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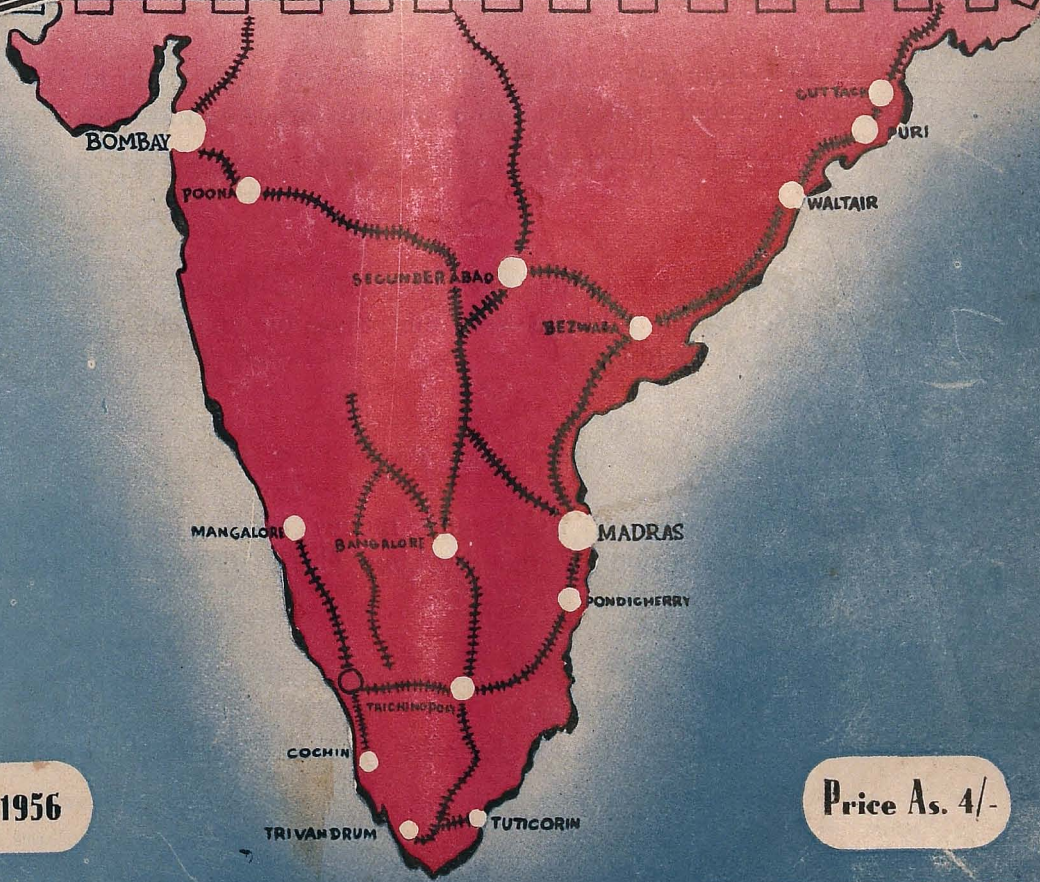
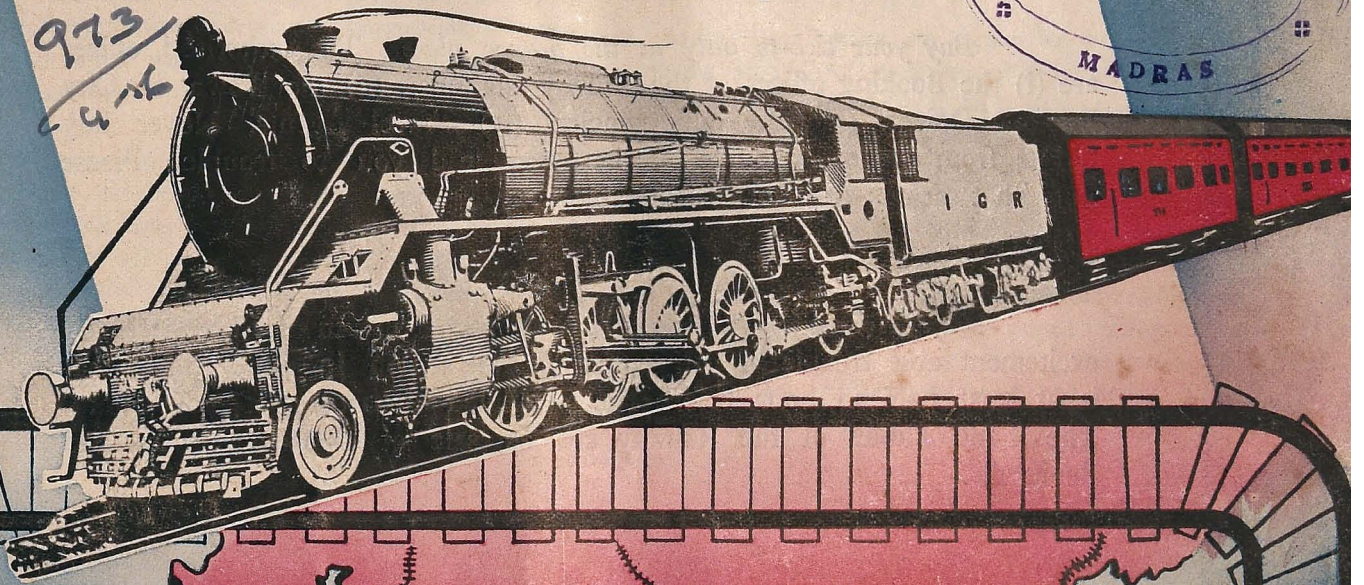
# SOUTHERN RAILWAYS

*Magazine*

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# BRITISH RAILWAYS ELECTRIFICATION

**T**HE British Transport Commission have announced the award of contracts to British Insulated Callender's Cables Limited and British Insulated Callender's Construction Company Limited for the design, supply and installation of overhead conductor equipment for Britain's first 25kV single-phase A.C. railway electrification schemes. These contracts form part of the extensive modernization programme of British Railways which will restore national supremacy in the field of railway traction.

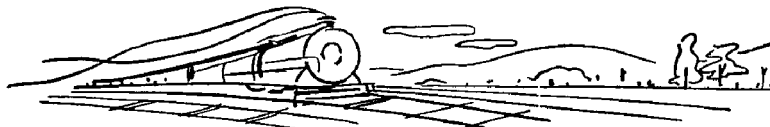
The first two routes to be electrified under this bold programme are between Manchester and Crewe, and between Colchester, Clacton and Walton. The former route involves 220 track miles of main line of the London Midland Region and includes the electrification of the main lines at Crewe Station—a vital junction for many of the routes to be electrified in the future. The latter route consists of fifty track miles of the Eastern Region of British Railways.

The BICC Group is well equipped to undertake this important task in view of its outstanding experience in electrifying the World's railways. It has been engaged in this type of work for over 40 years, particularly overseas, and has carried out extensive research into the problems associated with modern high-voltage A. C. railway electrification practice.

At Rye Hey, Prescott, the Group has built a special proving ground where experimental installations have been erected for research and field trials. These facilities have provided, and should continue to provide, much useful data on many aspects of overhead conductor equipment. In addition, during 1953, the Group—in collaboration with British Railways—installed equipment suitable for high voltage A. C. operation over a route mile of double track on the Lancaster-Morecambe-Heysham electrified lines. The experience gained from studying the performance of this equipment under commercial conditions was of great benefit to the design finally decided upon for these contracts.

*(Continued on page 5)*

## MORE LOCOMOTIVES FOR OUR RAIL ROADS



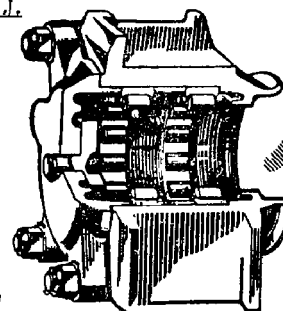
The 910 crores of rupees earmarked for the Railways in the Second Five-Year Plan provides for, among other things, a 51 percent increase in goods traffic, a 15 percent increase in passenger traffic and an increase in the production of locomotives at Chittaranjan from 170 at the end of the First Five-Year Plan to 300 in 1960-61.

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# RAILWAY SIGNALLING RELAYS

By *H. C. Towers, M. I. E. E., M. I. R. S. E., M. Inst. T.*

**T**HE invention of the railway track circuit may undoubtedly be accepted as the beginning of railway signalling relay development. Without the track circuit, relays controlling other circuits would not have been in demand so early. The first track circuit originated in England in the early sixties. Installed on the Crystal Palace line it was invented by Mr. W. R. Sykes. It was not a success, but the experiment was repeated in 1871 by a Dr. Robinson. In 1879 trials commenced in the U. S. A.

In 1890, two track circuits were put down on British Railways, one at Cannon Street, on the London, Chatham and Dover Railway, and the other through Kings Cross Tunnel, on the Great Northern Railway. The latter was part of a very complete scheme which dispensed with the use of two mechanical slots, two mechanical wires through the tunnel and two levers, in the signal boxes. For the insulated rail joint, a fibre bar was used in place of fishplates, and the ends of the rails rested in separate joint chairs which were fixed to a special sleeper.

The use of this primitive form of track circuit was discussed at some length at a meeting of the Institution of Electrical Engineers held in 1897 and most of the members present, showed considerable scepticism. Some of the questions asked were: how the track circuit functioned when the line was flooded; how could sufficient insulation resistance be afforded to make the track circuit operate in such a damp climate as England; and what assurance was there that the track relay would operate when a train stood on the track circuit. The fact that fifty years later thousands of track circuits are in use all over the world proves the reliability of this appliance. In 1901, track circuits were introduced on the London and South Western Railway between Grately and Andover, and in 1905 they came into general use on the District Railway and tube lines with the installation of power and automatic signalling.

The track relay varies in shape and design according to the manufacturer's patents. The essential requirement was that it should operate on a minimum current. The earliest designs had two coils enclosed in vulcanite tubing which were fixed outside the case containing the relay armature and contacts. The case was circular with a glass wall for purpose of observation. In Great Britain, D. C. track relays have a coil resistance of 9

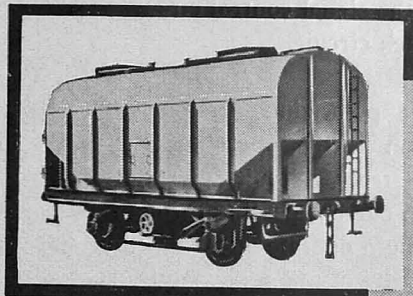


*Two element vane relay with detachable terminal top.*

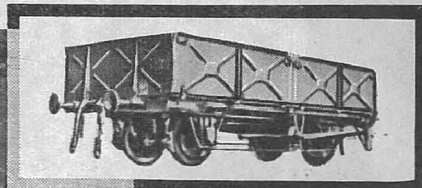
ohms, while in the U. S. A. 4 and even 2 ohms are used. The relay's contacts are screwed to the relay armature and suitably insulated from it. The ends of the contacts are connected to terminals on the case by flexible conductors. In the earlier relays, platinum to graphite was the usual combination for 'front' or energised contacts, and platinum to platinum for 'back' (de-energised) contacts. The design of the direct current relays has been improved in regard to the number of contacts per assembly and other details, but generally they are very much the same in shape and appearance and operate on the same voltages. This type of relay is quite suitable for steam railways, but cannot be used on railways where electric traction is in operation. In these cases the running rails have to be used for the return traction current and as they have to be insulated at intervals to make the necessary divisions between the tracks circuits, the return traction current has to be passed around the insulated joints by a device known as

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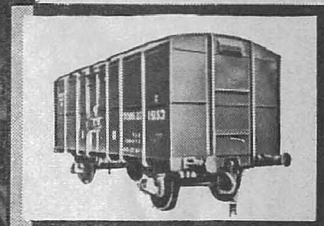


20-ton capacity Bulk Grain Van to the order of British Railways.

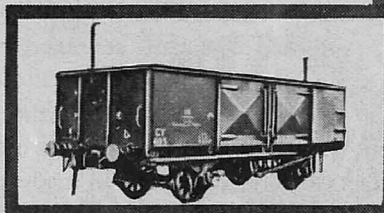


F.J.S. Low-sided Open type Wagon as used by Queensland Government Railways, Australia.

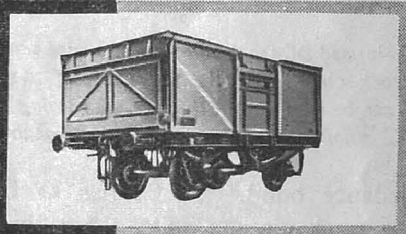
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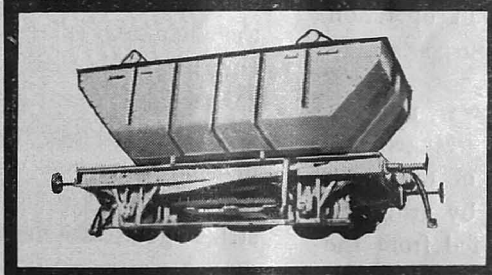
Broad gauge covered Wagon type C.R. as used by Indian Railways.



22-ton G.Y. type Wagon as used by Victoria Government Railways, Australia.



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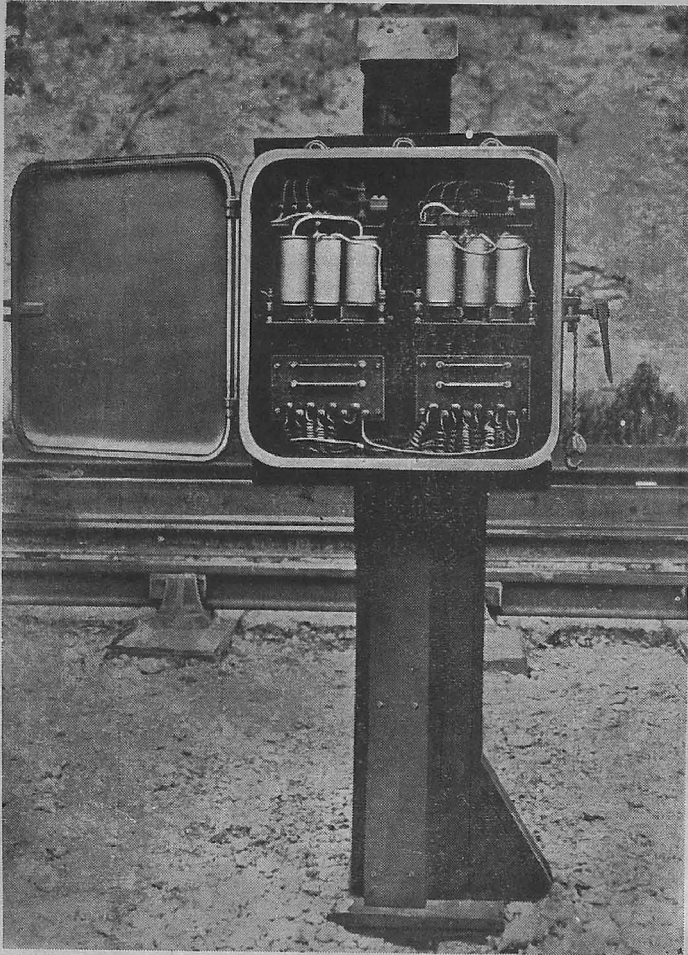


V. J. M. Hopper type Wagon with Drop Bottom Door as used by Queensland Government Railways, Australia.

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*Brown's polarised DC track relays. The case contains the 'A' relay of one track circuit and the 'B' relay of the next. The track armature can be seen at the bottom, the swing coil in the middle and the signal control contacts at the top.*

an impedance bond. A. C. has to be used for the signalling track circuits. On the railways of London Transport, a negative conductor rail is in operation leaving the running rails free for signalling purposes.

The original power signalling on these railways included D. C. track circuits, and special arrangements had to be made owing to the possibility of the track relays being operated by false feeds caused by grounded traction motors. The signal main was fed from the sub-stations at a pressure of 60 V and the positive pole of the signal generator was connected to earth. In this way the signal main became a negative main. The track circuits were fed at a pressure of from between 2 V to 6 V and the voltage was reduced by 450 and 900 ohm resistances wound in the form of a tube and coated with porcelain.

The relays were of a special polarized type and consisted of three coils, two being known as the track coils and the third the swing coil.

Two relays were used on each track circuit, one at each end. The signal circuit was taken over the swing coil contacts at both ends. On a train entering the track circuit, both sets of track coils were shunted causing the track armature to fail, thereby breaking the circuit to the swing coil. Both swing coils assumed the vertical position and the signal control circuit was broken at each end of the track circuit.

The object of the polarizing arrangements was to guard against traction earths operating the relays incorrectly when the track circuit was occupied. It follows that a traction current passing through both sets of relay track coils would operate one relay but not the other, since the polarity of one relay would be reversed because of the fixed polarity of the swing coil. The first relays to be designed, had four coils, the swing coils being duplicated and in series with each other. They were pivoted at an angle of  $90^\circ$  with respect to the track coils. A latter design used a single coil only for the swing portion. The two relays per track circuit were designated A and B relays and the signal control line between them was called the A to B line. They were known as Brown's polarized relays and were named after their inventor. The Brown relay was in use on the London Transport lines from their earliest electrification days and remained in service for many years.

An early type of A. C. track relay was the ironless galvanometer type. This relay consisted of a local coil, permanently energized, and a track coil arranged to partially rotate between the local coil. The track element or armature was a loop made of a few turns of heavy wire secured to but insulated from, a frame which was pivoted. The connection to these coils was made by two flexible copper spirals attached to the terminals on the outer case. This coil was fed from the track circuit current. The local coil was supplied from two terminals connected to the signal main, the voltage of which was generally 110 on A. C. circuit. The armature was balanced by small adjustable weights and stop-screws were provided to limit its travel so that it could not strike against the fixed coils.

The electrical principle of the relay is that at any time, when the track element is energized, there is continual attraction between the top of the field coil and the armature, but repulsion at the bottom. The armature is thereby subject to a continual torque which closes the relay contacts. The relay is immune from operation by direct currents on the traction side since such currents flowing through the armature coil produce polarity which is not affected by the alternating magnetic field of the local coils.

(Continued from page 1)

Alternating current at this high voltage and at standard mains frequency was chosen by the British Transport Commission as its ultimate aim after very thorough examinations of all other systems of railway traction, including D. C., lower frequency A. C., diesel-electric and

diesel. A feature of the new scheme, which will form the basis of future overhead work on British Railways, is the use of much lighter overhead equipment than would have been possible with any other system of overhead electrification.

### DEVELOPMENT CO-ORDINATION CELL TO HELP MANUFACTURERS OF RAIL EQUIPMENT

DEVELOPMENT Co-ordination Cell has been set up as part of the Railway Equipment Directorate of the Railway Board to assist in the development of specialised railway equipment manufacture in the country, and to provide technical guidance to prospective manufacturers. A recommendation that such a cell should be set up was recently made by the Railway Equipment Committee.

The Railway Board has also compiled rough estimates of the future requirements of imported railway equipment and important indigenous railway stores in short supply, and printed copies of these are available at the four show rooms.

The Government of India feel confident that manufacturers in the country will extend their co-operation in achieving the aim of self-sufficiency in respect of railway

equipment, so as to eliminate the need of importing these during the course of the Second Five-Year Plan. Governments are prepared to entertain offers for new products of use to the railways, and products proved to be satisfactory as a result of trials will be standardised.

Work in relation to trials with new products is handled in the Central Standards Office for Railways, Baroda House Annexe, New Delhi, by the following Officers :

For Carriage & Wagon items : Chief Design Engineer (Carriage & Wagon); for track and building items : Chief Design Engineer (Civil); for Signalling items : Chief Design Engineer (Signals); for locomotive items the Chief Design Engineer (Locomotives) at Chittaranjan should be addressed.



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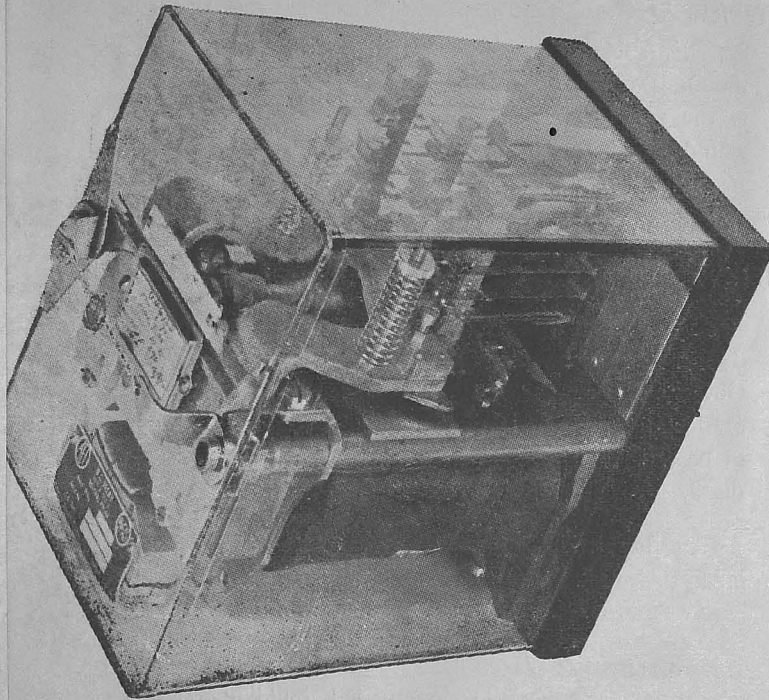
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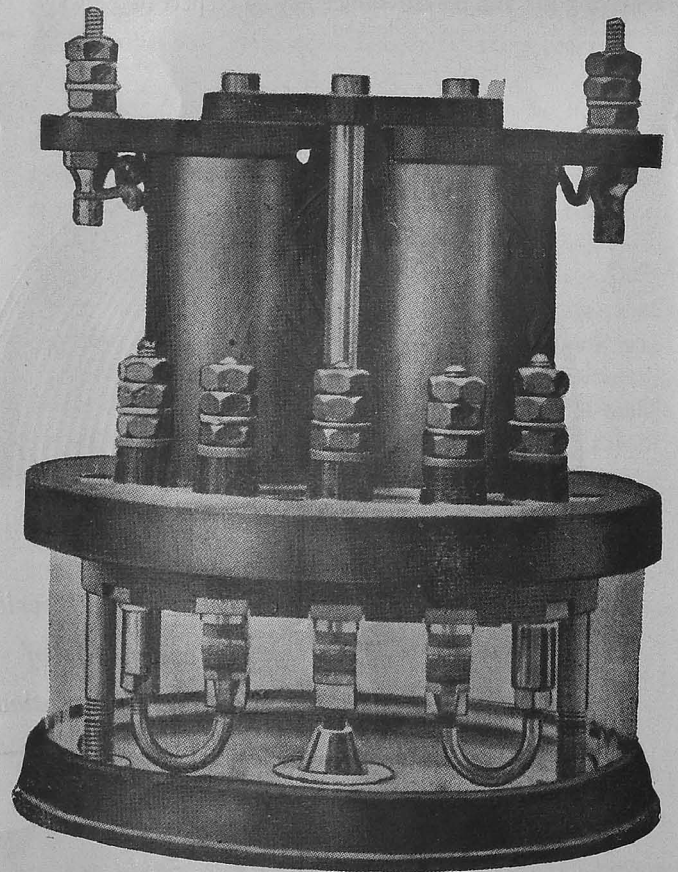


*Plug in type signal relay.*

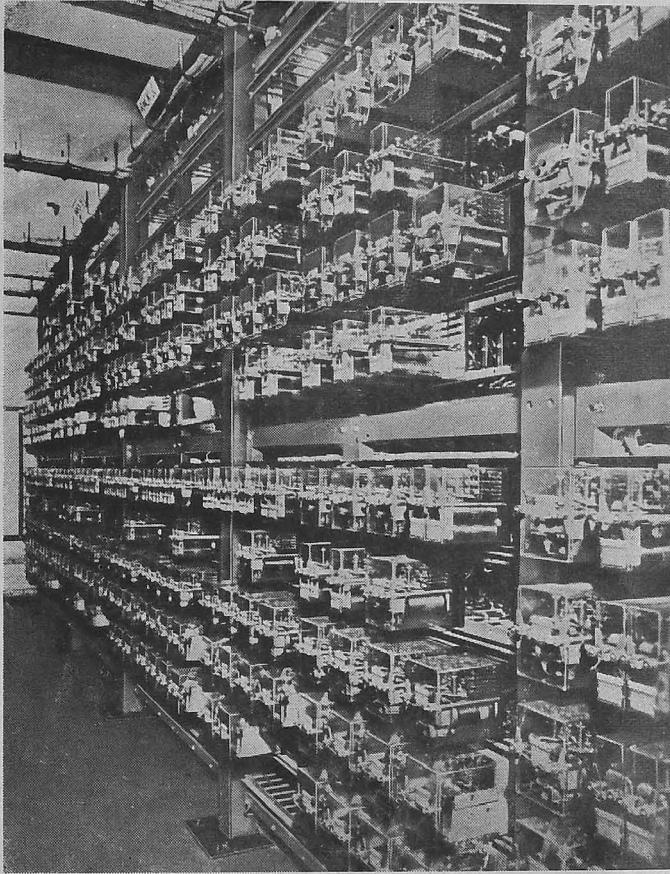
Another early type of A. C. track relay was the single-element vane relay. The moving element of this is an aluminium vane pivoted and arranged to move vertically between a C-shaped laminated magnetic core. The electrical principle of the relay is magnetic induction. The sector shaped vane is mounted so that it can rotate between the poles of the electro-magnet. Each pole face is partially covered with a heavy shading band of copper. Currents are induced in the shading band by the main magnetic field and these are in opposition to the latter which causes the main field to shift towards the unshaded portion of the pole face. The main flux also produces an eddy current in the vane at that particular part which is in phase with the eddy current produced in the shading band. There is, therefore, attraction between the two, and the vane being free to rotate is lifted, thereby closing the relay contacts. When the relay is de-energized, the vane drops and rests against a roller fixed at the bottom of the case. The two-element or double-element vane relay was designed for use on long track circuits or those having low ballast resistance since the energy required to operate the vane and galvanometer type relays was high. This relay has two iron systems, one magnetized by a local coil, which produces the major portion of the operating power. The other iron system is energized by a coil fed from the track circuit and for which comparatively little energy is required. The two coils are fixed at right angles to one another, the local coils forming a vertical slot in which an aluminium vane is pivoted. The eddy currents

induced in the vane are given definite paths by the introduction of slots cut in the vane. When the track coil is energized, it produces a flux  $90^\circ$  out of phase with that of the local coil. It therefore exerts a force on the conductors of the vane which tends to move it in a vertical direction, either upwards or downwards, according to the direction of the current in the track coil with respect to that of the local coil. The most efficient operation of the relay is obtained when the respective currents are  $90^\circ$  out of phase. The double element vane relay is now almost universally used for A. C. track circuits.

Other relays used in railway signalling circuits are those which repeat track circuits in the signal boxes, relays for indicating the position of points, and others for lock-stick circuits, inter-cabin slots, and for special features. There is an operating limit to the length of cable connecting the rails of a track circuit to the track relay and not all the track relays can be placed in the relay room of the signal box. The balance have to be accommodated alongside the track in cast iron boxes or special cubicles. These track relays operate repeater relays in the signal box which are known as track



*Early type of signal relay.*



*Rack of plug in signal relays.*

repeater or line relays. D.C. or A.C. relays are used for this purpose, but generally the A.C. single-element relay is favoured.

The advent of the copper-oxide rectifier brought about the introduction of a number of useful appliances in the signalling field. The inclusion of a small rectifier in series with an A. C. signal circuit permitted a small D. C. telephone-type relay to be connected across it, the contacts of which operated the signal repeater visual lights in the lever frame and other auxiliary and detecting appliances. Rectifiers are also used in A. C. signalling circuits where electro-magnets and solenoids are in operation, enabling the quite D. C. coil to be worked off an A. C. circuit without the attendant

chattering and overheating associated with A. C. electro-magnetic devices.

Direct current for railway signalling was utilized from the very beginning where the early telegraph circuits were operated by weak currents from primary batteries. Some three or four decades past, A. C. came into favour chiefly on account of its immunity from interference where D. C. electric traction was present and also for its ease in transmission and voltage reduction. It also brought with it the disadvantages of operating electro-magnetic appliances by A. C. power.

Present day signalling schemes increasingly favour a combination of A.C. and D.C. circuits. A.C. is used for track circuits and for operation of colour light signals where only small transformers are affected. For all others circuits, D. C. relays, electric locks, etc. are employed; the D.C. power usually being obtained through a charging unit connected to the main A.C. supply.

In modern signal boxes, many miles of wire are run for connecting the various types of relays together for the interlocking and selection circuits. Relays may have as many as forty or fifty wires attached to their terminals. In the case of a relay becoming defective, it has to be changed and, with so many wires to contend with, the task is one occupying considerable time and calling for great care. Each wire has to be labelled to ensure that it is correctly replaced. When the work is completed each circuit affected must be tested.

In order to overcome the risk of possible wrong connection and also to reduce the time necessary for changing a relay, detachable tops were introduced. This means that the top of the relay, containing the terminals, is plugged into the relay proper and secured by a clamping device. If the relay has to be changed it can be done in a few movements without the necessity of disconnecting a single wire. Another type of relay which has been recently used on new signalling works, is the plug-in type. Here the base containing the terminals is rigidly fixed to the mounting rack and the relay is plugged in.

## CHITTARANJAN TOUCHES NEW PRODUCTION PEAK

THE Chittaranjan Locomotive Works, which recently turned out the 400th locomotive, touched a new production peak by completing 14 locomotives during August, 1956.

The output at Chittaranjan has increased rapidly from six locomotives per month in the early part of 1954 to ten per month from January to June 1955. Thereafter, production was increased to 11 locomotives per month, and subsequently to 12 per month.

## General Manager, Central Railway inaugurates Full Divisional System on Jhansi Division

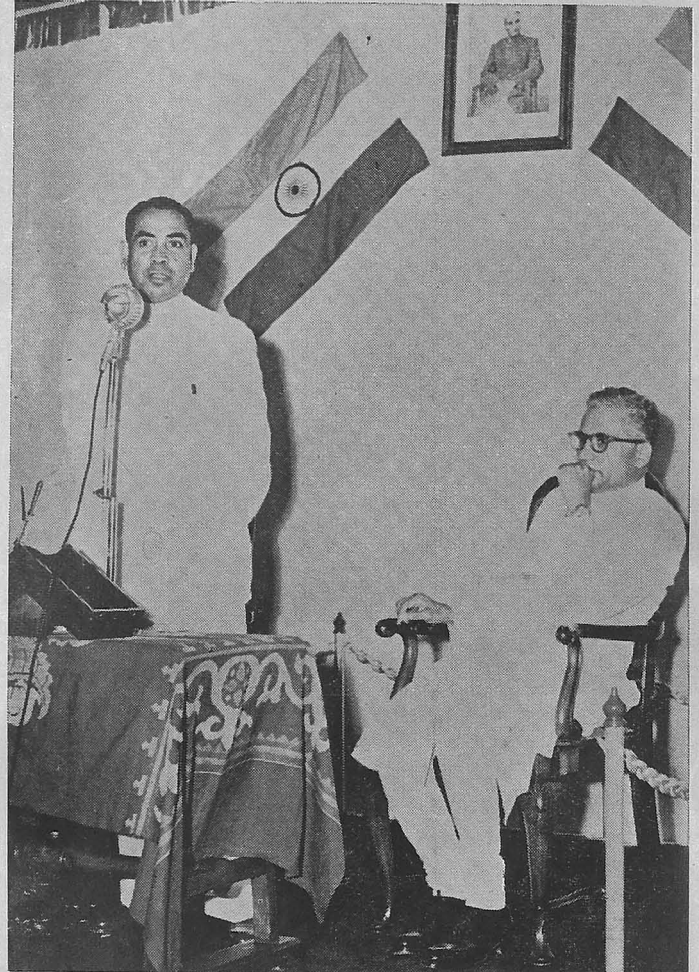
**B**EFORE a large and distinguished gathering, the General Manager, Central Railway Shri M. N. Chakravarti performed the inaugural ceremony of the introduction of the Full Divisional System on the Jhansi Division, at the Divisional Offices at Jhansi today. Earlier, Shri M. A. Qadeer, Divisional Superintendent, welcomed the General Manager and other distinguished guests and gave a brief account of the importance of the Jhansi Division in the transportation set-up of the Central Railway.

Shri Chakravarti operated a miniature electric lever switching out the illuminated organisational chart showing the old administrative set-up and simultaneously switching on the schematic chart showing the new set-up, thus symbolising the introduction of the Full Divisional System on one of the major Divisions of the Central Railway.

Shri O. V. Alagesan, Dy. Minister for Railways & Transport, Government of India, who was to have inaugurated the Full Divisional System but could not come, owing to indisposition, in a message, which was read out on the occasion stated that the Second Five-Year Plan called for the utmost effort on the part of Railwaymen; its success depended mostly upon the capacity of the Railways to move the traffic generated. Continuing, he added that the gap in the resources could only be filled if railwaymen rose to the occasion. He had full faith in them and had no doubt that they would rise to the occasion and do their job well.

Shri M. N. Chakravarti, General Manager of the Central Railway gave an account of the various endeavours made by the Railways in the past to gear the administrative organisation to a pitch that would enable it to meet the country's increasing transport requirements. Indian Railways, he said, had therefore been regrouped in November 1951 to achieve economies and greater efficiency. The integration enabled the introduction of a number of operational reforms which helped the Railways to meet more fully the demands of the rapidly increasing volume of traffic.

The Jhansi Division, Shri Chakravarti said had been in the forefront of the all-round progress registered by



*Shri M. N. Chakravarti, General Manager of the Central Railway delivering his inaugural address on the occasion of the inauguration of the Full Divisional System on the Jhansi Division, at the Divisional Offices, Jhansi on September 15, 1956.*

the Railway. The net ton miles carried on this Division on the Broad Gauge rose from 1,030 million in 1950-51 to approximately 1,842 million in 1955-56 representing an increase of 79%. Operational efficiency also made a notable improvement with 914 net ton miles being moved per wagon day in 1955-56 as against 565 in 1950-51, thus recording an increase of 61.8%. It was mainly as a result of this increase in operational efficiency that the Railway was enabled to carry so large an increase in traffic.

The development of agriculture and industry under the Second Plan would bring about a substantial rise in



Left: Shri M. N. Chakravarti, General Manager of the Central Railway in the unavoidable absence of Shri O. V. Alagesan, Dy. Minister for Railways & Transport, performed the inaugural ceremony of the introduction of the Full Divisional System on the Jhansi Division of the Central Railway at Jhansi on September 15, 1956. He is seen here operating the miniature electrical lever which switched out the illuminated organisational chart showing the old administrative set-up simultaneously flashing on the schematic organisational chart showing the new set-up thus symbolising the introduction of the Full Divisional System at Jhansi.

reform, involving several far-reaching economies was keenly felt, Shri Chakravarti said.

Under the New Divisional System, the Unit is administered by a Divisional Superintendent of sufficiently high rank who is helped by a number of executive Officers specially qualified to handle Operation, Personnel, Power, etc. Shri Chakravarti stated. The Divisional Superintendent would be responsible to the Heads of Departments for the maintenance of high standards of technical efficiency and the efficient discharge of the obligations placed on the Divisional Officers besides being responsible to the General Manager for the overall efficiency of the Division. In short, the Divisional Superintendent functions on his Division as a Regional Manager with adequate powers to take decisions on matters connected with the working and the development within his Division, he added.

Concluding his address, Shri Chakravarti said that while planning to expand the transport capacity and to improve the standards of operative efficiency, the Railway Administration would, with even greater determination, endeavour to move all the goods traffic offering and to make passenger travel more comfortable and ensure the highest standards of safety for the future.

the volume of traffic to be carried and to execute expeditiously the many railway projects that would be necessary for the purpose, the need for the introduction of the Full Divisionalisation scheme, as an administrative

### EXTENSION OF EXPRESS GOODS SERVICE ON THE WESTERN RAILWAY

A Special scheme for the quick transit of goods both wagon loads and smalls was introduced on Western Railway from 1st April 1956 between Carnac Bridge and Delhi and later between Ahmedabad and New Delhi on the Broad Gauge. The basic features of the scheme are that the goods are conveyed by express goods trains within a guaranteed period and their movement is specially watched. A small percentage fee is levied extra for the service, which is refunded if the guarantee is not fulfilled.

There has been very good response from the trade to the scheme and it is now proposed to extend the scheme to other sections on Western Railway from 1st October 1956.

The quick transit service will now be made available between Carnac Bridge, Bombay and Ahmedabad, between Kandla and Jaipur and between Surendranagar and Jaipur.

The guaranteed period for transit is 4 days between Carnac Bridge and Ahmedabad and 5 days for the express service between Kandla and Jaipur and between Surendranagar and Jaipur, from the date of booking.

For this express service, an extra fee of 6 pies per rupee on the 'total freight' subject to a minimum of 4 annas per consignment will be levied in respect of every consignment which is booked under this scheme. The extra fee will be refunded if the goods are not offered for delivery within the guaranteed period.

# COUNTRYWIDE DRIVE TO INCREASE RAIL TRANSPORT CAPACITY

**T**HE main lines of a countrywide drive to secure the most intensive utilisation of Railway rolling stock in the country were finalised at a four-day conference of the Chief Operating Superintendents of all the Indian Railways with the Railway Board, which concluded in New Delhi last month.

Top-level Railway Operating Executives present at the meeting decided on a series of far-reaching measures designed to tackle the problem on an emergency basis, with a view to closing, to the largest practical extent, the present uncovered gap between freight traffic likely to develop during the second Plan period and the resources available for carrying it.

The Railway Board emphasised that in view of the shortage of funds, it was of the utmost importance that the Railways should through superior organisation effect economy on new capital expenditure.

The Railway Board also reviewed the past operational results of each Railway, and set new higher targets of performance for the ensuing busy season (November 1956 to April 1957) in regard to the wagon loading and wagon engine usage.

The conference attached the greatest importance to co-operation from the staff. It was decided that frequent meetings of Railwaymen at all levels should be arranged to explain to them the revised targets of performance; so that all classes of workers, including even shunting porters and pointsmen, may have a clearer perception of their respective duties and their share in the fulfilment of the targets.

The conference decided that a systematic and persistent campaign should be initiated immediately to streamline all aspects of operation, particularly in regard to faster loading and release of wagons at terminal points, expeditious disposal and proper marshalling of Goods trains and punctual running of trains from terminal yards. There should be greater supervision at focal points like Moghalsarai, Bezawada, Ratlam, Baroda, Waltair, Agra etc. to remove any deficiencies which may exist.

An important decision related to the establishment of a number of "traffic control" areas to maintain

constant touch over the telephone with the various points which handle wagons, so that individual wagon movement and specific traffic movements could be closely watched with a view to ensuring better output from the existing yards and wagons. Telecommunications facilities should be strengthened in accordance with individual requirements.

## TELEPRINTER LINKS

It was also decided that teleprinter services should be introduced between important marshalling yard to convey full particulars of wagons despatched on different trains, thereby facilitating advance planning of further movement and disposal of wagons.

Among the other decisions taken at the meeting were the following:

The "wagon-chasing" organisation should be strengthened by posting selected senior and experienced personnel, and their retention in these jobs should solely depend upon the results they produce.

Loading Inspectors should be appointed to introduce scientific loading of wagons, particularly in big sheds and transshipment sheds so as to ensure better wagon loadings.

## ADDITIONAL EXPRESS GOODS TRAINS

Additional Express Goods trains should be introduced, and these should be run like scheduled Passenger trains, providing a minimum of a weekly fast service on all the important trunk routes to enable transport of all commodities essential to the life of the community. It is proposed not to apply ordinary operational restrictions to the running of these trains.

Under this scheme some of the additional important Goods services from North Bihar to Assam, Madras to Cochin, Bombay to Kanpur, Bikaner to Rajkot etc. will be introduced.

Punctuality of Passenger trains was also discussed and various measures for ensuring better punctuality were decided upon.

## NEW GEC AUTOMATIC ANNOUNCER

**T**HE General Electric Co. Ltd., (represented in India by The General Electric Co. of India Private Ltd.) has developed a novel automatic announcing system which can reproduce, at the touch of a button, any one of 25 pre-recorded announcements or signals, which can then be relayed over a loudspeaker system.

The messages are recorded side by side on a special loop of 3 in. wide magnetic tape, and the appropriate one selected by push-button when required. To make the system fully automatic, particular announcements such as shift changes, meal breaks or other messages can be triggered off by a master clock mechanism without the need for any human attendance. Also, of course, the push-button can be mounted remotely from the instrument so that announcements, emergency calls such as fire alarms, whatever broadcast is desired can be initiated from other parts of the premises.

The automatic announcer was originally developed by the GEC for British Railways (Eastern Region) and first installed at Startford Station. In this installation the platform announcements for passengers are automatically initiated by the trains themselves, first as they approach the station and then again as they come to a standstill at the platform. Equipment of this type has now been adapted for general industrial use and may be applied in any situation where numbers of routine broadcasts have to be repeated fairly frequently.

### BRIEF DESCRIPTION OF EQUIPMENT

The paper-backed magnetic tape used is made in the form of a continuous loop 3.1/8 in. wide, which normally lasts 30 seconds. Special loops can be supplied, however, having any duration between 10 seconds and about 4 minutes. A short length of metallic

foil is spliced in at the point where the two ends of the loop join. At the end of the announcement the foil completes the circuit between two contact fingers, automatically switching off the mechanism and preparing it for the next announcement.

The loop of tape is moved past the playback head at a steady speed of 7½ in. per second by a mechanical drive system powered by a 1/20 h. p. motor. The motor is dynamically balanced and resiliently mounted at the rear of the panel, the drive being transmitted by a flexible shaft, nylon helical gears and two large diameter pulleys coupled by a nylon loaded fabric belt. On selecting the required announcement, either by push-button or by remote control, the playback head is moved to the correct tracking position by a specially designed mechanism patented by the GEC Control of the tape motor and the head positioning device is effected by a 25 position rotary selector switch associated with seven switching relays mounted under detachable covers.

The method of storing the tape is also original to the GEC. As the tape is played it passes through a guide into a perspex-fronted casket, where it falls naturally into folds or convolutions. The use of a continuous loop of tape eliminates the need for spools, and of course no re-winding is necessary.

The three basic units comprising the complete equipment are designed in panel form so that they may be mounted on a standard Post Office type rack frame. These units are the Announcer Unit; the Pre-Amplifier and Monitor Unit; and the Power Unit consisting of a heavy duty transformer and rectifier assembly providing 50V D. C. and 24V A. C.

The price of the complete set of panels, complete with spares, is £ 620 and delivery can be made from stock.

### A CORRECTION

We regret for the misprint in the article entitled "A REVIEW OF THE RESPECTIVE MERITS OF THE SOLID AND THE BUILT-UP ROLLED STEEL WHEEL" contributed by Mr. C. F. Ryan, M.B.E., A.M.I.E.Mech.E., M.I.Loco.E., of the United Steel Companies Ltd., Sheffield, England and published in our "ENGINEERING SUPPLEMENT cum ANNUAL NUMBER" of July 1956 edition.

The second word in the fourth line of the first paragraph should read as "NOTING" instead of "Nothing".

EDITOR.

# INDIAN RAILWAY DELEGATION FOR WORLD BANK DISCUSSIONS

**A** Delegation of Railway Officers, led by Shri P. C. Bhattacharya, Secretary, Ministry of Finance (Department of Expenditure), is to leave towards the end of this week for Washington to assist in the preliminary round of negotiations with the World Bank for a loan for the Indian Railway programme under the Second Five Year Plan.

The Delegation consists of two senior officials of the Railway Board, one Operational and the other Financial, and Technical Advisers. The following is the personnel of the Delegation :

1. Shri P. C. Bhattacharya, Secretary, Ministry of Finance, (Expenditure), who was until recently Financial Commissioner, Indian Railways.
2. Shri K. B. Mathur, Member, Transportation, Railway Board.
3. Shri P.N.Murti, Electrical Adviser, Railway Board.
4. Shri P. Sahai, Joint Director, Mechanical (Planning), Railway Board.
5. Shri J. B. Rao, Joint Director, Traffic (Rates), Railway Board.
6. Shri Jagjit Singh, Joint Director, Efficiency Bureau, Railway Board (for Statistics).
7. Shri Y. T. Shah, Joint Director, Finance, Railway Board.
8. Shri R. G. Dacosta, Railway Adviser to the High Commissioner in London—to join from London.

After their participation in the discussions with the World Bank, the delegates may stay on in the United States for about ten days to study the American railroad system.

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## WORLD BANK LOAN FOR DEVELOPMENT OF INDIAN RAILWAYS

An eight-man delegation representing the Government of India is in the United States to discuss with officials of the World Bank a loan for railway development in India.

Following the completion of discussions with the Bank, the group which arrived last week, hopes to spend 10 days visiting rail and industrial centres.

The group is headed by Mr. K. B. Mathur, a member of the Railway Board, and Mr. P. C. Bhattacharya, Secretary of the Ministry of Finance.

Of particular interest to the group will be a coal-mining area and a steel plant, for the purpose of studying loading and other rail traffic problems, and a major marshalling yard, to study the operation of a central traffic system on single line sections.

### TECHNICAL ADVANCE

Mr. Mathur stated that the group is primarily interested in the latest technical advancements for possible employment on Indian Railways.

Also in the group are Mr. P. N. Murti, Electrical Adviser to the Railway Board ; Mr. P. Sahai, Joint Director, Mechanical, Railway Board ; Mr. Y. T. Shah, Joint Director, Finance, Railway Board ; Mr. Jagjit Singh, Joint Director, Efficiency Bureau, Railway Board ; Mr. J. B. Rao, Joint Director for Rates, Railway Board, and Mr. R. G. Dacosta, Railway Adviser. Mr. B. K. Nehru, in the United States for the past several weeks, has joined the group in discussions at the Bank.

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### SCHOOLING FACILITIES TO RAILWAYMEN'S CHILDREN

The Railway Board has appointed a team of four Educational Advisers for undertaking a countrywide survey of the existing schooling facilities available for the children of Railway employees.

The survey, among other things, would cover subjects like accommodation, teaching standards, adequacy of staff and equipment etc.

Each of the Advisers will have certain States allotted to him for the purpose of the survey. The respective Headquarters of the four Advisers would be located at Banaras, Allahabad, Madras and Nasirabad (Rajasthan).

The four Advisers are Shri Boni Prasad Uita, retired Principal, Banaras (Orissa, West Bengal, Assam and part of Bihar); Shri Chander Shekhar Vajpai, retired Principal, Allahabad (U. P., Delhi, Punjab, Madhya Bharat and part of Bihar); Shri V. T. M. Thirunavukkarasu Chettiar, retired Headmaster, Kancheepuram (States of Andhra, Madras, Hyderabad and southern part of Bombay); and Shri N. G. Nath, retired Principal, Nasirabad (Ajmer, Rajasthan, Saurashtra, Madhya Pradesh, Bombay excluding southern part).

# LATHES IN RAILWAY WORKSHOPS

By A. C. BHATTACHARYA, A. M. I. Prod. E.

**M**ODERN Specifications covering the construction and upkeep of Railway rolling stock call for a high grade of finish on all constructional parts, corresponding to the latest advance in technical knowledge. The man in the Workshop is only capable of meeting the ever-increasing demands made by the designer if the machine—tool industry produces suitable machinery which will enable him to machine the parts in question in a practical and economical manner.

Probably the most primitive form of machine tool was a sort of lathe which has been in use for centuries past by the brass and wood workers of India. This lathe has the head and tail stocks consisting of wooden stakes driven into the ground at the required distance to take the work, and a bar of wood lashed to them to support the tool. The spindle was driven by a kind of bow, made from a stick about a yard long with a cord attached to its end, the cord making one or two turns round the spindle, which was caused to rotate, first in one direction and then in the other, by alternately pulling and pushing the stick, the work being turned during the forward stroke by means of hand tools, just as was common practice in brass finishing shops until quite recently.

Though it was of a very simple form, but the human skill and pride of craftsmanship enabled excellent work to be turned out. Development from this crude tool to the highly complex machine tool of present times is comparatively recent and may generally be considered to have commenced towards the end of the 18th century.

## HISTORICAL RESUME

Although the boring machine, built by John Wilkinson in 1775, is considered the first "modern" tool, this machine was, after all, only a special adaption of the lathe, the latter being considered as the parent of all machine tools, as from it have been derived the drilling, milling, screwing, sawing and grinding machines, in addition to the boring machine.

Till 1680, the lathe was developed to an extent whereby only high class wood work could be turned out of it very easily. In 1741, Hindley, a clockmaker of York, produced a small screw-cutting lathe, having change gears.

The real foundation of the modern lathe was laid by Henry Maudslay, who designed the first slide rest to

receive general practical application in about 1794. In his own works in London in 1800, he produced his first screw-cutting lathe with 28 change wheels embodying the feature of the self-acting slide rest. Commenting on this invention, James Nasmyth, who is famous for his association with the development of Steam hammer, stated—"it is not at all saying too much that its influence in improving and extending the use of machinery has been as great as that produced by the Steam Engine". In fact this invention paved the way for the rapid and continuous development of the lathe along the familiar modern lines.

## TYPES OF LATHES

The lathe is undoubtedly the most widely used of all machines in all workshops including railway workshops and is regarded as essential for certain types of work. For mass production, the plain lathe has been supplanted by specially developed turning machines, such as the multi-tool production type, the automatic, capstan and turret lathes, screw-cutting or threading machines, etc.

Among the special purpose lathes used in railway workshops are the wheel lathe, axle journal returning and burnishing lathe and axle turning lathe. Most of these more or less complicated types have been developed from the plain metal turning lathe of the past.

Multiple-tool lathes are used for machining a large number of identical parts in greater speed and is suitable for mass-production purpose. As the name implies, in place of a single tool that has to be changed for each individual turning operation, a number of fixed tools are provided in the multiple-tool lathe. A front set, mounted on the saddle tool rest for turning parallel diameters is usually incorporated in this type of lathe so that when these tools are fed along the bed, towards the headstock, all the different diameters can be turned at a single operation.

For producing corners, radii, shouldering, bevelling, forming etc., another set of tools, which are fed towards the work together, is provided at the back of the saddle. The single feeding operation does all this work at once. Thus in two operations, viz: a bed feed and a traverse, the complete machining is accomplished.

In the automatic machine, the machine itself need only be started and it then operates automatically. The work piece, is fed into the headstock chuck and after machining ejected automatically through a guide or

conveyer to a hopper. The machine needs no attention until all of the work stock is used up. Mud plugs and fusible plugs of locomotives are usually manufactured in this type of machine.

### CAPSTAN AND TURRET LATHES

Capstan lathe is a very popular type of lathe for quick production of similar parts and is very widely used for production of studs, machined bolts etc. in railway workshops. Operating on the same principle as the plain type, it is provided with special facilities for rapidly changing over from one tool to another. Further the tools may be fed on to the work by hand in a convenient manner, stops being provided to limit their movement.

The special tool-holding arrangement, known as the Capstan, consists of a substantially designed circular or hexagonal block mounted on a vertical bearing. Holes located in each of the hexagon sides carry a separate machining tool. The capstan unit is mounted on a long dovetailed sliding member working in corresponding guides in a similar direction to that of the ordinary lathe saddle on the lathe bed. In some capstan lathes there is an automatic feed for the capstan unit, a special lead screw being provided for this purpose.

Possibly the machine tool which has been developed to a greater extent than any other and which is most certainly indispensable in the locomotive workshops, is the turret lathe. This lathe is in fact a development of the Capstan lathe and designed mainly for a longer and heavier class of work than in the case of capstan lathes.

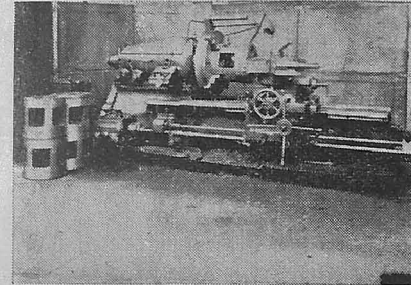
In turret lathes, the saddle moves directly on the bed being fed from a lead shaft with a range of different feeds. Usually two types of turret lathes are used in railway Workshops viz: one for producing finished articles from the bar, which is held on a special bar-feed device behind the headstock and fed in through the hollow spindle of the latter, and the other, the combination turret lathe which is suitable for both bar and chuck work. Items like piston valve port bushes, cylinder liners, crown stays, stay bolts etc., are turned, bored or screwed as necessary at a high production rate, utilising tungsten — carbide tipped tools on combination turret lathes.

### SURFACING AND BORING LATHES

For work of general nature in railway workshops, the surfacing and boring lathes are increasingly favoured. The work piece in this case is machined while being held in a chuck. They are extremely economical and the

standard tooling can be easily and cheaply adapted to suit varying types of workpiece.

Fig. 1 Illustrates a 36" swing surfacing and boring lathe, manufactured by John Lang & Sons Ltd., machining a typical chucking job. Amongst the many noteworthy features incorporated in this machine and



*Fig. 1. Lang 36" swing Surfacing and Boring Lathe.*

explained below, are that it has a spindle speed numbering 12 with a range of feeds (cuts per inch) from 12 to 168 (normal) and 3 to 42 coarse.

The machine has the centre height from the floor as low as possible, consistent with strength, in order to give the operator an uninterrupted view of the cutting tool and facilitate gauging of large diameters.

The clearance of cuttings is well catered for in the form of a chute which conveys swarf to the rear of the bed. The tool holders in the hexagon turret are designed to suit most work of small batches and to take standard lathe tools.

The saddle is provided with quick power traverse motion in both directions along the bed, this being engaged by the normal sliding handwheel being pulled outwards towards the operator and given a part turn in the direction in which the saddle is to travel. Release of this handwheel automatically disengages the motion and stops the saddle traverse.

The gearbox is of the multi-change type giving a choice of 28 changes of feed in the normal range; by movement of a lever on the headstock a second range of 28 feeds, four times coarser than normal, can be obtained. The apron is arranged to give easy control to the operator, all levers being grouped for convenience. Provision is, of course, also made for an adequate coolant supply.

This machine is specially suitable for dealing with locomotive eccentric straps and sheaves and white metal liners.

Illustrated in Fig. 2 is a Lang 17" in Swing special precision tool room lathe to cater for light high speed turning. As a tool room is indispensable for any modern machine shop, similarly a lathe of this type is absolutely essential for a tool room.

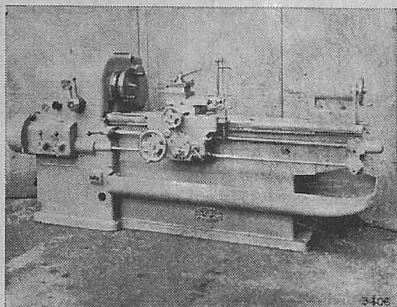


Fig. 2. Lang 17" swing precision centre lathe.

The bed of this machine is made of close grained cast iron containing a high percentage of steel to ensure the greatest possible rigidity under cut. The limits of error to which the machine is built, are of an exceptionally fine degree.

These lathes are on special demands supplied with a Monobloc Hydraulic Profiling Attachment enabling a batch of work to be copied from a model held between centres at the rear of the machine. Complete accuracy is ensured and very high rates of production are obtained owing to the elimination of non-machining time.

## WHEEL LATHE

The machining of the outsides of the mounted wheels with their tyres represents one of the most difficult turning operations that are encountered by railway workshops. To get over this difficulty, the wheel set lathe, often called wheel lathe only, has been designed.

The wheel set lathes are in fact centre lathes with special contrivances for turning the tyres, both treads and flanges, of wheels mounted on axles. To shorten the operation time both wheels are turned simultaneously. Two carriages are therefore adopted for each wheel with chucking and driving arrangements on both sides of the machine, on the headstock and on the tail stock. Both are connected to the same driving device.

Fig. 3 depicts a wheel lathe manufactured by Maschinenfabrik Deutschland, Germany for dealing with carriage and Wagon Wheel sets with outside axle journal.

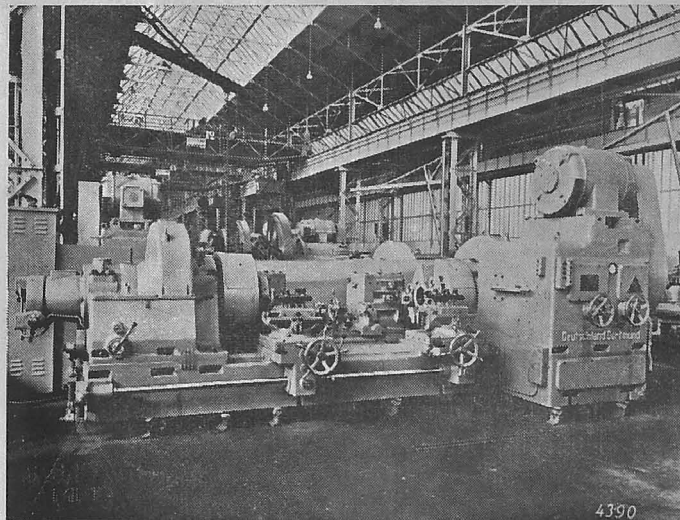


Fig. 3. MFD Wheel lathe for wheel sets with outside journals.

The placing of the wheel set between the centres and the performance of gripping in this machine is effected by two synchronised pendulum clamping devices with electro-mechanical control. This arrangement provides automatic, rapid centering and clamping as well as positive driving of the wheel sets. The pendulams are equipped with adjustable friction drives to compensate variable clamping diameters.

The roughing tool posts are for turning the treads and flanges of tyres in their main inclination whereas the final shape is given by the profiling tool post. The roughing tool posts also carry tools to plane new tyres at the faces to exact dimensions and gauge distance. The profiling tool posts operate on cam principle, one cam being provided for the shape of the flange and one cam for the taper of the tread. Each of these cams is controlling a traverse of one tool, thus dividing the total length of the profile to be machined into two parts.

The variety of wheel sets, regarding the diameter of wheels and gauges, as well as the possibility of centering and driving call for different types of machines and different manufacturers have placed in the market different types, each having its own distinguishable features, so as to offer a wider scope of selection. Illustrated in Fig. 4, is a CRAVEN 4'-0" faceplate double railway wheel lathe in operation. The tool rests in this case are fitted with turrets of 4-position type and arranged to take both high speed and carbide tipped tools. They are, as may be seen in the photograph, are mounted on a turret slide which is fitted on a swivel slide to be set at the correct angle for the tread. The tool slides have longitudinal and transverse continuous feed traverse in both direction.

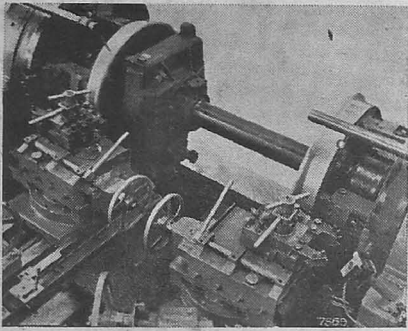


Fig. 4. 4'-0" Face plate C & W wheel lathe of craven make with turret type tool rests.

### AXLE JOURNAL RETURNING AND BURNISHING LATHE

Fig. 5, illustrates the friction roller drive type axle journal re-turning and burnishing lathe to deal with outside journals of carriage and Wagon axles with the wheels mounted.

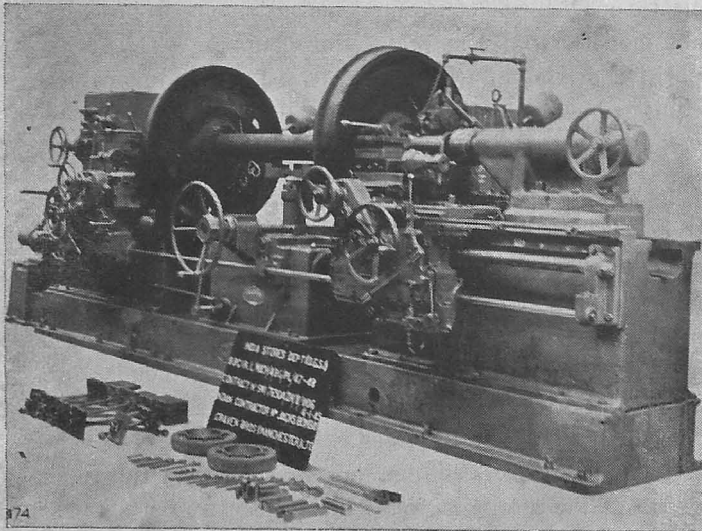


Fig. 5. Friction roller Type axle journal returning & Burnishing lathe. (craven make)

The lathe consists of a straight main bed with short members mounted on each end forming a double gap to take the wheel sets. The short members are provided with slideways on the upper surface upon which are mounted the saddles and the fast and loose headstocks.

The two live friction rollers acting on the treads of the wheels are driven by a shaft along the bed, from a constant speed motor and change speed gear box at the end.

The burnishing is effected by means of three rollers. A device is incorporated in the arrangement to bring the rollers readily into position against the journals, the frame carrying the top roller being balanced. A four-position turret tool rest, having variable self-acting transverse feed traverse, with adjustable stops for tripping the feed, and hand operated transverse and longitudinal adjustment is mounted at the front of each saddle for returning and radiusing the journals, and facing the outside bosses of the wheels.

Fig. 6 shows the special type of sliding bed lathe arranged for the re-turning of railway axle journals. The machine is arranged with a double sliding bed so

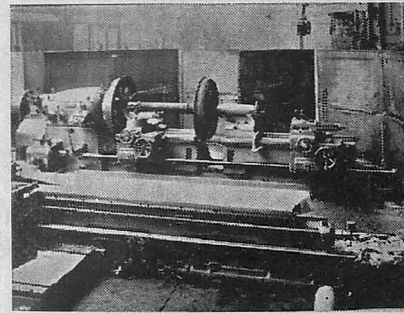


Fig. 6. Lang Axle journal re-turning break lathe.

that two gaps may be formed to take the wheels while the axle journals are being machined. Two saddles are fitted at each piece of sliding bed.

The lathe is suitable for returning journals which are inside or outside the wheels. The width of the gap can be varied to suit different lengths of axle.

### AXLE TURNING LATHE

The typical arrangement of a lathe suitable for axle turning is shown in Fig. 7. The machine is arranged

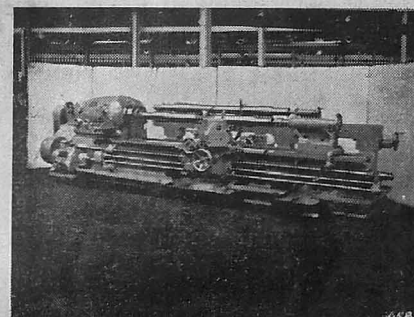


Fig. 7. Axle turning lathe.

with a special two-speed drive to the fasthead giving two speed ranges as follows:—

Fast : 12 speeds, 12.8 to 630 r. p. m.

Slow : 12 speeds, 4.4 to 219 r. p. m.

The slow range of speeds is intended for finish turning the radii of the journals and water scraping the journals. The fast range enables full use to be made of tungsten carbide tools on high speed cuts giving a fine finish.

The saddle is arranged with two mild steel square turrets one at the front and one at the rear of the machine. This enables the tools for machining the radii of the journals to be drawn into the work without any indexing of the turret. The saddle is arranged with a clock and brackets for length rods which can be used for accurate sizing if required.

The lathe is arranged with taper turning attachment with capacity of  $4\frac{1}{2}$  deg. at either side of the centre line with a maximum length of taper of  $30''$ , enabling the taper in the centre of the axle and the taper on the wheel seat to be machined.

#### AXLE TURNING BY PROFILING

A recent advance has been made from the above method of axle turning whereby the axle is machined by profiling from a master carried at the rear of the lathe as shown in Fig. 8.

Many different means of operations have been developed for profiling. They are electronic, hydraulic, pneumatic, electronic-hydraulic and pneumatic hydraulic. Each method has its own peculiar advantages and disadvantages, but for economy and reliability, the simple hydraulic methods are generally preferred.

It is however emphasized that all methods are essentially error-operated that is, the following stylus

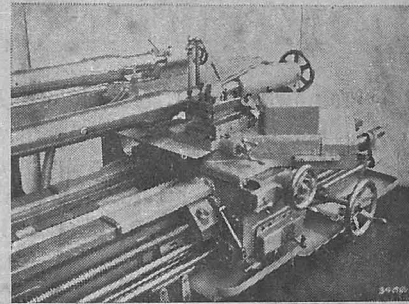


Fig. 8. Axle turning by hydraulic profiling.

must be displaced to produce movement of the tool slide. The electronic methods are the most sensitive from this point of view and are therefore more accurate. Nevertheless, for normal machining purposes ample accuracy can be obtained hydraulically and this method has now been generally adopted for profiling on lathes.

In the machine illustrated, which incorporates a hydraulic profiling arrangement, the action of the profiling is as follows:—

A 45 deg. tool slide is operated by a hydraulic cylinder which is controlled by a stylus bearing on a master. As the saddle traverses the stylus causes the cylinder to move the tool in such a way as to reproduce the profile of the model on the work. An adjustment is provided to allow the tool to be moved relative to the stylus to adjust for diameter and shoulder position. The arrangement ensures consistent accuracy between each axle and also produces faster production times owing to the elimination of non-cutting time.

Before concluding the writer wants to emphasize that the machines illustrated and described are by no means the only suitable examples of their kind rather it has been his endeavour to select some typical and present day models from along the impressive array turned out by the machine-tool builders of to-day with a view to showing the progress so far made in this direction.

#### RECORD PRODUCTION AND EXPORT OF U. K. DIESEL LOCOS.

The production and export of Diesel locomotives built in the United Kingdom have broken all records this year.

In the first half of this year, the combined output of British firms making Diesel and Diesel-electric locomotives was 501. This is a rise of 50 per cent. compared with the same period in 1955.

The English Electric Co. recently completed delivery of 23 2,000-h.p. Diesel locomotives for Rhodesian Railways, and 42 mixed-traffic units for New Zealand. These orders are in addition to those for Netherlands Railways, British Railways, and others. Diesel locomotives built by English Electric are also operating in the Calcutta area.

At present, British builders of Diesel locomotives are executing orders from Malayan Railways, East African Railways, Netherlands Railways and Irish State Transport, as well as from the British Transport Commission.

## LOCOMOTIVE OPERATION IN TASMANIA

**F**OR two years now the 3 ft. 6 in. gauge Emu Bay Railway in Tasmania has been running with great profit a 530 b.h.p. Paxman-engined diesel-hydraulic locomotive in line service. It is used in freight service only, for passenger traffic on the line is handled by railcar.

Silver lead ore is the main traffic on the Emu Bay Railway, the loaded trains coming from the mining area around Rosebery to the sea at Burnie, a distance of 70 miles, in the course of which the track climbs from 640 ft. to 2,306 ft. in 25 miles mainly by 1 in 40 grades, and then falls from the summit to 125 ft. at Burnie at gradients of 1 in 33-40-60. In combination with the heavy grades are almost continuous curves, and full-length ore trains are sometimes on three curves at once. In fact, we believe it true to say that except in stations a

full length train is never wholly on straight track for 65 out of the 70 miles; and the locomotive itself is fitted with a Beugnot bogie connecting the two leading axles in order to ease the passage round the numerous 4-chain curves which, along with the track conditions have resulted in a top speed limit of 25 m.p.h. for all locomotives.

Extremes of climate are considerable; in temperature from over 80 deg. F. to under 25 deg F., and with long-maintained cold winds coming in off the sea into Burnie shed. Routine traffic on the railway calls for two trips a day with load from Rosebery to Burnie, and two corresponding return trips with empties and miscellaneous supplies. One of these round trips is usually made by the diesel, and the other by the Garratt steam locomotive built years ago.



Both forms of motive power take a normal trailing load of 165 to 200 tons, and the diesel pulls this up the 1 in 33 ruling grade at a steady 5 to 6 m.p.h. with great consistency day after day, whereas the steam locomotives have some difficulties with moist rails. Time for a round trip of 140 miles is 11 to 11½ hr., and the return journey is accomplished six days a week. An immersion heater has been fitted into the cooling water circuit to give easy engine starting after lying over the week end Burnie

during the winter, and to minimise cylinder liner wear; and the radiators have been moved to the casing roof to help equal cooling in each direction of travel. Apart from these details, no modifications have been made, or special equipment fitted to the Paxman pressure-charged 12-cylinder 7 in. bore engine, which is to give 530 b.h.p. at 1,150 r.p.m. at 2,300 ft., and no troubles have been encountered with it. Compared with steam traction the overall economy is reckoned at about £ 60 per round trip.

## "CREATING" NEW RAIL TRANSPORT CAPACITY

### RAILWAY BOARD'S APPEAL FOR CO-OPERATION FROM TRADE

In a communication addressed to chambers of commerce and other representative business organisations, in the country, the Railway Board has invited the co-operation of the business community in making a success of the railway campaign to "work the wagons harder".

These organisations have been informed that the Railway Board has decided to reduce to five hours the existing "free time" allotted to the trade for loading and unloading of wagons, so that these may be back-loaded the very same day. The reduced "free time" will be enforced from November 1, 1956, when the new busy season starts.

As part of the campaign to "work the wagons harder", the Railway Board has already issued instructions that the Railway's own coal wagons should, with immediate effect, be released in three hours instead of six and that wagons containing other railway material should be released within five hours instead of in six, as previously. Steps are also in hand to reduce the detention of wagons in collieries and other sidings and port areas.

The Railway Board's communication emphasises that in view of the likelihood of a shortfall in the availability of rail transportation during the second Plan period, it is of the highest importance that the maximum possible use should be made of the railway's existing resources in wagons, engines and line capacity, as more intensive use of existing resources would mean the "creation" of additional transportation capacity.

The Railway Board has urged the business community to extend its whole-hearted support to this and to any other measures which Railway Administrations may be constrained to take, as these measures will not only be in the wider national interests, but also in the particular interests of the large number of individual business

organisations which depend for their development on the maximum possible availability of rail transportation.

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### FRENCH TEAM'S REPORT ON RAILWAY ELECTRIFICATION PRESENTED

A report on certain technical aspects of railway electrification in India by a team of French railway experts was recently presented to the Railway Board at a ceremony in New Delhi.

The report was presented by the leader of the team Mr. F. Nouvion, Chief Engineer of the French National Railways, to Shri G. Pande, Chairman, Railway Board. Among those present at the ceremony were Mr. M. Christian Belle, French Minister Counsellor in New Delhi, Mr. M. Guy Chaumet, French Counsellor for Economic Affairs, Mr. J. Boulgne, Project Engineer, French Railways, and Members and Additional Members of the Railway Board.

Acknowledging the "very hard" work put in by the team, Shri Pande said that the report would be most valuable in helping the Government of India in coming to a final decision on railway electrification. He requested Mr. Belle, the French Minister Counsellor, to convey to his Government and to the French National Railways, the gratitude of the Government of India for the help given by the team.

In their report, the team has expressed the opinion that the A. C. 50 cycles traction system would be more appropriate for the Indian conditions, and substantially cheaper than the D. C. system.

The services of the team were placed at the disposal of the Government of India about three months ago by the French Government, which had also offered to meet the teams' expenses on travel and stay in India.

The team undertook a tour of certain sections of the Indian railways where electrification is proposed, and flew back to France, where the report was finalised. The report will now be considered by the Railway Board.

## GANG SLITTING MACHINE

**B**UILT to give absolute precision in operation, the Besco Model No. 36 Gang Slitter provides the Tin Box Making and Light Sheet Metal Industries with a fine product and first class cutting service. It embodies the essential modern features, necessary to mass production technique, of faster and more efficient feeding, with accurate cutter maintenance. The machine has been designed with practical forethought for introduction into existing production lines and the grinding attachment, cutters and hubs are interchangeable in some cases with similar equipment produced by other well known machinery manufacturers.

Simple to operate, this machine will slit lithographed and other tin plate, with accurate parallel cuts, up to 60 sheets per minute, according to the operator's skill. Its speedy performance and ease of adaptability for the cutting of blanks for all kinds of metal packs makes it eminently suitable for installation in can making lines where frequent changes in size are required. Mild steel sheet up to a maximum thickness of .0375 inches can also be cut with less cuts per operation.

Constructed to endure long working periods at high out-put rates, the machine is manufactured with the table, a heavily ribbed casting with a precisely machined flat top surface, superimposed upon a rigid box section cast iron stand of ample strength for complete steadiness while running. The machine is arranged so that it can be driven by belt from a line shaft or by self-contained motor for 400-440 volts, 3 phase, 50 cycles supply, with drive and machine cut gears adequately guarded by sheet metal covers.

All working parts, drive gears, clutch, etc., with the exception of the gears for driving the feed-in rolls are positioned on the left hand side of the machine.

The machine will also cut paper and card, thin wire mesh, sheet celluloid, plastics and other similar light materials.

*Cutters:* Shearing cutters are of high grade alloy steel, with double edges, ground with uniform accuracy, to an angle of  $1\frac{1}{2}^{\circ}$  to  $3^{\circ}$ , from the outside edge towards the centre, the variation of grinding angle depending upon the hardness of the material which is to be cut. These cutters are attached by countersunk screws to the hub, this being locked on the shaft by a method which

ensures long cutter life and accurate cutting. Should one side of the cutters become dulled they can be mated with either the inside or outside cutting edge, thus providing a double life for each cutter and a ready answer should one edge become dull. Standard or narrow width hubs can be supplied as required. The cutters are mounted on heat treated precision ground alloy steel shafts.

*Grinding attachment:* An electrical grinding attachment can be supplied, this may be said to be essential equipment because the cutters must be ground with uniform accuracy and this can only be achieved on the machine. The grinding apparatus fits to the rear of the machine after removal of the feed-out rolls and the grinding of the cutters takes place *in situ*.

*Front feed Rolls,* for fixing in front of the cutters, can be supplied if required. These are a special feature of the machine and greatly increase feeding efficiency in slitting, preventing twisting of the metal during cutting operations, particularly while cutting very narrow strips. Guide fingers with finger bars can be supplied for supporting the metal in position while slitting. These are not necessary if front feed rolls are used.

*Feed out Rolls* are supplied as standard equipment. These are fitted to the rear of the machine and easy access is provided to the fixing screws of the bearings when the necessity of grinding the cutters makes removal of the rolls essential.

All rolls are of high grade alloy steel, heat treated and precision ground, and ample means of lubrication are provided.

*The Clutch* is of the internal expansion type with a smooth positive action and non-slip operation. Control is by hand lever with a lateral movement, situated on the left hand side of the machine.

The machine is supplied fitted with table, feed out rolls and provision for grinding attachment. *Extra Equipment* includes feed finger bars, feed fingers, front feed rolls, cutters, wide hubs, narrow hubs, grinding attachment, and self-contained motor 400-440 volts, 3 phase, 50 cycles and starter. The motor mounts on a base plate, adjustable for varying tension in the vee belt drive.

# HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I and II Class)<sup>o</sup> or Seat (3rd Class long distance) in advance, you may not be sure of getting accommodation on the train you wish to travel by.

Application should be made to the Station Master of your starting station at least 3 days in advance specifying the date and train by which you intend travelling and the tickets must be bought in advance. The reservation fee leviable is 8 Annas per seat or berth.

Reservation by I and II Class from intermediate stations by Express trains can also be made similarly, but reservation ticket can be issued only after getting an advice from the Reservation Centre that the reservation has been made.

Tickets will be issued only if accommodation is available.

If the reserved seats or berths are not occupied at least 5 minutes before the booked departure of the train the reservation will be cancelled and the seat or berth given away to another.

*Reservation fee is not refundable.*

III Class seats are also reservable on Express and certain other important trains for long distance passengers from the train-starting stations on payment of a reservation fee of 4 Annas per seat.

Do not occupy a berth or seat reserved for another, as you are liable to be displaced at the last moment.

If you find another person occupying the berth or seat reserved for you and if he will not vacate it on demand, report it to the Guard or Station Master. They will help you.

*( Inserted in the interests of Travelling Public )*

# CLEANLINESS LEADS TO HEALTH AND HAPPINESS

*Clean orderly habits contribute to general health and welfare and as such to happiness and prosperity; they are more important than medicines.*

*Cleanliness prevents disease; medicine only attempts to cure.*

*Cleanliness of the person, of the houses and colonies, reflects discipline in the individual and the community. Discipline is the foundation stone for progress of oneself and the country. Cleanliness is a good habit. It is also cheap.*

*All Railwaymen should set an example of cleanliness. This will help others and themselves.*