PROPERTIES OF ADHESIVES

Flexibility—Compared with other adhesive media such as animal glues and urea and phenolic resins, rubber-based adhesives have this out-standing feature. A film of hardened adhesive tends to distribute stresses from one substrate to the other, but a rubber-based adhesive will absorb some of the shock and also take up stresses occurring due to differing co-efficients of expansion.

Adhesion—Natural rubber has a unique dry tack and will adhere readily to many surfaces; by adding resins this tack can be still further improved and extended. The dry tack has many industrial applications, common examples being the puncture repair solution adhesive and self-sealing envelopes where the flaps are coated with a film of rubber deposited from latex, sticking plaster, adhesive tape, etc

Water resistance—This property needs no explanation; suffice it to say that where water resistance is vital, as in the fabrication of liferafts solution adhesives based on natural rubber are invariably employed.

Versatility—Natural rubber is the most universal adhesive base, being utilized for light assembly work as instanced by the pre-stitch solutions used in leatherwork to the heavy cements used for bonding ceramic tiles to cement rendered surfaces.

There are two methods of utilizing natural rubber in adhesives: in its naturally occurring form as latex, or in the solid form dissolved in organic solvents.

Broadly, latex-based adhesives are utilized where porous surfaces are to be bonded such as textiles and paper. Solution adhesives find their field where more difficult, frequently non-porous surfaces are encountered.

TYPES OF RUBBER ADHESIVES

Rubber solutions—Milled rubber, either pale crepe or smoked sheet, is dissolved in petroleum solvents to give adhesives suitable for light assembly work as in footwear manufacture, rubberized fabrics, and are used for rainwear and bonding nitro-cellulose leathercloth to hardboard in motor trimming. These simple solutions are used on a variety of surfaces and when tested on canvas to canvas, bond strengths of up to approximately 12 lb. per in. width are obtained.

Rubber/resin solutions—The properties of the simple solutions already described can be modified to suit specific requirements. Wood rosin is a common additive which increases the tack but at the same time reduces the cohesive strength. In addition, the ageing characteristics and heat resistance suffer. Hydrogenated rosin and resin esters are superior in this respect but naturally the price of the adhesive is increased. Zinc oxide is frequently incorporated. This confers a very high tack as instanced by surgical dressing tape.

Self-vulcanizing adhesives—Where high bond strengths, good ageing properties and improved resistance to heat are required, self-vulcanizing solution is used. This is usually supplied in two parts,

sulphur in one part and an accelerator in the other. On mixing the two parts stability is sufficient to allow one day's production. On drying, vulcanization begins and complete cure can be effected rapidly by heat or will take place over one to three days depending on ambient temperatures. These products are used mainly in bonding rubber to itself and for foam latex building.

Rubber cements—Natural or reclaimed rubber can be compounded together with tackifying resins and fillers to produce heavy consistency, high strength, gap-filling cements which will bond firmly to metal, wood and concrete.

These can be tailored for heavy duty such as is required for floor laying, bonding ceramic tiles to cement and in the motor industry where one surface to be bonded is frequently metal. The ageing properties and heat resistance of this class of adhesive are good and rugged service conditions can be adequately met.

Latex adhesives—These materials are ideally suited for bonding porous surfaces such as textiles, paper and leather. An additional important use is as an additive to cement screeds, where its presence increases the adhesion of the screed to the substrate.

Latex can be compounded in the same way as solution adhesives, *i. e.* with resin emulsions, to tackify the rubber.

The rubber film deposited from latex is stronger and has better ageing characteristics than solution-deposited films because it has not been subjected to degradation by milling.

When a latex adhesive is applied to a porous surface such as paper, very rapid tack development ensues, due in part to the water wicking into the surface, leaving the rubber particles to coalesce. The wet tack can be increased by additions of casein and water-soluble gums. These tend to reduce the water-resistance of the dried film, however, and where this is not permissible, water dispersions of insoluble resins can be used very satisfactorily.

As with solution adhesives, if the deposited film can be vulcanized, much improved ageing characteristics result. Self-vulcanizing latex adhesives can be supplied, usually in two parts, to fulfil this function, formulated in a similar fashion to the vulcanizing solution adhesive.

One outstanding property of latex adhesives is the property of dry tack bonding. Two coated surfaces, completely dried, will when pressed together form an instant bond. Use is made of this fact to produce self-sealing envelopes and cartons.

PRODUCTION OF SOLUTION ADHESIVES

The first stage in the production of solution adhesives is the milling of the raw rubber. This is a very critical process; the amount of milling controls the viscosity/solids relationship of the final product.

Where insoluble fillers or chemicals are included in the formulation it is usual to incorporate them at the milling stage to ensure uniform dispersion throughout the rubber. A two-roll rubber mill or Banbury-type mill are usual for this process.

Following milling, the stock is frequently steeped in solvent to produce a soft swollen mass. This procedure keeps final mixing time to the minimum.

When this jelly-like stage has been reached the mass is transferred to a mixing hopper. The type used will depend on the final viscosity required. For heavy cements a Z-shaped blade or plain inter-meching blade mixer of the Beken type is used, but for light solutions a simple agitator only is required. Any further ingredients such as filler slurries or resin solutions are added to the steeped rubber in the mixer and finally, solids content and viscosity are adjusted by addition of further solvent. It is highly desirable to have water-jacketed mixers to prevent excessive loss of volatile solvents, which is both wasteful and a danger. Finally, the adhesive is sampled to undergo physical testing to ensure that its performance is up to specification.

LATEX ADHESIVES

In the main these products are of lower viscosity than solution adhesives and are not compounded with heavy fillers. The mixers required, therefore, are of the lighter variety such as simple drum-type stirrers. The complete manufacturing operation can be carried out in one container.

Additions of emulsified resin solution must be carefully controlled; the particle size must not be too coarse.

Solutions of water-solubles such as glues and thickening agents are added to adjust wet tack and

viscosity characteristics respectively. These materials also control the degree of penetration into the substrate. For vulcanizing adhesives the sulphur and accelerator are first ball milled and then added as dispersions.

Further items such as bactericides, antifoamers and wetting agents are used where required, and during the whole process care must be taken to keep the pH at the correct level.

Finally, as with solution adhesives, solids content and viscosity are adjusted and the finished adhesive is subjected to other physical tests as required by the performance specification.

RUBBER ADHESIVE DEVELOPMENT

During the post-war period, the requirements which adhesives have been called upon to meet have become increasingly demanding, particularly with regard to rapid tack development, reduced setting times and increased resistance to heat and ageing. In addition, there has been a wider variety of surfaces to be bonded.

To keep pace with industrial requirements the formulator has been investigating the properties of diverse additives, in particular, surfactants and polymers in order to boost specific features.

There are numerous examples to illustrate the results of this work :

Ceramic tile adhesives based on rubber are relatively new but already have become accepted as the cleanest and quickest method of securing tiles to a variety of surfaces. Here the problem was to provide an immediate bond which would be sufficient to prevent slip on a vertical surface.

Transparent self-adhesive tapes have come into common use and they owe this popularity to the adhesives chemist who provided the correct rubber resin compound to "stick to anything."

Heated sub-floors have presented a problem, but a flooring adhesive with good ageing properties at continual elevated temperatures has been produced and provides permanent bonds. In the same vein, the motor manufacturers' requirements have been raised. The export market demands that cars should withstand both arctic and tropical conditions. This is an outstanding example of rubber adequately fulfilling a function where flexibility is a prime requisite.

Conductive rubber adhesives have been called upon for many applications. An important example is for bonding flooring in operating theatres, where a build-up of static electricity could be fatal.

Latex adhesives have also been developed to keep pace with the increasing tempo of industry. In the paper and board conversion industry the development of self-erecting cartons, the flaps of which are pre-coated with latex, has cut transportation costs, the cartons being despatched flat and erected by the users merely by light finger pressure. Self-seal envelopes utilize this dry tack property in the same way.

The speed of conventional carton-making machinery has steadily increased and quick-sealing latex adhesives have still kept abreast, giving instant bonds between highly finished kraft board surfaces.

In textile bonding, latex has provided the answer for yarn splicing, where the bond is under tension fractions of a second after being made. Tufted carpets rely on latex for complete anchorage of the pile to the hessian backing. A still later similar requirement is involved in the manufacture of pile fabrics utilizing synthetic fibres; here again vulcanizing latex provides excellent adhesion between the fibres and backing cloth.

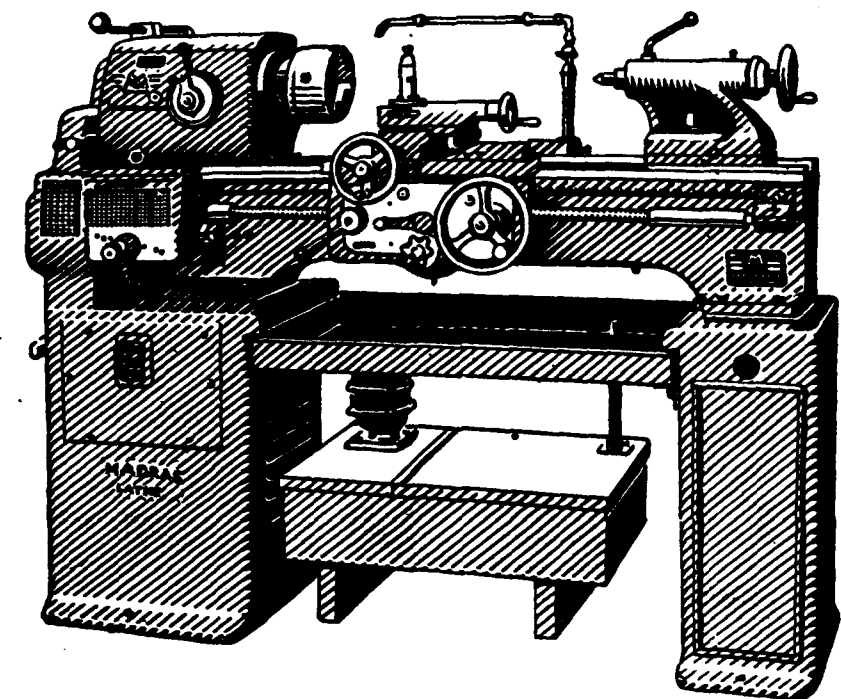
Not only are natural rubber adhesives continuing to prove their worth in the well-accepted fields, but are coping adequately with many of the latest requirements thrust upon them by new industrial developments.

The tremendous impetus gained by "Do It Yourself" in recent years has been helped considerably by adhesives in general, but particularly by rubber-based types, from carpet-seaming latex to tiling mastics. There is ample scope for the do-it-yourself enthusiast using rubber adhesive. Particularly in applique work and in the small jobs about the house where a touch of adhesive will save the use of a needle, such as putting braid on chairs or lampshades, or even patching a pair of jeans. Farmers have been quick to appreciate the practical uses of rubber adhesive for patching sacks, repairing tarpaulin, and even labelling cattle for auction. A tube of adhesive is invaluable in a motorist's repair kits although the oldest, perhaps still the best known, do-it-yourself use for adhesives is the rubber solution in every cyclist's puncture repair outfit.

—' RUBBER DEVELOPMENTS'



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The Modern Rail Track Diagram Switchboard

THE rapid expansion of an intricate network of railway lines has made the development of more efficient control methods necessary for the speedy, safe and dependable operation of trains. The conventional mechanical and powered locking frames are being replaced by modern relay locking equipment to comply with latest requirements.

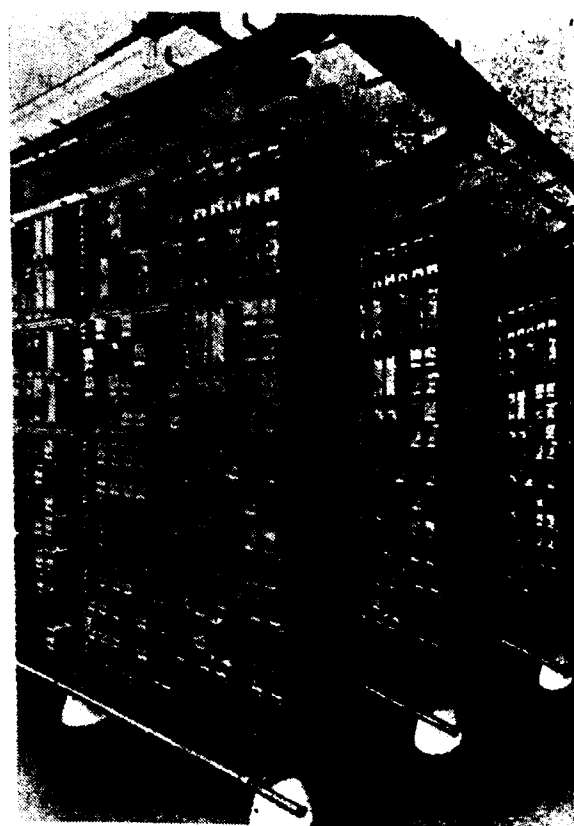
The centralized rail track diagram switchboard incorporates a system of relays which have converted all mechanical contacts and operations into electric processes. A replica of an entire section of the railway network with all its signals and switches is shown on a diagram, and below this a set of knobs and levers governs the entire system. Appropriate relays thus set each rail switch and signal providing for quick automatic and dependable route-setting. This makes it possible to handle more traffic at greater speed and with full protection against conflicting train movement.

Modern track diagram switchboards must be adapted to such requirements as:

- (1) Specific traffic and signal regulations prevailing in the country where they are to be installed;
- (2) That signal relays comply with safety and operational requirements;
- (3) Fast assembly and simple method of changing;
- (4) Components subject to great wear should be provided with plug-socket connection (or similar method) for fast exchanging;
- (5) Simple and clear construction and low space requirement;
- (6) Standardized unit construction to raise efficiency.

In the German Democratic Republic Rail Track Diagram Switchboards have been built by VEB Werk für Signal- und Sicherungstechnik Berlin since 1948. Their new development introduced in 1957 complies with the most up-to-date standards.

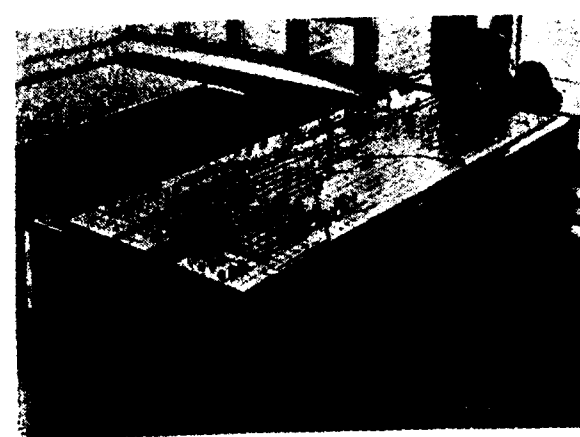
The newly developed signal relays are produced as small relay with 9 contacts, as normal relay with 21



Relay Stand.

contacts, as switching relay with 20 contacts and as a relay with 18 contacts. These relays are united in groups according to the circuit. The relays in the groups are all of the plug-in type, while a special arrangement prevents errors. The groups incorporate all components as resistances, condensers, pilot lamps and soldering terminal distributors for switching from one group to another. The groups are designed according to their purpose of application as track group, switch group, signal group, clearing group, command group, etc. The groups are produced as fully circuited component units.

Four relay groups can be built in any sequence according to the project in a rack. Two, four or six racks can in turn be assembled in a rack frame. All relay groups are interchangeable. For this purpose only four screws have to be loosened and the connections detached.



Centralized Rail Track Diagram Switchboard.

The rack frame supports, the cable shelf for laying the indoor cables as well as the illumination and power supply lines. This ensures speedy assembly and simple changing of the equipment.

The track diagram is composed of 40 mm. square diagram elements. The surface consists of interchangeable crystal-clear Polystyrene caps. The required symbols are printed in a special ink according to the silk screen printing process. The colour is mild blue-green and fully anti-reflex. Glass rods and prisms give a flood-light effect, brightly illuminating the symbols.

The track diagram gives the operator exact visual knowledge of the location of trains and of the position of switches and signals. By pulling the start and end keys of a track a line is cleared. This operation automatically adjusts switches in the correct position, checks the track, and sets the signals after all safety conditions have been fulfilled. Normally the line is cleared automatically by the train itself as it passes various contacts provided for this purpose. Relays undertake the necessary clearing operations.

Polythene insulated and PVC sheathed cables for Electrical Power

In the series of Indian Standards for Insulated Wires and Cables, the Indian Standards Institution has just issued on general circulation one more draft Indian Standard Specification for Polythene Insulated and PVC Sheathed Cables for Electrical Power and Lighting for Working Voltages upto and including 250 Volts to Earth [Doc: ETDC 2 (24)]. This draft covers the requirements of both cables as well as

In cases of emergency and disruptions, special keys which can be sealed or fitted with a numbering device, can interrupt the automatic clearing operation. Resetting can also be manually undertaken.

A 60-volt buffer battery provides the power for the relays of the rail track diagram switchboard.

Power supply is fully automatic and in a failure of the mains, power is provided by an emergency petrol or diesel power pack which can supply all units of the track, including the switch gearing. A high-speed transformer bridges the 15 seconds elapsing between mains failure and full operation of the power pack. This transformer is powered by a buffer battery requiring only 1.5 to 2 seconds for starting. Switch-over from mains to emergency power supply is therefore hardly noticeable.

The power pack is automatically stopped by a five-minute retarding relay excited by the mains. The relay throttles the fuel supply and the entire equipment is switched back to mains operation. A retarding period of five minutes was selected to prevent repeated switch-ons and switch-offs of the set.

With electrified lines battery operation and mains switching equipment is usually not used as the line, and locking installation is operated from the same power mains. For industrial and mine railways, for instance, direct current is generated by a selenium rectifier of corresponding amperage while the power for the rail switches and the remaining alternating power requirements is met by the existing three-phase mains.

The Rail Track Diagram Switchboard of VEB Werk für Signal- und Sicherungstechnik can be adapted in all its components to the requirements existing in the country where it is to be installed. The equipment has proved its worth through its efficient and dependable service.

flexible cords.

Polythene, by virtue of its better electrical insulating properties than PVC, is being increasingly used as an insulating material. In the case of cables, however, owing to the lower mechanical strength of polythene, the cables insulated with it require a sheathing of PVC.

Developments in high-speed blanking-press building

THE aim in press development is to produce presses of increased rigidity and accuracy allowing to blank components of great quality and precision.

Among the most important facts which are the cause of this evolution, two must be pointed out: the apparition of the tungstene carbide tools for more and more complicated precision blanks, the growing production figures in the press shops. Those two facts are interdependent as the mass production requires tungstene carbide tools for economy reasons.

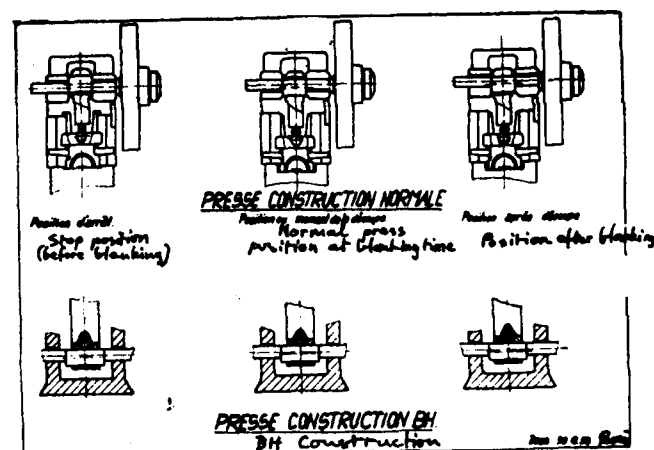
However the tungstene carbide tool has one disadvantage: it does not support easily a penetration of the punch into the die without damage, even if the penetration is absolutely perpendicular. The Swiss press manufacturers, Messrs. ESSA of Brugg/Bienne, were among the first to have to deal with these factors, for the watchmakers were requiring presses with an increased rigidity and, if possible, the suppression of the clearances causing the penetration of the punch, their tungstene carbide tools being very delicate and small. Besides, tool wear is not only caused by the blanking operation itself, but for a great part by the punch into die penetration. Thus a way was to be found to suppress the backlashes in the clearances, which are one of the main cause of this penetration.

The use of springs to hold the moving parts is one of the solutions to try to avoid backlashes, but it is only a palliatif. If the plays of the main shaft in its bearings can be eliminated with efficacy by using counterbearings and springs, this cannot be the case with the plays in the connecting rod, the pittmann (ball head) and the tool clamping. In those parts, backlashes can be eliminated only partially, for springs are not capable of absorbing the reaction caused by the blanking operation. Springs will never be able to prevent completely the punch from diving into the die, unless they are calculated to be as strong as the working reaction, the latter being equal to the pressure necessitated for blanking. The solution of putting all the driving members in the bottom of the machine (4 tie-rod design) allows to increase the speed, but certainly does not allow to avoid backlashes. Their suppression necessitates notwithstanding the use of springs

and supplementary bearings or bridges, so that we have again the same problem as before.

Only a quite new construction principle could allow to suppress backlashes and to increase at the same time the rigidity, the precision and the speed of the press. The ESSA engineers found out that the use of the gravity law was the best way to suppress all the backlashes which are so harmful for the tools.

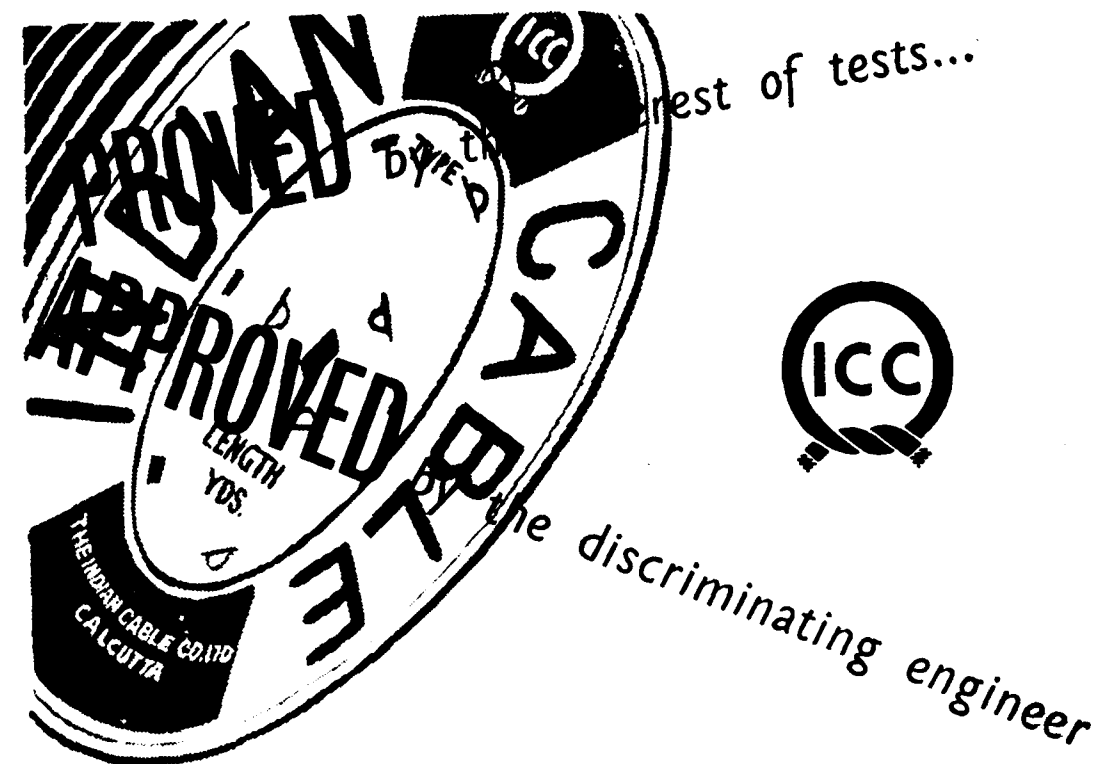
On this idea they build the first presses, the ram of which was working *upward* and no more downward. All the moving parts of the presses of this model called BH are located in the lower portion of the machine. The ram working upwards, the shaft, ram, connecting rod, etc., rest in their working position in their bearings before, during and after the blanking operation. In this way, the rebounding of the moving parts (cause of the backlashes) from their rest position to their working position and back to their



Sketch 1. BH Principle

rest position is avoided (sketch). As shown on the above sketch, the use of the BH principle suppress the backlashes in a completely natural way, without any help of springs or supplementary bridges.

Moreover, this principle has many other advantages. It allows the manufacturing of a 2 or 4 column frame of grey cast iron, which is more rigid than steel, and as much better guiding of the ram. Only a two or 4 column frame can ensure a perpendicular diving of the punch. This last point is most important while



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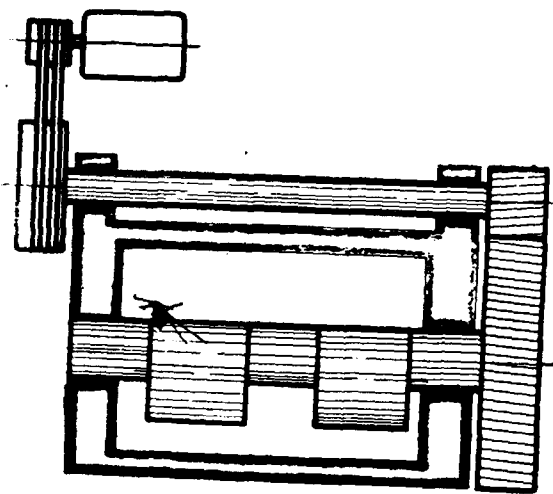
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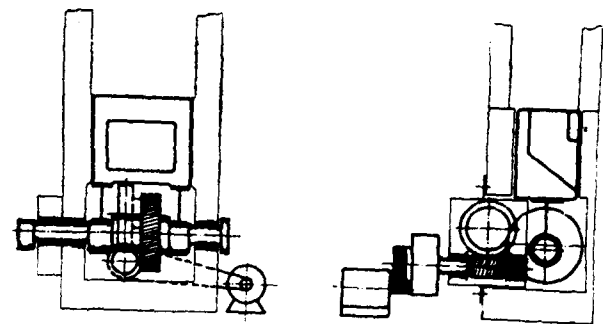
using tungstene carbide follow-on-tools for blanking of very thin sheet, where it is almost impossible to avoid the penetration of the punch into the die, especially as pressures are never centered in this kind of tools. The movable parts and the motor being now in the low portion of the machine, the upper part is freed from vibrations. The low center of gravity allows a considerable increase in speed, permitting speed of 700 r. p. m. for a 6 ton, 500 r. p. m. for a 15 ton and 150 r. p. m. for a 180 ton press. However this is only a consequence of this new construction principle, the essential advantage lying in the suppression of all vertical backlashes and the reduction of the tool costs in connection therewith. The life of standard tools was increased up to four times, even with an increased blanking speed.

In order to obtain a ram drive as direct and as accurate as possible, a new transmission of the power from fly-wheel to eccentershaf was developed for the automatic presses Type BHA 120 and 180 tons.

The customary gear and pinion arrangement was abandoned and replaced by a worm gear drive. The



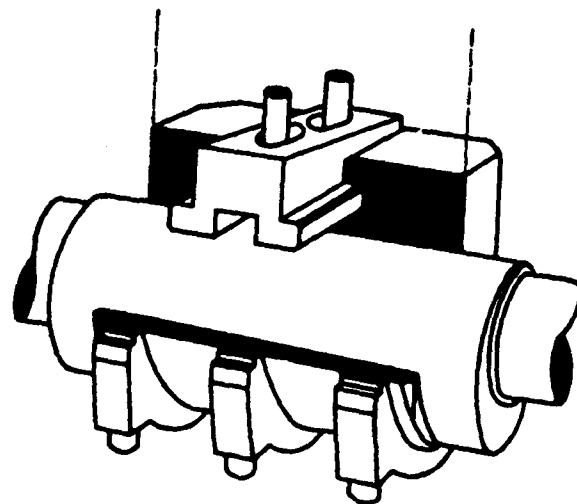
Sketch 2. Old drive



Sketch 2. BHA drive

big difference between the new ESSA driving and the old one is shown by sketch 2.

The shaft located longitudinally and parallel to the strip, the gear wheel driven by the worm gear, the reduction box (see sketch 5, No. 3) and the 2 eccentrics are building a rigid unit, practically insensible to torsion. The connecting rods are of new design too.



Sketch 3. Connecting rod

This design gives an increased contact area between ram and connecting rod, much greater than the one a ball head could give. Moreover, the horizontal bearings give a very accurate control of the ram motion. Owing to the use of these two horizontal bearings and the excellent guiding of the ram on its four faces, any tilting which may be caused by offcentre pressure when using follow-on-tools, is avoided. As the BHA presses are constructed for automatic production, they are equipped with 2 automatic roll-feeds which allow to work either with strips or coil material.

A further step has been done to ensure security of production and avoid any downtime in automatic production. As a matter of fact, the press is equipped with three most useful devices: a scrap shear, a strip end shear, and a strip stopping device.

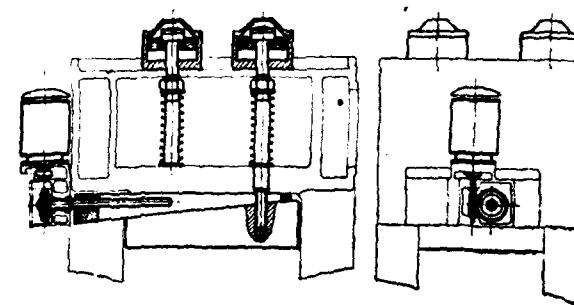
The Scrap shear driven by the main shaft cuts in small pieces the blanked strips, allowing an easy storage of the scraps. The strip stopping device and the strip end shear are the "life guards" of the tool. It is well-known that a half-cut occurring in a blanking tool causes a harmful unbalance. This latter is detrimental to a good function and to the life of the tool, when not resulting in the breakage of the

punches. It goes without saying that the half-cuts might occur only at the beginning and at the end of the strip. It is almost impossible to obtain strips which length is in perfect relation with the pitch required by the tool, especially as the feed length always varies from a serial to another, the size of the blanks being quite different. The purpose of the strip stopping device and of the strip end shear is to give automatically to the strip the necessary length to ensure a serial of complete blanks.

The strip stopping device consists of a lever against which the strip comes when the operator inserts it into the feed apparatus. This stop, actuated electro-magnetically, is synchronised with the upward and downward movements of the upper roller of the feed apparatus. The motion of a handlever let the upper roll fall and remove the stop. In this way, no error can be made at the beginning of the strip, the stop being set to the pitch beforehand.

The strip end cuts at the end of the strip the overlength which could have given only a half-cut. This shear is operated electro-magnetically by a feeler set at a multiple of the pitch.

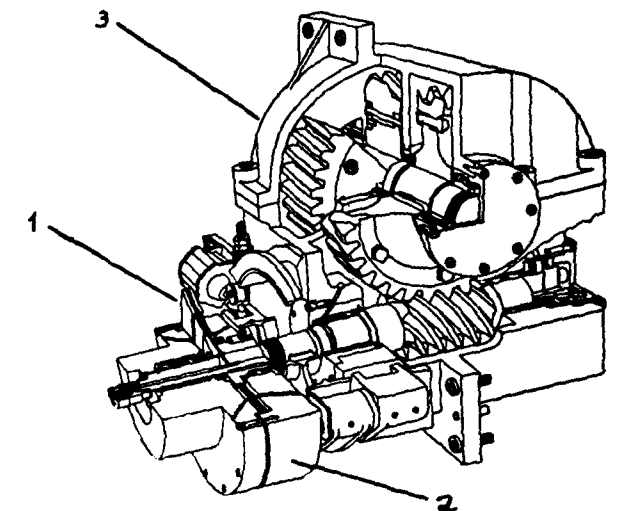
On the BHA presses the depth adjustment is effected very easily by means of an electric motor. Placed in the head of the machine, it enables the operator to adjust the height without losing sight of the tool (see sketch 4).



Sketch 4. Depth adjustment

Another very interesting feature of the BHA presses is their electro-pneumatically driven friction clutch. By choosing a high rotation speed for the flywheel, it was possible to reduce the volume of that cumbersome aggregate. In order to keep the smallest possible

size of the unit flywheel/clutch, the engineers of ESSA designed a completely new construction, placing the clutch *inside* of the flywheel (2). Two clutch plates (1) being moved by compressed air are the soul of this new high-powered and small-sized clutch without any axial effects. (see sketch 5)



Sketch 5. Clutch and reduction box

The two plates fitted with clutch lining are pressed onto the free rotating flywheel and transmit the kinetic energy of the flywheel to the machine. Contrarily to certain affirmations that electro-pneumatically operated clutches are slow, the ESSA clutch, without axial displacement of any sorts, is instantaneous and faster than any other one. A powerful jaw-brake is synchronised with the clutch and gives an instantly and reliable stop of the press. The quick clutch reaction allows the use of safety devices for the tools, for inst. for feed checking, even if the press is running at high-speed. This clutch can evidently be engaged and disengaged in any position of the ram and can be driven by micro-switches of photo-electric cells.

It goes without saying that a great importance has been devoted to the safety. The guards do not allow to penetrate in the working area as long as the press is running. As soon as the guards are raised, the clutch is disengaged and the press stopped. It is impossible to put it into motion as long as the guards are opened. Moreover any interruption in electric current or air pressure causes the immediate disengagement of the clutch and an instantaneous stop of the press.

Out of the Steam Age

The modernisation of Britain's railways, with steel playing an integral part, is to be speeded up. Here J. H. Davies examines the scope of the original plans on which this vital project is based

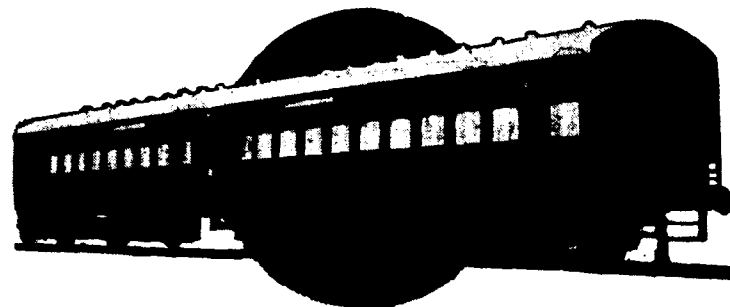
ON branch railway lines throughout Britain, green painted two-coach trains have been making their appearance: and, literally heralding their arrival by the now familiar two-tone horns, diesels have come to stay. Railway lines, which up to a short time ago faced closure due to lack of passengers, have been able to attract double or even treble the amount of traffic carried—thanks entirely to the advent of this new form of transport.

Why are these new trains appearing, and what else can the traveller expect to see on Britain's railways of the future? To find the answers we must consult 'The Plan' (officially titled *Modernisation and Re-equipment of British Railways*). This report, published

by the British Transport Commission in 1955, outlined one of the most ambitious projects ever to be considered by any railway system in the world. The amount of money involved was then estimated at £1,200 million, to be spent over a period of fifteen years. Under the 1955-56 plan improvements to be made in every sphere of the railways embrace passenger amenities in stations and in trains; newer and better equipped marshalling yards to speed freight traffic; replacement of steam locomotives by diesel and electric locomotives; track improvements to allow higher speeds; ever safer forms of signalling to take the place of existing systems.

Altogether, 2,500 main line and 1,200 shunting and

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trip diesel locomotives are to be built either by private manufacturers or in British Railways locomotive works. A total of 4,600 diesel multiple-unit trains will be in service at the end of the fifteen-year period. Electrification will play an important part in the plan and will involve the provision of 1,100 electric locomotives together with multiple-unit trains. Initially, the emphasis will be on the introduction of diesel motive power. This is due to the fact that diesel locomotives are independent of any fixed installations and can be introduced as and when they are built, without having to wait for the erection of overhead lines and substations. It is the ultimate intention to electrify a high proportion of the main lines to the north over which traffic density is greatest; until that day, diesel locomotives with their high availability will bear the brunt of the load.

Nearly four years have elapsed since the announcement of modernisation, and nearly three since the first orders for diesel locomotives were placed, and much has happened in that time. The first main line diesel locomotive to be completed under the plan—a 1,000 horse-power unit destined primarily for freight duties—was handed over in June, 1957. The first unit designed for passenger train haulage was put into service a few months later. Up to September, 1958, 75 main line diesel locomotives had been put into service together with 2,115 diesel multiple trains. These figures are being added to at an ever increasing rate. It is anticipated that within the next three years, 400 main line locomotives will be in service on the Eastern Region alone.

The diesel locomotive is of course much more expensive to build than its steam counterpart, and a great many people have doubted the wisdom of abandoning steam traction. However, it should be pointed out that approximate relative thermal efficiencies at the wheel are 25 per cent as opposed to 6 per cent. (The term thermal efficiency is used to denote the useful work obtained from the fuel consumed.) In addition, the diesel locomotive has a much higher availability than steam, the terminal turn-round and servicing time being cut to a minimum.

Recently, the Transport Commission, announcing an order for twenty-two 3,300 horsepower Deltic locomotives, stated that their introduction would displace 55 steam locomotives on Anglo-Scottish passenger trains. There is a Deltic locomotive in service with British Railways operating on the London Midland Region between London—Liverpool and London—Crewe, although it still remains the property

of its makers, The English Electric Company. It is the most powerful single-unit diesel locomotive in the world. Running at the rate of 4,000 miles a week, in service for 17 hours out of the 24, six days a week—something no steam locomotive could do—this unit has won admiration from the thousands of passengers who have travelled behind it.

As mentioned previously, it is not possible to introduce electric traction as quickly as its diesel counterpart. A tremendous amount of work has to be done in the planning stage, to ensure that fixed structures such as bridges and tunnels provide sufficient clearance for the overhead conductors. British Railways have, in common with the French National Railways, adopted the 25,000 volt 50 cycle single-phase alternating current system as the standard for all new electrifications. Where it is impracticable to lower the track or remove the overhead obstruction, it is proposed to have sections of overhead line which will feed in the required power at a reduced voltage. This will mean that the distance between roofs of tunnels and the overhead line can be smaller, as the insulation required for the lower voltage is less.

Work is now proceeding rapidly on the Manchester-Wilmslow and Colchester-Clacton lines of the London Midland and Eastern Regions respectively. Special work trains are being used, one to bore holes and pour concrete for the overhead line carrying structure, the other for the erection of the overhead line itself. The former train can erect up to five single track-miles of posts in a working day. Initially, these sections of line, soon to be commissioned, will be used as test areas for the 100 electric locomotives and 300 multiple-unit trains now on order. The first main line to be electrified will be that between Manchester and Crewe. This will be followed by the Enfield-Chingford line of the Eastern Region. Eventually (the target date is currently set as 1967), the main line between London (Euston) to Manchester and Liverpool will be electrified. The rate of electrification builds up to a peak in 1962, when it will be necessary to commission electrified single track at the rate of 1,000 single track-miles a year and to place in service at least 200 electric locomotives and 900 electric multiple-unit train coaches a year.

Apart from the replacement of steam motive power, both new passenger and freight rolling stock is to be introduced. Great emphasis is being given to the replacement of older, wooden-bodied, unbraked freight and mineral wagons by larger steel-bodied wagons, all of which will be fitted with vacuum brakes.

The new wagons will have capacities of 16 and 24 tons: this, coupled with the fitting of brakes, will enable heavier freight trains to be hauled at speed up to 60 mph, thus increasing line capacity considerably. Mechanised handling plants are being installed at suitable terminals to reduce loading and unloading times in order to get greater revenue-earning service from vehicles.

New general merchandise wagons are also to be built to cater for mixed loads and the use of pallets will speed the terminal time occupied. Various forms of containers are being developed to cater for bulk shipment of such materials as cement. Freight reception depots are also being modernised, conveyor belts being used in ever increasing quantity, particularly where transfer to British Railways road delivery vehicles is involved.

New types of passenger coaching stock are being evolved, both by British Railways and private manufacturers. Several prototypes have been in service for some months and embody various features hitherto untried in Britain. Aircraft-type seating,

double glazed windows and modern interior decor have been incorporated and the result of their impression on the travelling public will no doubt be taken into account when new orders for passenger vehicles are placed. It has been stated that 31,000 of these all-steel coaches will be brought into commission over a period.

The passenger safety record in Great Britain is one of the best in the world, and British Railways are paying particular attention to bettering it. Automatic train control, a form of which has been in successful operation on the former Great Western Railway for many years, is being applied to more of our main lines as time goes by. One type of automatic train control is at present in use on nearly 1,500 route miles of British Railways although a new system has been developed and is to be installed on five of the main routes out of London. An initial order for 2,000 sets of equipment has been placed.

'Modernisation in progress' read the signs in stations and on linesides all over the country. They are evidence that at last Britain's railways are moving rapidly out of the steam age.—(INGOT)

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Squiggles and Wiggles for Testing Locomotives

By An Engineering Correspondent

LOCATED just outside of this bustling industrial center is a railroad that would give even the most seasoned locomotive engineer nightmares.

It's the 4.5 mile long test track of General Electric (U. S. A.) Locomotive & Car Equipment Department. Complete with oddly convoluted rails and a maze of multi-gauge trackage, it is possibly the world's most unique railroad.

General Electric uses the track to test riding qualities and engineering refinements of the electric and diesel-electric locomotives it builds for railroads all over the world.

Recently, when G-E was testing an experimental truck design for its new 700 horsepower, universal-type diesel-electric on the track, Globe Press Service reporter was privileged to ride in the cab of the test locomotive as it rocketed down the track at speeds close to sixty miles an hour. Crammed into the small cab with the reporter were four design engineers, all heatedly discussing the riding characteristics of the new running gear, the locomotive operator—test pilot—and a trainman.

An exciting ride? You bet! I'd ridden trains going considerably faster than 60 miles an hour in the past, but there's a lot of difference between riding in a comfortable coach seat on a ten-car express train and bouncing along in a locomotive cab with no cars hitched on behind at all.

"A string of cars would hold her down," an engineer explained. The 50-ton locomotive in which we were roaring down the track needed some holding down, I informed him, as we bounced around the crowded cab like dice in a dice cup at Monte Carlo.

Sometimes, engineers study the lateral and vertical motion of experimental running gear by attaching movie cameras to the frame of the locomotive. The cameras record the amount and direction of sway and bounce. Studies such as these are often made on a

section of the test track where the rails wiggle back and forth a few inches from a true straight line. On another section, the rails squiggle up and down. On still another, the tracks shake back and forth in a lazy "S". Experimental apparatus has got to weather all of these tests before it is approved for manufacture and sale.

Sometimes recording instruments are placed along the track. On some occasions, the locomotives are rigged with instruments to measure everything from lateral sway to current consumption.

The multi-gauge sections aren't there to confuse the locomotive engineers. Since G-E builds locomotives for railroads all over the world, it has to have track of suitable gauge to test them. Parallel rails are laid to six different track gauges (36, 39-3/4, 42, 56-1/2, 63 and 66-inch) for the first mile and a half of the test track. There's even a multi-gauge switch.

It was over this test track that G-E first tested the experimental designs for its now famous line of universal-type diesel-electric locomotives back in 1955. Not content with having exhaustively road tested the original design, G-E still subjects each new model it builds to a trial run as a quality control check.

As a matter of fact, the basic designs of the very first diesel-electric locomotives built for regular railroad service were tested over the G-E track back in 1924.

One of the most unusual tests ever conducted on the track was done in 1924 when G-E staged a gargantuan "tug-of-war" between a steam locomotive, borrowed from the New York Central Railroad, and a electric locomotive built for the Maxicano Railway for use on a rugged stretch of the main line between Vera Cruz and Mexico City—called the Maltrata incline—where grades up to four per cent are common. The point of the tug-of-war was, of course, to test the electric's regenerative braking system.

This type of brake, similar to the "dynamic braking" used in today's diesel-electric locomotive,

works by electrically reversing the locomotive's motors. The net result is a little like holding a car going downhill in low gear by the compression of the motor, only the locomotive actually pumps power back into the line.

In the test, the two locomotives were coupled and the steamer towed the electric down the track. At the start, the controller of the electric was off and the steamer pulled it easily enough. But as the electric's regenerative braking was gradually cut in the steamer labored harder and harder. By working his controls, the engineer on the electric finally brought the steamer to a dead stop. No matter how hard it puffed it could no longer pull the electric even an inch. Then, as the electric's throttle was opened wider, the struggling steamer was pulled backward down the track.

In another early test, G-E engineers proved to skeptics that it was practical to run electric locomotives with high-voltage direct-current. Opponents of d-c operation, which is widely used today on electrified railroads all over the world, argued that sufficient direct-current to power a heavy train at high speed would burn out the "collecting shoes" or contacts used to pick up power from the overhead wires. G-E successfully ran a series of tests using 3000 volts direct-current, supplied from wires strung over the test track, proved its point and established an important precedent in railroad engineering.

In the early 1930's a long series of tests was run on various designs of 11,000-volt a-c locomotives for the Pennsylvania Railroad. These culminated in the tests of the first of this Railroad's famous GG-1 high-speed electrics, and included measurements of the forces on the rails by means of the "otheograph"—a section of track specially designed to record wheel loads as the locomotive hurtled over it at

speeds up to 100 miles an hour. Evidence of their success is found in the fact that after 25 years, No. 4800, the first GG-1 locomotive—is still in active mainline service.

In still another test, General Electric engineers "high-balled" an electric locomotive built for the Paris-Orleans Railway in France over the test track at a speed of 105 miles an hour. And that was in 1923.

Currently under test on the track are huge 8500 horsepower, gas-turbine electric locomotives built by G-E for a Western U. S. railroad. These locomotives are the most powerful internally powered units in the world. Each one weighs 420 tons and is capable of pulling a train more than a mile long at speeds in excess of 60 miles an hour on a flat stretch.

First used by G-E in 1915, the test track was originally intended for running-in locomotives equipped with the friction type journal bearings that were standard equipment in those days. Locomotives were run for up to 100 miles on the track before shipment to customers. The idea was to run in the bearings and correct any troubles before shipment. With today's roller bearings this is no longer necessary.

Oddly enough, the G-E test track is operated not by General Electric but by a regular short line railroad, the East Erie Commercial Railroad—fondly referred to by G-E personnel as the East Erie Comical. The test track is approximately one third of the East Erie's 14-mile right of way which runs right through the G-E Erie plant. Consequently, on almost any day of the week, standard U. S. style freight cars can be seen on its tracks along with locomotives built for far-away lands, such as India, Turkey, Argentina, South Africa or Brazil.

General Plan for Metric Screw Threads with ISO Profile

The Indian Standards Institution has issued a general plan for Metric Screw Threads with ISO Profile (IS : 1330-1958) which deals with the general plan for metric screw threads with ISO profile, for the diameter range 0.25 to 300 mm.

This is one of a number of Indian Standards, being prepared by ISI, consequential to the decision of the Government of India to introduce a uniform system of weights and measures in the country, based on the metric system. This standard is a general plan, intended to provide a series of diameter and pitch

combinations from which selections can be made for various applications. It is based on a draft general plan for screw threads, with triangular profile, for the diameter range 0.25 to 300 mm, prepared by the International Organization for Standardization (ISO).

On the basis of the draft ISO recommendation No. 84, for Screw Threads, ISI had already published below 6 mm (IS : 886-1957). It has now been decided to withdraw that standard and to issue another standard, covering the range 0.25 to 39 mm, and based on the corresponding ISO work.

Air conditioning, Refrigeration making gains in South East Asia

Air conditioning and refrigeration are on the upswing in South East Asia, according to Morton R. Berger, resident sales engineer for Worthington Corporation in the South East Asian countries.

Berger, interviewed at Worthington's headquarters during a business trip to the U. S., said, however, that the real future of air conditioning and refrigeration in Asia is contingent on availability of foreign exchange. Current dollar shortages have forced some governments to put restrictive import duties on refrigeration and air conditioning equipment or to block their import altogether, he said.

Any easing of the foreign exchange situation will immediately be reflected in an upturn in sales, Berger feels. His confidence is based on the almost unlimited market potential for air conditioning and refrigeration equipment throughout the area.

For instance, the Worthington engineer noted that according to official policy every government building in India is eventually to be air conditioned. While lack of exchange presently makes it impossible to install equipment in many of the buildings currently under construction, practically all are designed with air conditioning in mind.

In Pakistan, Berger said that there is a pressing need for refrigeration equipment to be used in cold storage facilities for food. He noted that Pakistan's Sind Valley is capable of producing almost enough food for the entire country but because there are no cold storage facilities, most of the fruits and vegetables grown in this rich area do not reach the markets of many cities.

In spite of these exchange shortages, a considerable amount of air conditioning and refrigeration has been installed in Pakistan and India. The largest percentage of these installations have been in industrial plants.

For example, 6500 horsepower of Worthington

equipment is installed in the Sindri Fertilisers & Chemicals Ltd. ammonium sulphate fertilizer plant in Sindri. Installed by the Chemical Construction Co. and serviced by Blue Star Engineering Co. (Bombay) Pvt., Ltd., the refrigeration system is the largest in India and one of the biggest in the world. The same firm has also installed process air conditioning equipment in several other factories, including a large penicillin plant.

In Pakistan, the Worthington distributor, Jaleel Bros., Karachi, recently installed 400 tons of Worthington equipment in the country's largest drug manufacturing facility—also a penicillin plant.

Berger said the fact that industrial applications get priority when dollars are available is indicative of the understandable desire of the people and governments of Asian countries to take care of first things first. "Comfort air conditioning," he said, "will have to come later in most of these countries except when it is vital to productivity in offices and factories."

Burma, said Berger, is in the same boat as India and Pakistan. Without dollars, this country is right now not considered much of a sales prospect.

Thailand, however, is a different matter. There are no dollar problems, the climate is right and there are no import restrictions. The thing that's holding the market there back at the present time is the lack of electric power. However, by 1961 a number of power projects will be completed and the market for air conditioning and refrigeration should expand rapidly.

The market possibilities in both Borneo and Malaya are tied to the future of these countries' exports. In Malaya, tin is the principal export and although it has taken a drubbing in the international market recently, the future looks better. Oil and lumber wealth in Borneo make it a strong possibility for future sales of comfort air conditioning equipment, Berger concluded.

INTRODUCTION OF A NEW QUICK FLUID HOSE COUPLING

Alfred Bullows & Sons Ltd., Long Street, Walsall, announce the introduction of a new quick release fluid hose coupling, which is manufactured under licence from the Binks Manufacturing Company of America.

This new Bullows coupling is compact, hard-wearing and its push-and-turn operation is simple, quick and foolproof. It is already being used extensively in the Motor Industry where its introduction has solved a major production problem caused by the enormous increase in the range of colours used today. It is true to say that this new Bullows quick-release fluid hose coupling is playing a vital part on the production line where a wide range of colours is in use and where rapid colour changes are necessary.

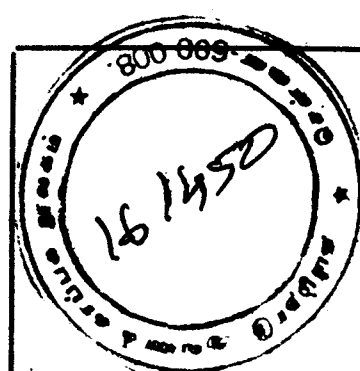
The principal advantages offered by the quick release fluid coupling are, firstly, that it enables the operator

to make a rapid change of colours and secondly, the gun can be disconnected for cleaning purposes without the necessity of 'blowing back' or cleaning out fluid lines.

The coupling consists of two sections, these being the body assembly, which is attached to the fluid hose, and the stem assembly which is connected to the fluid connection of the spray gun.

The basic unit comprises an E62 Body Assembly, with an E60 3/4" B. S. P. T. Stem Assembly. An alternative stem assembly, the E60/10 1/2" B. S. P. I., is available if required. With the complete coupling, Bullows also supply a fluid hose connector.

The complete coupling costs £1/8/0 plus 20% and delivery is ex stock.



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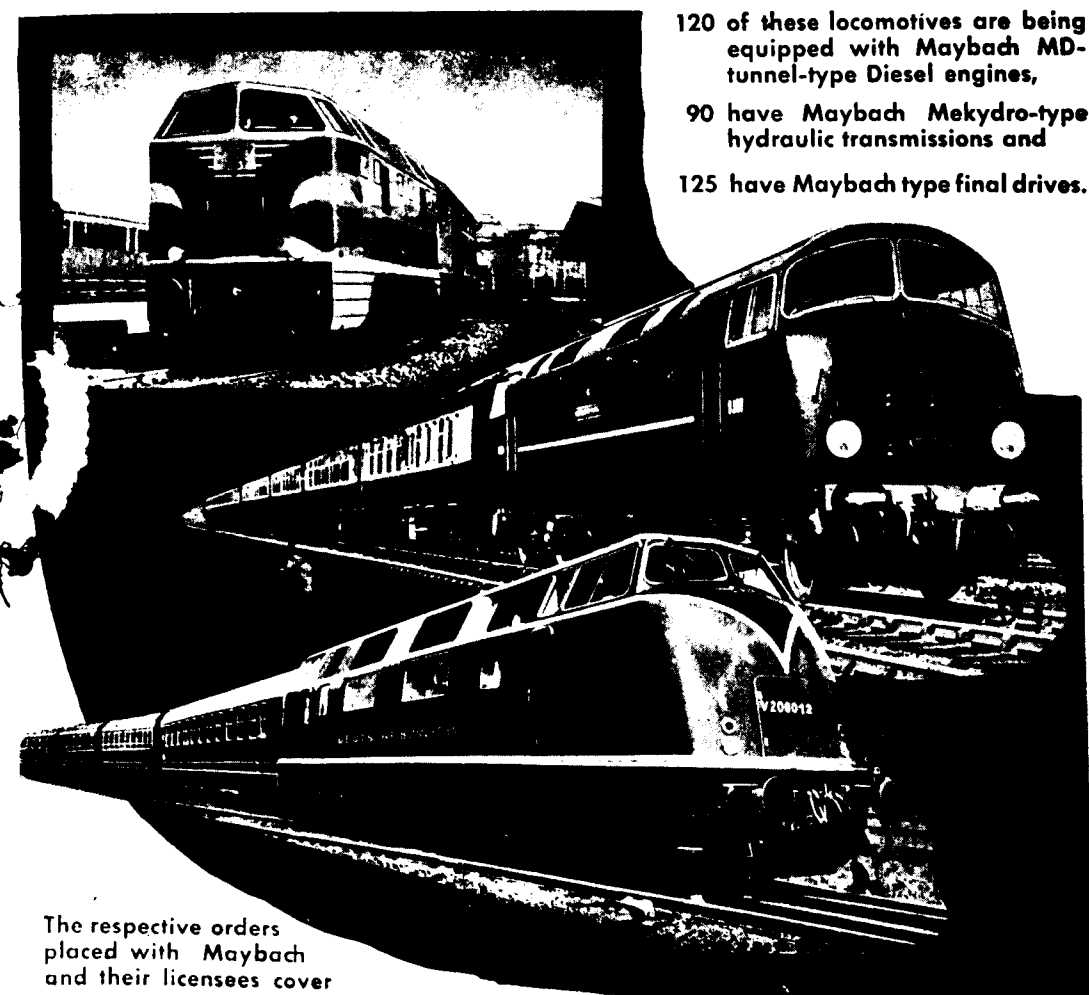
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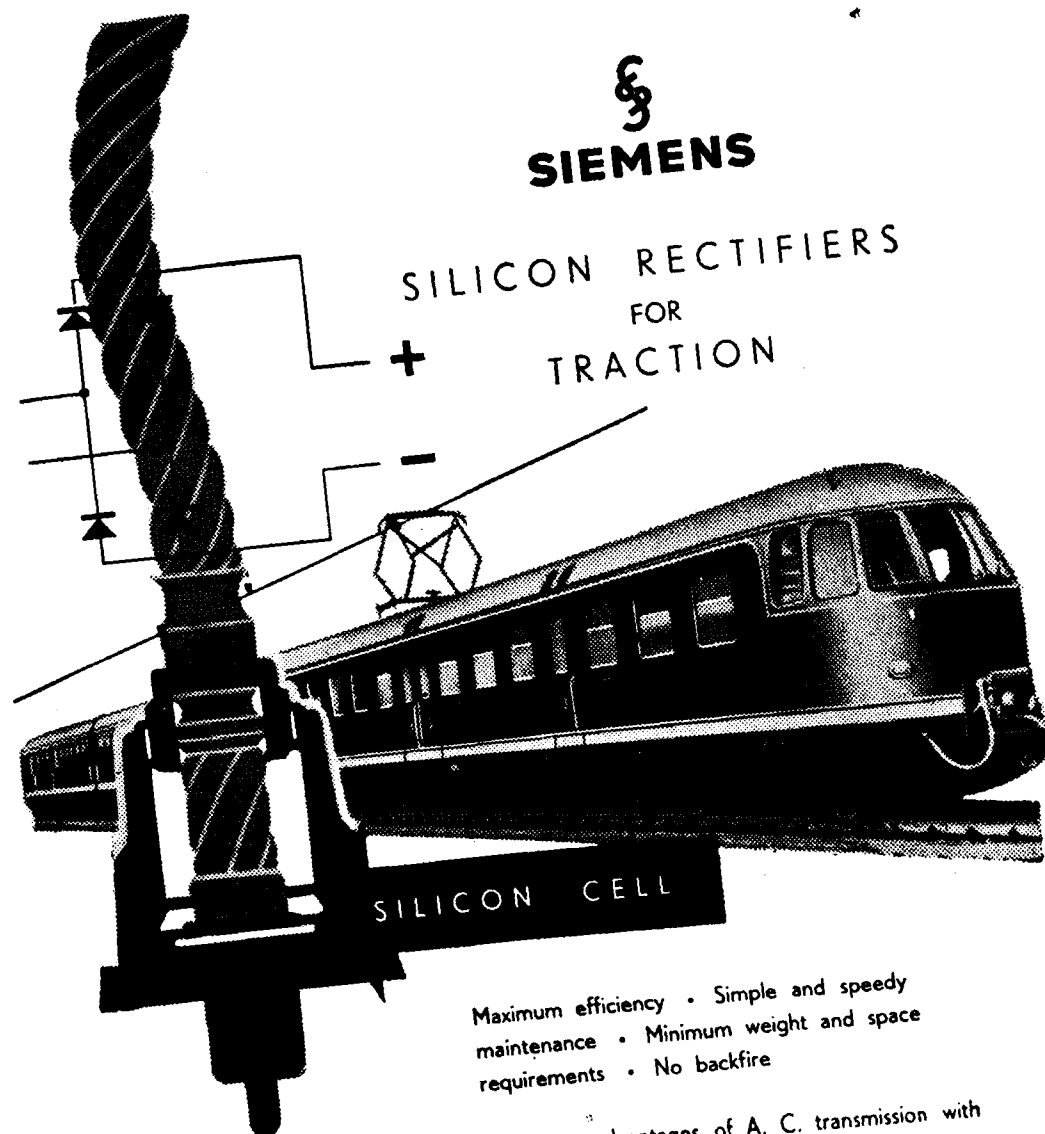
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