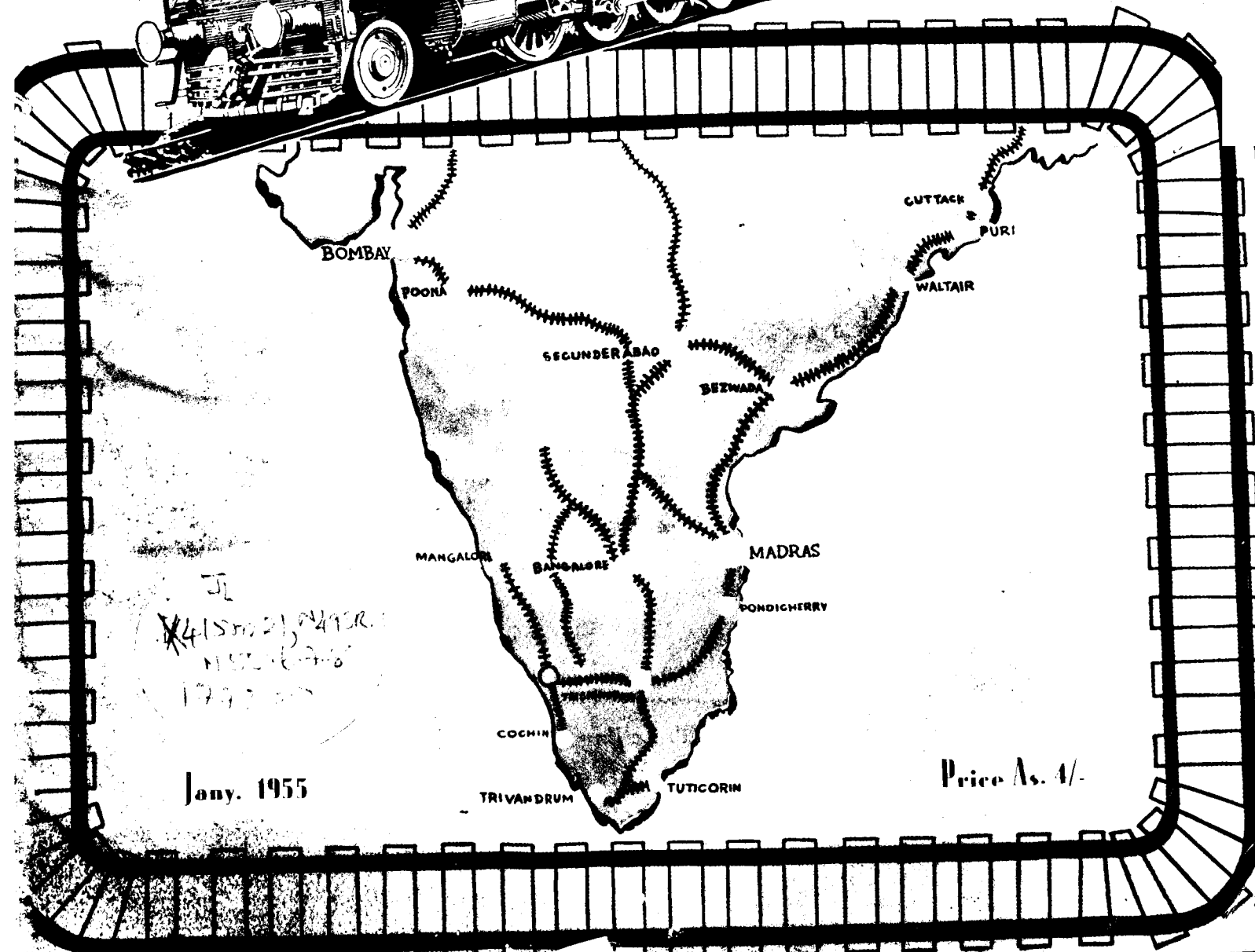
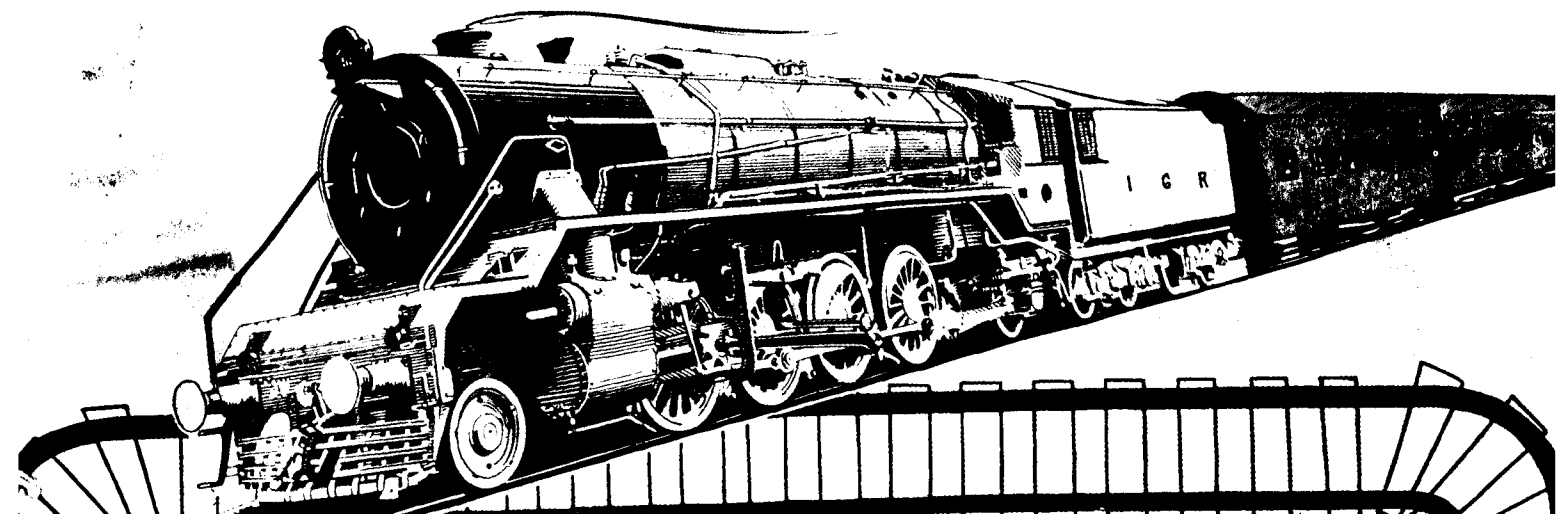


SOUTHERN RAILWAYS

Magazine



Jan. 1955

Price Rs. 4/-

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Unless you reserve your berth (I and II Class) or Seat (Inter and 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.

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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.

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(Inserted in the interests of Travelling Public by the Public Relations Officer, Southern Railways Magazine)

SOUTHERN RAILWAYS MAGAZINE

VOL. VI
NO. 7

JANUARY

ISSUED
MONTHLY

“COAL TRANSPORT POSITION IMPROVES”

RECENT statistics that have been made available with regard to the movement of coal indicates that there has been a definite improvement in the coal transport position.

Railway administrations concerned with the transport of coal claim that the daily allotment of wagons is being made in full in all directions, except up-country beyond Moghalsarai. But even in this direction there has been evidence of considerable improvement.

In the Bengal-Bihar coalfields the daily average loading of wagons has achieved somewhat of a record in September 1954, during which period 3593 wagons were loaded per day. If we glance over the figures of daily average loadings for this area in previous months, we find that 3558 wagons were loaded in August, 3351 in July, 3061 in March, 2865 in February and 2874 in January of this year. In October this figure was 3432, which shows a decline of 161 wagons. The average daily loadings of wagons in all coalfields in October 1954 came to 4162, as against 4407 in September, 4345 in August and 4135 in July 1954. From these statistics it is therefore obvious that the Bengal and Bihar coalfields accounted for a major portion of the loadings. To meet the pressing demands for the movement of coal beyond Moghalsarai, we find that the average daily movement of wagons in this direction was 1309 in October 1954 as compared with 1324 in September, 1297 in August and 1212 in July of this year. Even in this direction there has been some improvement.

Looking over the figures of the daily average loadings of wagons since July 1954, we find that here too there has been an improvement as compared with the corresponding period of the previous year. In October 1954 the daily average loadings were 4162 in all coalfields, as against 4164 for October 1953, a decrease of only two wagons. In September we have a far better performance, with 4407 loaded as against 4022 in the corresponding month of 1953; a substantial increase of 385 wagons per day. August 1954 shows 4345 as against 3732 for August 1953, an increase of 613 wagons daily, which is again a substantial improvement.

This substantial improvement in loadings has reflected favourably in the pithead coal stock position, by considerably reducing the pithead accumulation during the first

four months of the current half-year as compared with the same period of the previous year. At the end of October 1954 the pithead stocks were 2,913,695 tons as against 3,017,572 tons at the end of July 1954. The corresponding figures for the previous year were 2,960,000 and 3,286,030 tons respectively.

It appears that the daily average loadings of wagons would have been considerably higher, as a large number of empty wagons which were available for loading, but were not utilised for lack of indents of otherwise. The goods traffic position had thus, it is stated, also become easier.

The improved coal transport position has also had other favourable repercussions on the coal trade in general. Collieries have been permitted to open dumps of brick-burning coal at suitable places in consultation with State Coal Controllers and the Railway authorities. Depots and dumpholders, who are not colliery owners, have also been allowed to bring down 'slack' coal (below selected 'A' grade) to their depots of dumps from collieries with heavy stocks.

The position of industrial consumers who are required to use other than brick-burning coal or domestic coke, has also been eased, as they have been ad hoc sanctioned outside their usual quotas, thus enabling them to build up their stocks when wagon supplies are adequate.

Associations concerned with the manufacture of bricks have been allotted large numbers of wagons for the transport of slack coal to dumps from where the coal can be distributed according to the needs of the industry during the brick-burning season. Individual brick manufacturers are also permitted to take extra quantities, but within the brick-burning quota of collieries.

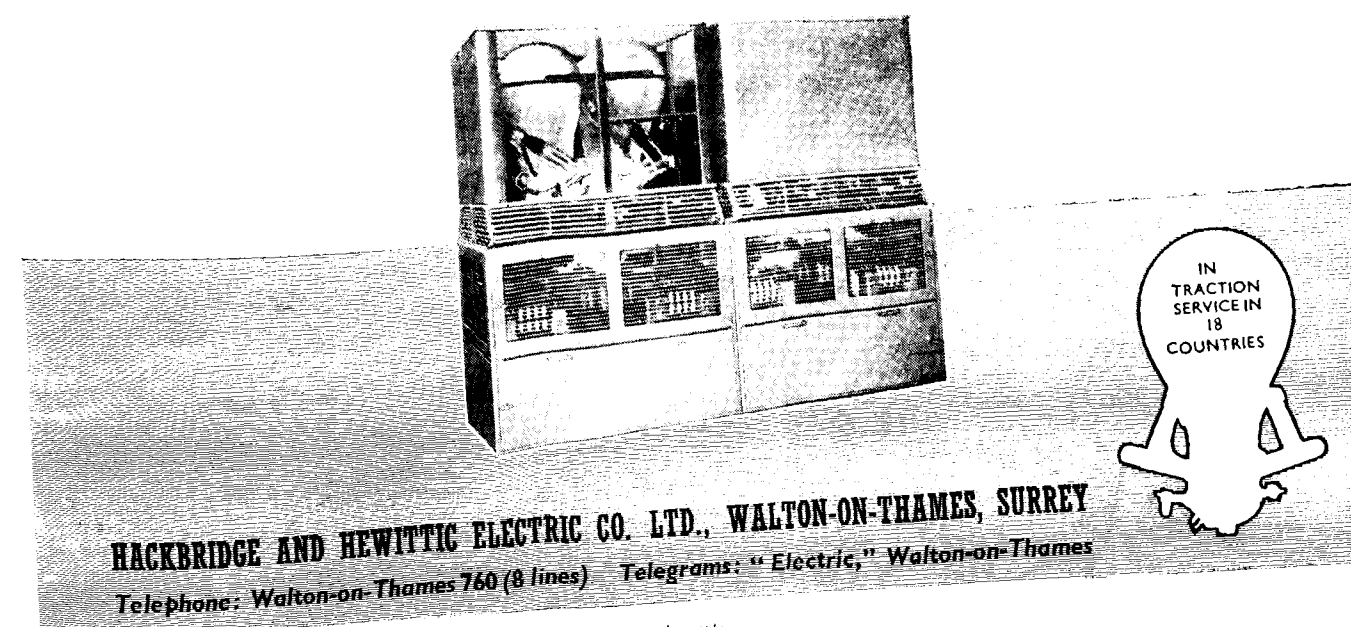
This substantial improvement in the coal transport situation is encouraging, but this should not let the Railways feel too complacent, as there are instances occasionally of maldistribution of wagons which have led to an accumulation of coal stocks at pitheads. The recent improved trends in coal transport have obviously been brought about by the Railways being on the alert to step up daily loadings and accelerate movement, and the coal trade can have the confidence that what has been achieved in recent months by the Railways, will continue at the same, if not at a higher level of performance.



ON THE RIGHT LINES

Electrification schemes in which HEWITTIC RECTIFIERS are specified as the converting plant are on the right lines—lines which stretch back over a past experience of 30 years in the manufacture of heavy duty rectifiers and which lead on to long, reliable and economical service.

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Pakistan: James Finlay & Co. Ltd., P. O. Box No. 29, Finlay House, Karachi.

INCREASED BOILER EFFICIENCY

By W. G. W. Reid, M. I. Loco. E.

Former Chief Mechanical Engineer, General Manager, Southern Railway & Member of the Railway Board.

THE continued steady rise in the cost of fuel, the heavy capital charge of replacement of locomotive power demands high boiler efficiency and minimum lay off time during operation.

Various methods are used to conserve coal, by lowering the amount used, per lb. of steam generated, but complication in the operation of the locomotive due to some of the devices used may lead to increase in the time it is laid off for repairs and although these may be an intrinsic saving in fuel, the value of such savings may be lost in the inability of the locomotive to earn revenue because of its non-availability.

It is essential that no auxiliary to the main engine should be the cause of putting a locomotive out of service. Such maintenance which every auxiliary must periodically be given should be undertaken only when it is imperative to lay the engine off for essential servicing. Intermittent stoppage due to the failure of any auxiliary must be avoided if its value is not to be swamped in the failure of the locomotive to be available for service when required.

The steam locomotive is a means of converting the latent energy of the fuel into useful work but before this heat energy can be utilised it must be released through the process of combustion, and then transferred through the boiler plates and flues to the water where it appears in the form of steam.

Anything which will facilitate the transfer of heat adds to the efficiency of the process.

The Nicholson Thermic Syphon materially adds to the firebox heating surface and being in the direct path of the firebox gases absorbs heat not only by direct radiation but also by convection, the efficiency of heat absorption being materially assisted by the rapid circulation of the water through the Syphon.

The improvement in heat transfer, since the Syphon is an integral part of the firebox from the commencement of its life, is effective from the time the locomotive is first fired until it is withdrawn from service. This increased heat transfer means:

Increased (Performance) Efficiency
Increased Capacity
Fuel Economy
Lower Maintenance Costs

Further the Syphon is used to support the brick arch, either by itself or in conjunction with arch tubes, and in the event of a low water failure serves to prevent extensive damage to the roof sheet. The question of maintenance as an auxiliary can be dismissed as a factor liable to cause the locomotive to be laid off for out of course repairs, as it is an integral part of the firebox and needs no attention which is not given to the firebox of a locomotive in ordinary service.

Any saving of fuel by the use of Nicholson Thermic Syphons can therefore be considered as an actual saving in overall operation since the factors which may have a serious effect on operating availability do not play any part once the Syphon is installed. No demands are placed upon the engine crew to pay special attention to the Syphon whilst any locomotive so fitted is in operation and beyond routine inspection given at the same time as the firebox is normally inspected by the shed staff, there is no extra work involved in its maintenance.

Lower Boiler Maintenance costs and longer life of flues and fireboxes are additional important results of effective circulation.

It has long been common knowledge that the principles of the amount of heating surface and rapid circulation are fundamental when considering the efficiency of steam boilers, so it is accepted that the greater degree to which a uniform temperature can be kept throughout the boiler (thereby minimizing the stresses set up by lack of uniformity) so will general boiler maintenance costs be reduced.

On the Locomotive Testing Plant owned by the University of Illinois, two Illinois Central locomotives alike in all respects, except that one was fitted with a Nicholson Thermic Syphon, were placed on test. The results of these tests indicated that the Syphon fitted boiler was more efficient at all firing rates varying between 30 lb. and 90 lb. per sq. ft. of grate area per hour. Further tests carried out on the Nashville, Chattanooga and St. Louis Railway with freight service locomotives

(Continued on page 5)

Growing Demand for Diesel and Electric Units

By R. E. Hicks

PRESTON, in Lancashire, is today famous as the place where the record-breaking jet bomber and the supersonic jet fighter are made. For a much longer time, however, going back far beyond the jet age, and even beyond the age of powered flight, to the end of the last century, these works at Preston have been renowned for the manufacture of electric and diesel electric locomotives and trains, trolley buses and tram cars, now in use all over the world.

British-built diesel-electric locomotives or their power equipment of widely varying weights and power, have been supplied to, or are on order for, the Argentine, Australia, Brazil, Ceylon, Egypt, the Gold Coast, Holland, India, Malaya, New Zealand, Nigeria, Rhodesia, Spain, the Sudan and Sweden. The 660-h. p. diesel-electric locomotives used in New Zealand for hauling the Royal train during the recent Royal tour of the Commonwealth were supplied by a British firm. Now the same firm is to supply, this year, ten 1500-h. p. diesel-electric locomotives which will be the most powerful of their type to operate in that country. Rhodesia has ordered twenty-three 2000-h. p. locomotives and they will be the largest narrow gauge diesel electrics in the world.

Examples of the application of diesel-electric transmission to complete trains are the high-speed five-

coach express air-conditioned units supplied to the Egyptian State Railways. Modified versions have also been supplied for suburban services and three-car versions for feeder services. Forty-eight diesel-electric locomotives, each weighing 77½ tons and of 1,105 h. p., have been ordered from Britain by the Western Australian Government.

OVERSEA INTERESTS

This British industry by virtue of its wide overseas interests has evolved naturally over the years into an engineering and production group which can meet the most diverse conditions required abroad. The limitations of load gauge, axle-loading, gradients and climatic conditions impose a considerable degree of restraint on standardisation of design. The industry has long experience of "design for the job" and does not attempt to force a standard product on overseas customers which may or may not meet their requirements.

The present high level of activity in both the railway diesel and electric traction field can be noted from the figures for export of locomotives other than steam, which have steadily increased over the last few years from £1.8 million in 1950 to £6.3 million in 1953. This compares with the steam locomotive exports of about £7.5 million in 1950 and £6.2 million in 1953.

(Continued from page 4)

showed an economy of fuel with engines fitted with Nicholson Thermic Syphons of 11.52% per 1000 gross ton miles and on the basis of fuel per drawbar Horse Power as 8.57.

A large number of fireboxes in modern locomotives are made of steel, the welding method of fabrication being favoured when steel is employed. The construction of the Nicholson Thermic Syphon ensures that there is no loss of strength in the construction of the firebox as a whole as the special methods of manufacturers enables the same factor of safety to be employed.

Firebox heating surface is the main factor (in considering the combustion efficiency as a whole) which determines the heat absorption by the boiler water. The evaporative power per unit of area of the firebox is considerably more than that of the flues and tubes and since the thermic

syphon is located in the firebox, the increase in heating surface is located in a position where any increase is producing the maximum efficiency.

Further the design of the Syphon itself increases the rate of water circulation enabling the boiler to deliver a heavier weight of steam, in effect more boiler horsepower is available than with engines not so equipped.

The use of Nicholson Thermic Syphons is extensive in the United States and over one hundred Railways in various other parts of the world are operating more than 7000 locomotives fitted with Nicholson Thermic Syphons. The world total usage in 1947 according to the Locomotive Firebox Company of America was 30,000 in nearly 13,000 locomotives, spread over 200 Railways. Since then many hundreds of additional locomotives have been equipped.

SAXENA THE INTREPID

By Socrates

"WELL, I think Saxena will be a better selection; he certainly has the dash and the push".

These prophetic words were more than amply proved by the events that took place since the occasion which have brought out the great qualities of Saxena, the present General Manager of the Western Railway.

Establishment matters are perplexing and even the keenest brain of an engineer would sometimes be baffled, and so, Saxena had not been an exception to it. As Director of Establishment for a number of years he had to tackle varied problems affecting the life and labour of the Indian railwaymen, and the peculiar problems that arose out of the partition of the country and the re-grouping of the railways presented a period of trial which he successfully piloted and won laurels. The very fact that he played his part so very well in spite of the difficulties of the times and shaped the destinies of the numberless railwaymen, whom he managed to keep firm in their saddle, despite bubbles here and there, is proof of the talents, capacities and industry he possessed in such abundant measure.

When Saxena was called upon to take charge of the personnel branch of the then East Indian Railway in the year 1946 many thought that he would not acclimatise himself to the tentacles that faced him. It was a peculiarly difficult time. Mother India was on the throes of a childbirth; division of the country was clearly visible in the horizon; the communal carnage had only partly subsided; the option of many technicians to Pakistan meant avoid that could not be adequately filled; the Pay Commission recommendations had just come in for implementation, and labour problems were assuming immense proportions—in short the entire railway system was so to say in pell-mell.

Saxena with his ingenious brain of an adept engineer decided that he must make history and applied himself to that task sedulously and courageously. Soon he found that success was on his side, for, he had, as his Chief one of the ablest General Managers whose *behest* it was that the time-honoured tradition? Of *delay and denial* in personnel matters should be done away with. Suffice it to say that Saxena was full up to the game.

When the Central Pay Commission's recommendations had been received it was his brain that thought of a shortcut to the entire new pay structure and within a few days he prepared a chart and named it "Saxena's



Shri P. N. Saxena.

Chart" which was hailed as a ready reckoner for fixation of pay in the new scales.

Similarly, when it came to the question of tackling the railway unions and its Federation in their regular and special meetings, as also at the Joint Advisory Committee discussions, Saxena faced the assembly fully armed with up-to-date information and statistics and while he calmly listened to the hot discussions he rarely offered an unthinking remark, but, in the end, when

his turn came, he argued convincingly and naturally victory was his.

It was a strange but unfortunate coincidence that Saxena who was responsible for expanding the grainshop facilities to the railwaymen as Deputy General Manager (Grainshop) he had at a later date also to curtail those very facilities as a Member of the Gadgil Committee.

Starting career as a probationary Engineer he rose to positions up to the District level in the Engineering cadre, and since his drafting to the personnel side his promotion had been rapid. For sometime he held charge of a Division on the then East Indian Railway and went to the Railway Board as its Director of Establishment after partition when Mushran went over to the Western Railway as its General Manager. In his new position as General Manager Saxena will have further opportunities of contributing vitally to the welfare and well-being of a large number of railwaymen in that part of the country and will perhaps "*write*" history.

23 NEW LOCOMOTIVES DELIVERED IN SEPTEMBER

Twenty-three new locomotives, of which 12 were made in India, were delivered to the Indian Railways during September last year.

The Chittaranjan Works delivered eight locomotives during the month, while another four were manufactured by TELCO. Of the 11 locomotives which came from abroad, Japan supplied 8, Germany 2 and the United Kingdom 1.

Including the 23 locomotives delivered during September, the Indian Railways had received in all 157 engines during the current financial year, leaving a balance of 1,071 engines to be delivered against orders placed for 1954-55 and the two succeeding years.

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British Expert to Lecture at U. N. Railway Training Centre

ONE-YEAR ASSIGNMENT IN LAHORE

Mr. Frederick C. E. Goss, technical assistant and signal engineer of the Westinghouse Brake and Signal Company, London, has accepted an appointment from the United Nations Technical Assistance Administration to serve as the principal lecturer at the U. N. Railway Training Centre in Lahore.

During his assignment in Lahore, Mr. Goss will organize and co-ordinate the teaching and training activities of the lecturers at the centre, supervise the general planning of the facilities at the centre, and undertake responsibility for its general administration. He will also act as secretary of the training centre's advisory board. His appointment is initially for one year.

Mr. Goss has served with the Westinghouse Brake and Signal Company since 1951 in his present post. He was with the same firm from 1925 to 1929 as a technical assistant. From 1929 to 1951, Mr. Goss was a signal

engineer with the Buenos Aires Great Southern Railway (now the Argentine National Railway). In this capacity he inaugurated a railway signalling school there, and was the chief lecturer and demonstrator.

FIVE COURSES A YEAR

The U. N. Railway Training Centre in Lahore, opened last April, is sponsored by two United Nations agencies—the U. N. Technical Assistance Administration, and the Economic Commission for Asia and the Far East (ECAFE). The centre is designed to serve trainees from all countries in the ECAFE area. It offers every year three courses in railway operations and two in signalling, with about 20 students taking each course. The overall policy of the centre is decided by an advisory board comprising, for the first year, representatives from India, Pakistan, Burma, the U. N. Technical Assistance Administration, and ECAFE.

The latest signalling and other equipment has been given to the centre by the United Kingdom, France, Japan, Belgium, and the Netherlands.

American Railway Engineering Association

PASSENGER CAR SHOPS

THE following essential points should be given consideration in designing passenger car repair shops:

1. Suitable provision to be made for future expansion of all facilities.
2. Capacity should be determined on basis of number of cars to be shopped in a given time, balanced against traffic demands and effect of manufacturing operations.
3. All buildings to be of substantial fireproof construction, amply lighted, both natural and artificial; comfortable heated and well ventilated.
4. Tracks in coach shop should have minimum spacing of 24 ft. centre to centre, except where columns are located between tracks, when 12 ft. from face of column to centre of track should be provided.
5. Where separate provisions are made for stripping and trimming, the minimum track spacing should be 20 ft., and in the truck shop 15 ft.

6. Overhead clearance in coach shop should be not less than 22 ft. to bottom chord of roof truss.

7. Width of coach shop should not be less than the length of longest car plus 27 ft.

8. Doors should provide a clear opening of 14 ft. by 17 ft. unless otherwise prescribed by law.

9. Generous use of cranes, hoists and monorail is desirable.

10. Layout to be such that all operations follow in logical sequence so far as possible. Drop tables and inspection pits may be provided.

11. Manufacturing departments should be grouped as conveniently as possible to the point where the respective parts are applied.

1 References, Vol. 27, 1926, pp. 303, 1312; Vol. 48, 1947, pp. 299, 883; Vol. 54, 1953, pp. 570, 1369.

1 Latest page consist: 1 and 2 (1953).

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Misc. 134/161

12. Main and substorehouses should be located as centrally as possible to the departments they serve. Sufficient substorerooms should be provided as to provide material reasonably close to the shop operations.

13. Paved roadways and walks of ample width are highly desirable.

14. Ample storage space for cars to be shopped, as well as finished cars, is essential.

15. Separate inspection facilities are desirable.

16. Special provision should be made for preventing and fighting fires.

' FREIGHT' CAR REPAIR SHOPS

1. The distance from the centre line of the outside car repair track in a car shop building to any projection on the outside wall should be not less than 11 ft.

2. The distance centre line to centre line of repair tracks that have a standard gage material track between them should be not less than 22 ft.

3. The distance centre line to centre line of repair tracks that do not have a material track between them should be not less than 18 ft.

4. The distance centre line to centre line of car repair tracks where a row of columns is located between the tracks should not be less than 22 ft., and in no case should the distance from face of columns to centre line of adjacent repair track be less than 10 ft.

5. The minimum distance from the top of rail to bottom of travelling crane bridge, in car shops that do not lift cars over each other, should be 23 ft.

6. Car repair shops should be arranged so that cars can be switched from both ends.

7. Material tracks in car repair shops and yards should be standard gage.

8. That portion of the car repair shop floor between the outer rails of adjacent repair tracks, having a material track between them, should be paved or planked and suitable paved or planked roadways should be extended out into material yards to facilitate trucking and the use of tractors for handling material.

9. In shops where cranes are not employed the overhead clearance, measuring from top of rail should be not less than 20 ft., door openings excepted.

10. Except where otherwise prescribed by law, repair track door openings should not be less than 13 ft. wide by 17 ft. high

11. Suitable provision should be made in the formulation of plans to provide for reasonable extensions of all buildings and facilities.

12. Suitable means should be provided for prompt and economical handling of material and supplies through the application of cranes, hoists, monorails, supply tracks and roadways for tractors and trailers.

¹ References, Vol. 26, 1925, pp. 137, 1260; Vol. 48, 1947, pp. 299, 883; Vol. 54, 1953, pp. 570, 1369.

¹ Latest page consist: 2 and 3 (1953).

13. It is recommended that fireproof or slow-burning construction be employed for the building structures.

14. It is recommended that the roof and side wall construction be such as to afford maximum natural light and ventilation.

15. Ample artificial illumination is recommended.

16. Heat is recommended for the colder climates.

' CAR PAINT' SHOPS

General

1. Paint shops should be separate buildings or separated from car shops by fire walls and cars should be prepared for painting outside of the paint shop.

2. The capacity of the proposed shop may be determined on a percentage basis by the following formula:

$$X = ac/bd$$

X represents capacity of shop expressed as a percentage of total cars to be serviced in the shop.

a represents number of cars to be painted annually.

b represents number of cars in service.

c represents number of days cars must be in shop.

d represents number of days shop is to be operated annually.

This percentage averages about $\frac{1}{2}$ of 1 percent for freight cars and about 2 percent for passenger cars; the length of time in shop depends on amount of cleaning done inside the shop, the number of coats of paint applied, and the stenciling.

3. It is preferable to have the paint stored in a separate building, but where this is undesirable the

storage should be in a room separated from the main shop by standard fire walls and approved fire doors.

4. All electric wiring should be in conduit and all electric switches for lights, fans or other equipment should be located in a separate room away from the paint fumes.

5. The car paint shop should be constructed entirely of fire proof material, with a concrete floor having a smooth surface and good drainage; this floor may be waterproofed and the corners rounded to facilitate cleaning. All shelving and lockers should be made of non-combustible material. The shop should be well lighted both naturally and artificially, vapor-proof globes being used. All belting should be eliminated in order that the hazard of static electricity will be minimized. Explosion-proof motors should be used.

6. The shop should be adequately heated and ventilated; artificial ventilation by fans and blowers, if used, should provide for the circulating of all the air in the shop, consideration being given to the specific gravity of the vapors. Fan blades should be rigid and made of non-sparking material with ample clearance to avoid creating fire by friction, necessary allowance being made for ordinary expansion and loading to prevent contact between moving parts and the duct. Special attention should be paid to the removal of spray paint fumes as fast as they are liberated. This promotes safety, increases the efficiency of the labour, and minimizes the danger of possible explosion.

7. The car paint shop should be provided with approved automatic sprinkler system and a sufficient number of fire extinguishers; as well as any other fire protection required by local conditions or laws.

FREIGHT CAR PAINT SHOPS

8. The paint shop for freight cars may be either of the longitudinal or transverse type, the longitudinal shop being more practical in most cases. The longitudinal shop should be open at both ends and the transverse shop should have a transfer table unless it is short enough to be served by a ladder track.

9. The tracks in shop should be 20 ft. centre to centre; the distance from centre line of outer track to face of outside wall should be at least 12 ft.; the distance allowed between ends of couplers of cars should be at

least 7 ft.; 10 ft. should be allowed between end of coupler and face of wall.

10. If painting is done by other than the spray process, permanent scaffolding should be provided; these scaffolds should be adjustable and easily operated.

PASSENGER CAR PAINT SHOPS

11. On account of the dust and dirt in the air; especially where cars are being cleaned, passenger cars should be painted in a shop. This shop should be separate from the freight car paint shop, as the class of work is different and paint from spray painting of freight cars would get on adjacent cars.

12. The paint shop for passenger cars may be either the transverse or longitudinal type, the transverse shop being more practical in most cases. The transverse shop should have a transfer table unless short enough to be served by a ladder track; the longitudinal shop should be open at both ends.

13. The tracks in shop should be 20 ft. centre to centre; the distance from centre line of outer track to face of outside wall should be at least 12 ft. 6 in.; the distance allowed between ends of couplers of cars should be at least 8 ft.; 11 ft. should be allowed between end of coupler and face of wall.

14. Additional space in separate room or building should be provided for the storage and cleaning of cushions and other facilities removed from the cars.

15. Separate room should be provided for the applying of lacquer, said room being separated from main shop by standard fire walls and self-closing fire doors.

16. Permanent scaffolding of non-combustible material should be provided; these scaffolds should be adjustable and easily operated.

17. Special attention should be given to ventilation of the lacquer room. (See Ventilation of Shop Buildings, Proceedings, Vol. 48, 1947, page 319.)

¹ References, Vol. 36, 1935, pp. 111, 926; Vol. 48, 1947, pp. 299, 883; Vol. 54, 1953, pp. 570, 1369.

¹ Latest page consist: 4 and 5 (1953).

Adaptability of Dowding & Doll's Range of Machines

PATENT SPUR GEAR GENERATING ATTACHMENT FOR THE SHAPER

A PART from keeping the Shaper fully employed, either on circular shaping, small internal gears and the like, when the Attachment is used as an ordinary dividing head, or on work where a better quality is desired than that obtained from ordinary milling cutters, consider what an advantage it would be to be able to cut shoulder pinions, bastard pitches, pinions of long addendum, special pressure angles, or to be able to generate involute gauge forms by means of straight sided "V" tools from which to produce cutters. The Attachment is regularly used for such purposes. When not required on the Shaper, the Attachment can be used as an ordinary dividing head on the Miller by locking the change wheels or, with the additional fitting as illustrated below, for spiral milling. The two banks of change wheels in series enable a very wide range of leads to be dealt with; indeed, with hand feed at the worm shaft leads below 1" are easily obtainable.

The only permanent alteration to the Shaping Machine is the cutting of a spline in the cross feed screw to receive a pinion, the existing feed motion being used.

Spiral fitting for the Milling Machine is an extra.

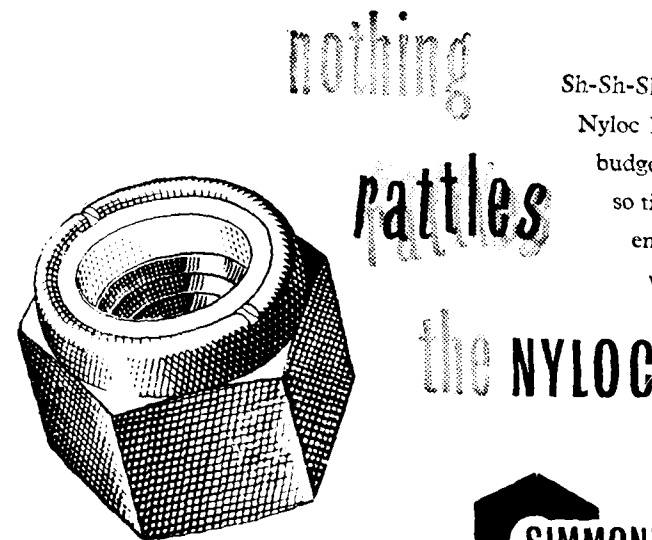
Dividing is effected by hand, through driving plate and plunger mechanism, the worm being adjustable for wear.

* * * * *

The Matterson Patent Bevel Gear Generating Attachment for the Shaper cuts 4 D. P. in cast iron full depth from the solid at one generating pass of the bevel. The whole design of the machine is robust, coupled with simplicity for ease in manufacture, enabling the article to be produced at a reasonable price.

The 6" size is arranged to bolt to the vertical face of the table, whilst the 12" size bolts to the table top.

The generating motion is produced by two Worm Divers, interdependent, through change gears selected



Sh-Sh-Shake it how you will, the great thing about the Nyloc Nut is that, once it is screwed on, nothing can budge it except a spanner. Its special nylon insert locks so tightly on the bolt that you can vibrate it for hours on end, soak it in oil or moisture, boil it, freeze it, and it still won't loosen. And you can use it over and over again.

Nyloc Self-Locking Nuts are used extensively by railway engineers on locomotives, rolling stock, bridges, permanent ways, etc., throughout the world.



SIMMONDS SELF-LOCKING NUTS

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- JESSOP & Co. Ltd., 63, Netaji Subhas Road, Calcutta 1.
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- PARRY & Co. Ltd., Dare House, Post Box 12, Madras 1.

Manufactured by: Simmonds Aerocessories Ltd., Treforest, Pontypridd, Glamorgan, Gt. Britain

CRC 22

for each pitch angle, provision being made for taking up wear in the teeth of these gears, and end wear in the worm shafts.

Adjustment is provided, together with gauges to bring the Tool and Gear Blank into correct relation, and adjustment for the angle of tooth below the pitch line is obtained independently of the setting for the pitch angle, suitable graduations being provided in the both cases.

The dividing is effected by hand, but a Semi-Auto-Feed Motion is provided.

Tables showing angles, etc., for the preparation of blanks, will be sent with each attachment, and simple "V" tools, ground from the bar to gauge provided, can be produced at small expense, a sample being supplied.

Work Mandrels of any diameter can be furnished, though one is supplied in the inclusive price with both sizes of attachment, and Collets can be supplied.

When cutting Skew Bevel Gears, the tool is merely "Offset" an amount to give the mean angle required, with a certain modification in the setting of the tool.

A number of parts subject to rough usage are hardened and replacements of any piece in the event of accidental damage can be effected at short notice, the manufacture being standardised.

Two systems of slotting are adopted in the 6" attachment to suit tables having vertical or horizontal slots. It is necessary to state whether the slots in the table side are vertical or horizontal. A Spur Gear Attachment is also made.

* * * * *

DOWDING V8 UNIVERSAL GEAR HOBGING MACHINE

The Dowding V8 not only effectively replaces the small and medium sized Continental machines; additional features give it an even wider working range. Ease of operation and accessibility for quick change-over of jobs encourage its use for a large variety of components, including spur gears, helicals, worm wheels, serrations, ratchets, film and chain sprockets and, if necessary, with an auxiliary tangential hobbing head, worms and high lead worm wheels.

For many years, Dowding & Doll's name has been closely associated with gear hobbing, over 1,000 gear hobbings having been sold and serviced by us in the

United Kingdom alone. This rich experience was drawn upon to the full in designing the Dowding V8 Gear Hobber, and today this successful machine has earned numbers of repeat orders from discerning users. Already there are batteries of four to eight machines in various parts of the country.

It is the only machine for use where consistently accurate gears are required with a high rate of production... ..and it is worthy of note that gears are regularly cut on this machine having a cumulative pitch error not exceeding one minute of arc (the equivalent of 0.00087" on a 6" dia. pitch circle.)

* * * * *

DOWDING V4 UNIVERSAL GEAR HOBGING MACHINE

The Dowding V4 universal gear hobber has been specially designed for the rapid and accurate production of small meter, clock and instrument spur gears, helical gears and worm wheels. The robust construction of the machine, its built-in accuracy and fine finish, are fully reflected in its dependable performance on production.

GENERAL DESCRIPTION

Rigid design and construction make it possible to take full advantage of the hobbing principle, resulting in extreme accuracy of pitch and form. The smooth, continuous indexing motion gives shockless working with absence of reciprocating movements, allowing maximum output by eliminating time losses due to idle return and indexing movements. Even distribution and uniformity of load, results in long, trouble-free working life, machine wear being reduced to a minimum. The machine is extremely versatile, and simplicity of setting and operation enable a wide variety of gears to be cut rapidly and economically.

DESIGN AND CONSTRUCTION

Design is based on modern engineering practice, all components are of substantial proportions the materials having been carefully selected, and machined to exacting standards of accuracy. Particular care has been taken to ensure that the helical and spiral bevel drives are of the highest precision. All shaft bearings are ground and run in bronze bushes, resulting in rigidity, smooth and quiet working. A differential unit is incorporated and ensures, irrespective of the face width or number of teeth to be cut, that the spiral angles of mating gears are absolutely the same and that gear axes are parallel.

MAIN DRIVE

The main drive is "V" belt from a 1 h.p. motor totally enclosed in the cabinet base of the machine. The direction of rotation is changed by a reversing starter.

HOB SPINDLE DRIVE

The drive to the hob spindle is continued from the main drive housing through spiral bevels, helical gears and pick-off gears which give a range of four hob speeds, chosen to give the best results on all work within the capacity of the machine. Smooth, shockless drive to the hob is ensured by a large balanced flywheel on the end of the vertical main shaft or, when cutting gears with a helix angle not exceeding 20° on the end of hob spindle. The hobbing head which can be set to any desired angle from 0 to 60° (greater angular adjustment can be provided if required) to accommodate right or left hand helical gear is mounted on a vertical saddle of robust dimensions. The saddle slides on wide vee guide ways on the main column and is provided with adjustment for smooth and rigid traverse. Overhang of the hob spindle from the vertical saddle has been reduced to a minimum, and provision is made for axial adjustment of the hob.

INDEX DRIVE

Index drive to the work table is taken from the main drive through change gears, according to the number of teeth to be cut, and a high tensile steel precision ground 4 start worm and mating phosphor bronze worm wheel of extreme accuracy, the index unit running in a totally enclosed oil bath. As an optional feature a single start index drive can be fitted enabling gears to be cut with a cumulative pitch error not exceeding one minute of arc (the equivalent of 0.00087" on a 6" dia. pitch circle.)

FEEDS

The feed drive, both to the hob saddle and to the table carriage, is by means of change gears and worm gearing. The latter give a uniform, smooth transmission at very low speeds. A wide range of feeds is available, so that the most suitable can be chosen for any material and any desired finish.

OPERATION

The operation of the machine is very simple and the few controls are placed in a convenient position,

reducing operator fatigue to a minimum. All external change gears are totally enclosed by quickly removable covers.

WORK MOUNTING

The work spindle has a No. 3 Morse Taper bore, and for holding work arbors of small diameter or gears which are solid with the shaft, a collet type attachment is supplied as standard equipment. The well-proportioned work arbor support arm carries a bayonet type centre which can be replaced with a pressure sleeve and is particularly useful when cutting gears with a small bore. A special work support allowing additional clearance is available for hobbing high angle gears.

METHODS OF WORKING

Spur gears and other work with teeth parallel to the axis are hobbled by feeding the hob parallel to the axis of the component, the hob and gear rotating in the ratio of: number of teeth in gear to number of starts in hob. The maximum helix angle which can be cut on worm wheels, using the standard hobbing head, is 6°—8°; for higher angles the special cross feed head must be used.

Helical gears are hobbled by the addition of an auxiliary rotation of the gear to the relative movement between the hob and work. This additional rotation corresponds to the helix angle of the tooth, and is obtained by means of a differential gear drive with a complementary change gear system. The maximum diameter of helical gears which can be hobbled on the machine diminishes as the tooth angle increases.

* * * * *

DOWDING H7 HORIZONTAL GEAR HOBGING MACHINE

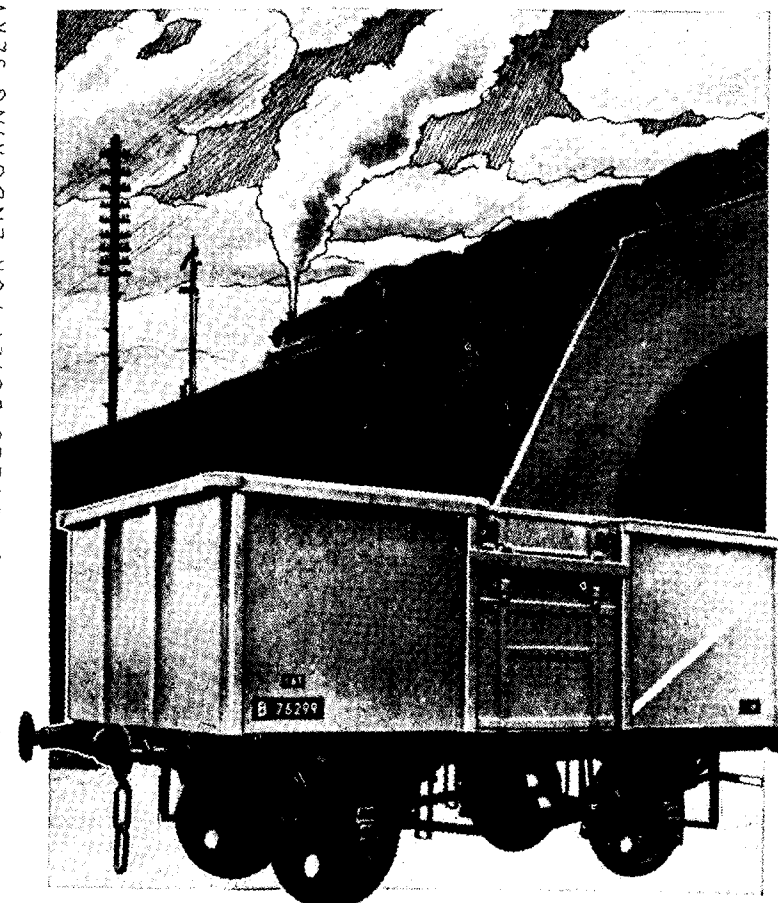
This machine, our latest development for high precision production hobbing, has been designed and built out of a wealth of practical experience covering many years. It fully meets the present day demand for a powerful, robust machine, trouble-free in service, and which will at the same time maintain the highest precision both in pitch and form.

The extensive range of application covers long spline and serrated shafts, spur and high angle helical gears, etc., such as are used in the automobile, aircraft, mining, machine tool, diesel engine and other industries.

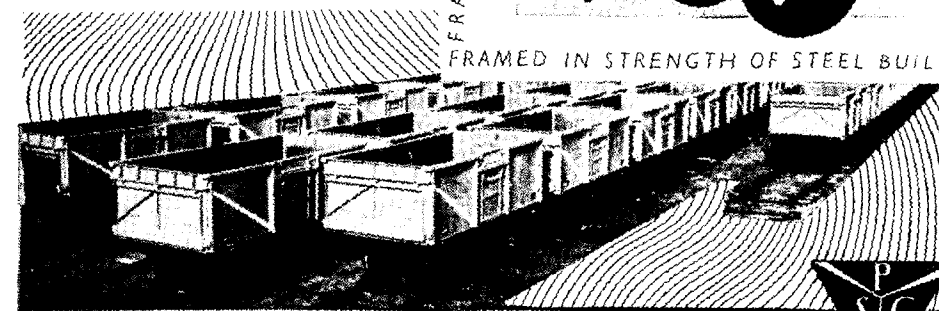
from strength to strength in steel

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wagons and
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PRESSED STEEL COMPANY LIMITED

London Office: Sceptre House, 169 Regent Street, W.1.

GENERAL CONSTRUCTION

In this powerful hobber the elimination of vibration has received special attention. The massive bed is strongly ribbed and designed to withstand very heavy cutting loads. All the gear drives, bearings and shafts are heavily proportioned to ensure minimum wear and long life under all conditions. Rigidity and freedom from backlash are such that climb hobbing can be successfully employed resulting in longer hob life, improved finish and faster output.

INDEX DRIVE OF WORK SPINDLE

The index drive of the work spindle has been specifically designed to ensure lasting accuracy and to prevent backlash. Drive is taken through change wheels and a high precision 6 in. diameter phosphor bronze worm wheel mating with a hardened and ground single start worm, which is easily adjusted to ensure correct meshing of the worm and worm wheel. The high tensile steel, hardened and ground work spindle is mounted in close grained mechanite bearings, the cutting pressure being taken on a ballthrust race. The spindle is bored 3 in. dia. to accommodate long shafts or special work holding equipment, including air or hand-operated collets. The whole index unit is totally enclosed and runs in an oil bath.

HOB DRIVE

The drive to the hob spindle is taken from the main drive housing through spiral bevels, helical and pick-off gears, giving a choice of six speeds. All speed change gears are readily accessible at the rear of the machine.

HOBGING HEAD

The two hobbing heads illustrated are available, a choice of either being supplied with the machine. The standard head is designed for the production of high-angle helical gears. The heavy-duty head, which has a fly-wheel mounted on the end of the hob spindle, gives smooth cutting when producing heavy spline shafts. The standard head, subject to variation dependent on pitch, helix angle and design of the component to be produced, swivels through 120°, and the heavy-duty flywheel head will swivel 45° right or left hand. Graduations in degrees and minutes permit fine angular setting of the hob, the adjustment being accurately and rapidly obtained through a hand-operated worm and worm wheel. For positioning the hob, the hob spindle is provided with 2" axial adjustment through a hand-operated rack and pinion.

WORE TABLE

Is a wide well-ribbed casting, having the top working surface inclined towards the hobbing head to give additional resistance against the cutting pressure; it is mounted on a transverse saddle which runs on two widely spaced vees on the bed of the machine. The table moves on one dovetail and one square slide, with taper gib adjustment. After setting "depth of cut" position the transverse saddle can be firmly locked by means of a knurled hand control operating on wedge cams at each side of the saddle. A well proportioned tailstock, having a spring loaded centre for ease of work loading, is mounted on the left hand end of the work table.

FEED

The feed drive to the work table is taken through change gears and a very accurate lead screw with thrust races and double lead-screw nuts. These double nuts eliminate all backlash so that the work can be produced by orthodox and climb hobbing methods. The feed is disengaged automatically by control stop, or by hand. The provision of six change gears enables the user to select the most suitable rate of feed for the material being cut and the finish required.

DIFFERENTIAL

The DOWDING H7 is fitted as standard with a differential mechanism which enables helical gears to be hobbled irrespective of the number of teeth to be cut and varying rates of feed. For hobbing spiral gears it is only necessary to take into account the pitch and helix angle required, and a simple calculation enables the correct change wheels to be selected ensuring uniform contact over the full width of the gear teeth produced.

LUBRICATION

Is by an electric gear pump supplying a header tank situated in the mainhead casting and then by gravity feed to all bearing surfaces, internal machine gears, change gears and indexing worm and wheel. Surplus oil is collected and returned to the sump where it is filtered and re-circulated.

COOLANT

A 1/8 h. p. electric centrifugal pump delivers a copious supply of coolant through an outlet nozzle which has a 1/2" diameter bore.

—By Courtesy The Indian Railway Engineer.

End-on Generation of Electricity on Railway Trains

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(Former Chief Electrical Engineer, Northern Railway & Presently Chairman, Central Power House, New Delhi).

INTRODUCTORY

ELECTRICAL services on Railway Trains are at present mostly confined to provide amenities to Passengers, like lights and fans, and more recently to air-conditioning of coaches. Although these are not operational necessities required for the actual movement of the trains, their importance varies from absolute necessity as in the case of lights to ordinary amenities like fans and luxurious comfort like air-conditioning. In addition they add to the beauty and appearance of the interior of the trains. The reactions of the passengers to the services correspond with the continued proper maintenance or failure of the equipment in their order of importance stated above.

The large amount of capital and maintenance expenditure involved in the provision and maintenance of these services is not generally known. It is difficult to assess the capital cost of the Electrical Equipment, but it will run into crores of Rupees. The maintenance cost, however, is known and during the year 1950 it amounted to about Rs. 88 lacs. Any substantial reduction in this expenditure would, therefore, be National Savings of considerable importance in the present economic state of the country.

The present condition of many of the equipments and the necessity to rehabilitate them, the provision of additional comforts, like fans in III and Intermediate Class of coaches and the building programme of a large number of new coaches all require the expenditure of a large amount of capital. It is the purpose of this article to propose to change over from the present system to End-on Generation of Electricity by installing Diesel Engine Driven Sets on the trains. The savings effected, both on capital and Revenue expenditure is anticipated to total up into several crores and lacs of Rupees respectively.

PRESENT SYSTEM

After the introduction of electricity for general lighting purposes at the close of the last century, it was soon adopted for illuminating trains also on account of the convenience and safety inherent in the Electrical System. The original lighting of trains was by means of Gas or Oil Lamps.

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In India, the system adopted for train lighting by electricity is known as the "Double Battery Block System". In this system, out of the 9 or 12 coaches usually making up a train, a few only are equipped with Batteries and Dynamos in addition to their consuming equipment, like fans, lamps, etc. Other coaches on the train are merely 'wired' to feed the lamps and fans. Each carriage is 'connected' electrically through 'Couplers' to the adjacent coaches so that the entire Electrical system on the train is linked together.

When the train is running, above a pre-determined speed, the Dynamos, which are driven by the carriage axles through belting, provide the necessary Electrical energy for all the consuming equipment on the train and also charge the Batteries. When the train is stationary or running at a slow speed, the Batteries supply the electric power required. Thus, even if the equipment on one particular coach suddenly proves defective the entire train is not affected thereby. The load of the defective carriage is supplied by the other Dynamos or Batteries on the train.

The Dynamos are of a special design so that they can function effectively under all conditions of train running such as wide changes in speed, change in direction of movement etc. The carriages also have to be provided with special types of switches so that the Dynamo could be "Cut in" and "Out" as the train speeds up or slows down.

FINANCIAL AND ECONOMIC ASPECTS

The system has worked satisfactorily. But it suffers from certain serious disadvantages. The first and foremost of these is capital cost involved. The cost of the lighting and fan equipment of a coach is roughly Rs. 4,000/- and, as this is common to all coaches, we may consider the capital cost involved in providing Generating, Storage and Switchgear equipment only on the carriage. This is approximately Rs. 16,000/- per coach. For an express or mail train having about six "equipped" coaches on a train, the capital cost (of Generating and Storage equipment only) would be about Rs. 96,000/- while for a slow passenger train with about three "equipped" coaches the cost would be Rs. 48,000/- approximately. The maintenance charges are also very heavy. According to the I. R. C. A. figures

for 1950 the total cost of maintenance of Batteries and Dynamos (Including Switch-gear) on different class I on all Indian Railway was as follows :—

Rail- way	No. of Vehi- cles-owned	Total equip- ed & wired	Total mainte- nance cost	Maintenance cost of Dynamos, Batteries inclu- ding Battery Boxes and Suspension gear
			Rs.	Rs.
B.N.	483	595	1078	7,20,118
E.I.	1192	1514	2706	29,03,748
E.P.	349	574	923	10,06,458
G.I.P.	822	1116	1938	29,00,291
M&S.M.	353	483	836	6,90,860
S.I.	222	198	420	5,22,153
Total	3421	4400	7901	87,43,628
				43,80,061

A very large organization of staff and stores distributed at various centres is necessary, and now exists, to look after the maintenance of Dynamos, Batteries, lights and Fans and rectify minor complaints during running of trains. In the last few years the problem of loss of belts has assumed very considerable proportion and is affecting electrical maintenance seriously. It is not merely the cost of the belt that is involved but the dislocation of electrical service due to the Dynamo being put out of action and consequently the Batteries being depleted very soon.

Most of the equipment has to be imported. Attempts are being made to manufacture Lead Acid Batteries for Train Lighting purposes in this country. Although one Company is making efforts to manufacture Train Lighting Cells on a large scale, the Industry itself cannot be said to have established itself sufficiently to meet our requirements even to a reasonable extent. We shall, of course, continue to require Train Lighting type Batteries for Saloons and other independent carriages. This refers only to Lead Acid Cells. Quite a large number of Batteries used on trains are of the Alkaline Type and all have to be imported. The Dynamo and Switchgear used for Train Lighting being of special type, i. e., suitable to give nearly constant output at varying speeds of the trains or with regulators to modify charging currents are costly, as they have to be specially designed and sold only to the Railways. Similarly, the equip-

ment used for lighting & fanning have to be specially manufactured for the Railways & hence are more costly than their counterparts in the general Electrical Industry. Besides the above, there are other minor disadvantages and it is not necessary to discuss them here for our present purposes.

For the last few years there has been a pressing demand to give more amenities to lower class passengers and in line with this policy the III and Inter class Carriages have been fitted with fans. This cannot be done on a large scale unless there is sufficient generating and storage capacity on the trains to supply the additional fans. The capital cost involved in equipping lower class carriages with additional Dynamos and Batteries required to meet the load of these fans amounts to roughly Rs. 16,00,000/- per 100 carriages, and there are about 1100 Carriages to be equipped. Standards of lighting intensity in existing carriages are also being increased and efforts are also being made to provide fittings for external lighting of trains and platforms. Air-conditioned coaches have been introduced on several important trains.

In view of the above additional demand it has become necessary to have a larger ratio of equipped coaches to wired ones, i. e., from 1:2 or even 1:1. Practically every carriage that comes to the Shops is being equipped to keep up the ratio of equipped carriages to wired coaches approximately 7:5 on an average. This includes some trains in which practically all coaches will be equipped ones.

Apart from the large amount of funds involved, it would take considerable amount of Shop capacity and time and some shops are not in position to deal with this heavy demand.

OTHER SYSTEMS NECESSITY FOR CHANGE OF PRESENT SYSTEM

In addition to the above, a controversy arose a few years back regarding the adoption of "Single Battery system" instead of the "Double Battery System" already referred to above. It is not intended to go into the merits of each system, but it is pointed out that on account of the necessity to equip practically all the carriages of a train, the discussion of "Single" or "Double Battery System" loses much of its importance. There is a definite limit to the size of Dynamos and Batteries that can be installed on the under-carriage of the coaches and we have nearly reached this limiting factor. It is therefore, necessary to equip more carriages with Batteries to have the desired storage capacity on the trains. For purposes of reference it

may be stated that the load on the trains a few years back was as follows :— (exclusive of air-conditioning load)

Mail and Express Trains — 7.5 K. W.

Slow Passenger Trains — 5 K. W.

The trains now have the following loadings.

Mail and Express Trains — 12 K. W.

Slow Passenger Trains — 7.5 K. W.

On account of the large amount of Rehabilitation and the new works to be undertaken in Shops, considerable funds are now required. It is necessary to examine other ways and means of getting out a less costly system of Electrical equipment including provision for increased load and more efficient maintenance. An added feature should be that the supply and manufacture of the equipment is from indigenous sources.

It may be mentioned here that a Steam Driven Turbo Set mounted on the Locomotive or on the train nearest to the Locomotive is not considered as an alternative arrangement for obvious reasons. A locomotive is not always attached to a train. After reaching the destination station, the Locomotive moves off to the Running Shed to be replaced by another. During shunting operations also the Locomotive is not connected to the whole train. Hence it is necessary to see that the Generating Set is completely independent.

The Head or End-on Generation System satisfies these requirements. The idea itself is nothing new. It was not found quite suitable or flexible enough in the past few decades. There have always been technical ideas which could not be fully adopted at the time of their invention and have to be put by till other suitable conditions have also developed. There is therefore no sufficient reason for the system not to be examined again in the light of present day possibilities. This subject was initiated for discussion in the I. R. C. A Electrical Section Meetings a few years back but was dropped for reasons unknown. Efforts of the writer to ascertain the circumstances for dropping this issue have been unsuccessful.

The necessity for introducing this system was closely felt, when on account of the various traffic circumstances the number of "sick" equipped carriage, especially Brake Vans, become large. As a consequence several trains were running without their full complement of equipped carriages and the lighting naturally suffered very badly at one stage. It was especially felt by the Author on the suburban services between Kancharapara and Sealdah.

THE END-ON GENERATION SYSTEM

In the system now proposed, Oil Engines directly coupled, to A. C. Generators supplying on the 220 or 110 volts, 50 Cycles, Single Phase System will be mounted in each Brake Van i. e., one Set at each end of the train. It would be preferable to mount the Generating Set on the under-carriage, somewhat similar to the Batteries. Certain types of Gas Engine Sets are installed in this manner in America. This can only be done if we can get a suitable compact Oil Engine Set. Till that time it will be necessary to mount the Oil Engine Driven Generating Sets on the floor of the Brake Van in an area similar to the Guard's compartment. Although this means a certain reduction in the Luggage space, the financial savings will entirely compensate for the loss of space.

The method of working on this system would be as follows :—

Normally one Engine Driven Set will be working at any one time to supply the entire standard trains. The second set may be put into commission under any of the following circumstances :—

- (1) When the train is overloaded due to additional bogies being put on.
- (2) A breakdown of the first Set.
- (3) When the train is parted, for shunting or any other reason.

Normally the two Sets may be run independently although they may be synchronised when the run is for long durations.

There should be no cause for any fear regarding the satisfactory operation of "Power House" on a running train. Necessary precaution and skill would be given in mounting the Engine Set, which should preferably be designed for this purpose. Large size Diesel Engines of several thousands of Horse Power are now used on Diesel Engines Locomotives. The same principles as are used for mounting an Automobile Engine may be adopted in the case Oil Engine Sets for train services also, i. e., a 3 point mounting on elastic rubber pads or springs.

The fuel Oil necessary for runs between important stations should be stored on the train. There should be no difficulty here, as fuelling stations can always be arranged to coincide with the Locomotive coaling and watering stations. There should be no risk of fire also if adequate precautions are taken.

A few words regarding the organization necessary for putting this service on an efficient basis may be useful at this stage.

For the scheme to be successful, an efficient and a well knit organization of both staff and materials is necessary. Such an organization, however, already exists. Generating Sets will have to be standardised and spares distributed over the whole country, so that in case of defects complete replacement of units or parts can be made easily and the defective part sent to the Shops for reconditioning for use later. However, at important stations a certain amount of complete units ready for service should be maintained depending upon the number of trains passing through the station and the time available for effecting repairs. The necessary equipment for changing engines quickly would also be designed and provided. This would not require a radical change in the present system of Train Lighting maintenance arrangements but some adjustments may be necessary.

Normally there would be on each train in service one skilled Engine Driver, together with an unskilled Assistant. Only in exceptional & important trains should there be a second set of staff to man the second engine.

At important stations a set of staff to look after general complaints and starting sets when trains are parted for shunting purposes at the station will also be allowed. The staff on the running trains will be there not only for supervising the running of the engine, but also to attend to any defects arising in the Electrical System of the train. We have not got this advantage at present, but considering the larger use of electricity on trains, especially air-conditioned coaches, and the demand to have defects attended to immediately, it will be a great improvement in the service to passengers.

Apart from the financial advantages, which will be referred to later, other advantages are as under:—

- (1) Standard Electrical consumable articles, like lamps, fans, etc., will be used. This means that the Railways, will have the advantage of cheaper and standard articles, both for first cost & for maintenance.
- (2) The Industry will be saved from building up special capacity for the manufacture of Railway equipment. This capacity can be turned to more useful production of standard articles.

- (3) Elimination of large amount of imports into the country of specialised equipment and making the country self-contained in this respect.
- (4) The trouble experienced recently due to thefts of Train Lighting Belts and their not being locally manufactured in sufficient quantity and quality will disappear and the Electric supply on trains will not be dependent on keeping a close watch to see that the Belts are there.
- (5) The system can be extended to eliminate entirely or supplement largely the existing system of Locomotive Headlight organization. This arrangement itself would effect considerable financial economies not considered here.
- (6) Provision of modern lighting e. g., fluorescent tubes, which work more efficiently on A. C. and at higher voltage.
- (7) Conservation in the amount of electricity generated by direct usage consuming equipment unlike the inefficient generation, medium of storage batteries and incandescent lamps required at present.
- (8) Larger reserve of Electric power and flexibility to meet additional future loads.
- (9) Less weight of electrical equipment to carry on the train.
- (10) Standard scaled type Refrigerator Units may be used for air-conditioning coaches without much expense and alteration to existing carriages. This will avoid importing special carriage air-conditioning equipment from abroad.

SYSTEM OF VOLTAGE

The Choice of voltage is a matter of opinion. 220 volts has been the standard voltage for general purposes and may be adopted, but there should be no objection for standardising on 110 Volts with suitable 220/110 Volt transformers with the mid point on 110 volt Coil earthed on the train to take advantage of the external 220 volts, Single Phase, 50 Cycles supply when the trains are standing for long periods at important stations. The lower voltage will probably keep some peoples minds at ease and it is therefore recommended for immediate adoption. With adequate precautions there should be

no objection to use 220 Volts and may be employed after some experience of 110 Volts. The experimental train on the system and the two Exhibition trains were supplied at 220 Volts.

FINANCIAL ASPECT OF THE PROPOSED SYSTEM

The comparative financial aspects of the proposed Oil Engine set against the existing Axle Driven Dynamo-cum-Storage Battery System will now be examined.

The total number of Fast and Slow train rakes in use in India on all the Railways is not readily available. We have statistics of equipped and wired carriages, but the number of rakes that would be formed out of these cannot be determined without collecting the figures from each Railway. It is, therefore, desirable to work out the financial comparison on equipment on the basis of units of 100 Mail and Express trains and another set of 100 Slow Passenger trains. The total capital cost involved for changing over the complete equipment to Oil Engine System may then be figured on 100 train unit basis. It is expected that the number of rakes on all the Indian Railways will be at least ten times this figure.

From the figures in the Appendix, it will be seen that the amount of capital involved is considerable and the saving, both in capital and maintenance cost, is very much in favour of the Oil Engine Generating System, i. e., the capital cost is in the ratio of Rs. 2,57,60,000/- for the present system to Rs. 52,80,000/- required for the proposed system to meet our present needs. The corresponding maintenance and operating charges are as follows.

	Present System.	Proposed System.
Maintenance charges	17,29,000	7,26,000

The attached table shows that the percentage savings on maintenance cost that may be expected from the installation of Oil Engine Driven sets is of the order of 60% of the maintenance charges of the present system. The total saving on all counts is approximately 48% of the capital cost of the proposed system, which is an extremely good financial position, in other words, it means that the capital cost would be paid within 2 or 3 years, even allowing for various errors, etc., in this very rough computations on very meagre data.

The amount of coal consumed on a locomotive solely for driving the Axle Driven Dynamos when compared with the total amount of coal burnt for hauling a train

is said to be negligible and possibly a thing not to bother the Locomotive Engineer. The writer understands that these figures are not available even from Dynamo Meter Car experiments. But the amount of coal involved is appreciable and if saved would mean so much available for other purposes.

It is, therefore, necessary to work out the coal consumption in an indirect manner by taking the Locomotive's overall thermal efficiency, i. e., Rates of energy on Coal fired in the grate of Boiler of the Locomotive to the Power developed at the wheels. Even in best Locomotive this does not exceed 5 to 6%. In our working conditions and with the types of Locomotives now in use, it is not probably more than 4% though the figures assumed for present calculations is 6% as marginal efficiency.

A comparative table of the costs has been prepared on the following conditions:—

- (i) The comparison is for Broad Gauge equipment only.
- (ii) The comparison is made on the basis of 100 Express and Mail Trains and 100 slow passenger trains excluding air-conditioned coaches.
- (iii) All the Batteries have been taken to be Lead Acid Batteries.
- (iv) The cells of the Batteries on any coach is taken to be 250 Amperehour capacity, i. e., on a 10 hour discharge rate, the net rate of output of any equipped coach will be 50 amps. at 24 Volts.
- (v) The annual load factor will be 50% and the maximum demand will be the full connected load. This has been worked out on the basis of 20 hours occupied time on the Rake per day. The fans are taken to be used throughout the period of occupation for 9 months in the year and the lights for 12 hours per day throughout the year. The total load is taken to be 1/3 due to fans and 2/3 due to lights. These figures have been arrived at, on checking samples of trains.
- (vi) The watt-hour efficiency of the Battery is taken to be 75% and the generating time of the Dynamo is 60% of the total running time. It is also assumed that the requirement of Electrical Power on the train is met from the

Dynamos. (Terminal Charging cost of Batteries is incorporated in maintenance costs.)

(*This figure has been furnished by the Directorate of Research, Railway Board.)

Hence the Dynamo is required to generate 113.3% of the total consumption.

(vii) The spare equipment for Batteries is taken as 20% of the total in service and for Dynamos and associated equipment is taken as 10%. Similarly the number of spare Generator Sets is taken as 10% of the total on trains.

(viii) The staff for running the Oil Engine Generating Set will be one skilled and one unskilled for each engine on train. Normally only one crew of two will be accompanying the train and they will be changed at the end of 8 hours. Additional staff for purposes of leave and Relief, etc., have also been included.

(ix) The cost of the equipment is taken as follows :—

Batteries including

Suspension.

—Rs. 8,000/- per coach.

Dynamo and Switchgear—Rs. 8,000/- per coach.

Oil Engine Generator Set—Rs. 12,000/- per set.

These figures are an average of present market prices. The future trend, if downward, would be a more rapid fall in the case of Diesel Engines, which have a variety of users, than in the case of Dynamos, which are in use only on the Railways.

(x) There will be less consumption of coal due to the lower weight of the equipment which has to be hauled by the Locomotive than on the present system. The consumption of coal in a Locomotive on the Indian Railways on an average is 187 lbs., per 1000 Gross Ton Miles B. G. according to the published statistics. This saving is calculated on the difference in the weight of the two types of the equipment, taking the present equipment to have been brought up to the required standard to meet the additional load. The weight of the present equipment per train is 12.8 tons for Mails and Express Trains and 9.6 tons for a slow passenger train. The weight of the proposed Diesel Engine Set would be 1.6 tons per train

for passenger trains as well as for fast Mail and Express trains.

(xi) In the case of the proposed system it is possible to mount the plant under the carriage. However, for present purposes it is assumed that the plant would be mounted in the Brake Van. On a casual view it would appear that there will be a loss of revenue on account of utilising the revenue earning space in Brake Van for installing Diesel Engine Sets. While this would be so if the Luggage Vans were fully loaded always, statistics indicate that is not the case. For instance, the revenue earned on Luggage Vans on the B. G. and N. G. in 1953 on the Northern Railway was 24 lacs only whereas if the earning had been 100% on the space available, the total earnings according to calculation would approximately 2 crores per year. It is possible that one or two Brake Vans may be fully loaded, but these special cases will not affect the general problem.

DISADVANTAGES AND REMEDIES

It is useful to examine the adverse effects that may result from the adoption of the End-on Generation by Diesel Engine Sets.

From the operating point of view there appears to be only one contingency that requires adequate provision. When at any Railway Station part of a train is moved away for shunting purposes, i. e., attaching or detaching of bogies etc., one portion of the train may be left in darkness. It is proposed to overcome this possible interruption by either of the following methods :—

(a) When the duration of the interruption is likely to be long, the second or stand by engine set at the other end of the train i. e., not containing the working engine, may be started up by the Train Lighting Crew or Platform Staff before the train is parted.

(b) Every Coach may be provided with a few emergency 24 Volt Lamps and supplied by means of two automobile type 12 Volts Batteries of the largest amperehour capacity manufactured in India. These Batteries can be automatically switched in to supply the 24 Volt lamps immediately the main 110 Volt supply from the Engine Set is interrupted, by means of an automatic relay held in position by a 110 volts or 220 Volts Coil. The charging of

the Batteries is a minor problem and can easily be arranged for installing Rectifier or other suitable type Battery Charges at various places or on the train itself and sufficient spare Batteries may also be carried to make replacements immediately. The Batteries should have a life of about three years and their recurring cost would be negligible.

The fans will be out of commission during the periods of interruptions to 110/220 Volts. It is no doubt possible to instal a few 24 Volt fans also and supply them by increasing the Battery capacity. This is, however, hardly worth the trouble as the interruptions would be of a very short duration not exceeding 5 or 10 minutes. In case the interruption are for longer periods the second or stand by engine set may be started up to maintain the continuity of the 110/220 Volts supply for the affected part of the train itself.

It is probably desirable to say a few words regarding changing the present Voltage from 24 D. C. to 110 or 220 Volts A. C. as it might cause apprehensions of danger to the passengers. The use of 110 Volts, 220 Volts or higher voltage on passenger vehicles is nothing new, e. g., tramways Electric trains, etc.

To be well within the margin of safety, it is proposed that during the first few years, at any rate, the supply to the train system may be at 110 Volts A. C. with the mid point "Earthed". When the supply is taken from an external source as at large Railway Stations a 220/110 Volts Single phase Transformer with the mid point of the 110 Volt Coil "Earthed" will satisfy all requirements.

What is necessary and should be done is that adequate and necessary precautions for the safe working of electricity are taken in the first installation itself & that these standards are maintained continuously. It is merely a question of being used to this system. The engine should be used on the cheapest form of Oil available consistent with efficient and trouble-free working of the engine. Although on grounds of National Economy, Diesel Engine Locomotives for Main Line operation may not be recommended for adoption in this country as Oil has to be imported, still there should be no objection to the use of Oil Engines for shunting locomotives and for stationary Oil Engines. The latter is very often a necessity and the amount of Oil required for the proposed Train Lighting purposes may be included in the requirements for stand by Power House Engine for all Practical purposes.

RESEARCH

It is suggested that research may be directed towards developing an Engine that will use Oils of vegetable origin that can be produced in the country itself.

Extending the research idea a little further it should be possible to design an Engine specially for this purposes. The Engine should have the characteristics of ruggedness, simplicity, easy maintenance, interchangeability of parts, compactness, economy in working and reliability of working under all climatic conditions. Till such time however, the Oil Engines now manufactured in India by reputable and well organised firms may be utilised.

PRACTICAL OPERATION OF THE PROPOSED SYSTEM

Trains are working in the United States with gas or Oil Engine mounted on the underframes of coaches of supplying electricity.

Even the Ambulance trains used in India during the last war had air-conditioned ward cars which were supplied by an oil Engine Driven Sets installed in an attached Begie.

The two Exhibition Trains, which recently went round the country in connection with the Indian Railway Centenary Exhibition, had a large number of 220 Volts fluorescent tubes for illuminating the Models. Two Oil Engine Generating Sets (220 Volts generation) were installed in attached Bogies or Trucks for supplying electricity to these tubes. During their run no defects were reported.

To demonstrate the practicability of the ideas outlined in this articles a special train of 8 carriages was fitted with 220 volt Fluorescent tubes, fans and a standard type 220 Volt Refrigerator. An oil Engine set installed in separate bogie was supplying electricity to the train for trial runs. Relays mounted on the train operate the 24 Volt System of original lighting when the main 220 Volts current is broken. The train has run successfully between Delhi and Kalka a few times.

SUMMARY

The main points elaborated in the above paras may now briefly be summarised :—

(1) There is a large amount of work to be undertaken at present in connection with the Electrical Equipment on trains with New

Stock to be built, rehabilitation or to meet the load of additional fittings to be installed in existing carriages.

- (2) This requires very heavy capital and maintenance expenditure. The latter is of the order of Rs. 67 lacs per annum.

- (3) By providing Oil Engine Driven Sets at each end of a train the axle driven dynamos and the batteries can be eliminated and the capital and maintenance charges reduced considerably. This latter amount is estimated to be about 7½ lacs for 200 trains i. e., 42% of the present expenditure.

- (4) Economies in coal consumption, more services with less electrical energy, no belt, etc., to be stolen.

- (5) Maintenance is simple and confined to apparatus situated in the body of coaches and not under them.

- (6) Staff running on the train will be available to attend to all minor troubles on the runs.

- (7) Practically complete elimination of foreign plant and relying on indigenous plant.

- (8) Reserve capacity to meet further increase in loads, like air-conditioning, more fans, lights, etc.

- (9) Locomotive Headlights also can be supplied by the same Oil Engine Set. This will mean considerable saving in the expenditure on this item, both in capital and maintenance.

- (10) The train Lighting on all Indian Railways can be changed over early without any dislocation to the working of the trains.

- (11) This is the quickest way of meeting the new work that is necessary.

Table showing the comparison costs of the present system of Train Lighting and the proposed Oil Engine System exclusive of Air-conditioned coaches.

Items	Existing System				Proposed system of Oil Engine Driven Gen : Sets (including addl : load of fans in 3rd Class Coaches.)
	Dynamos BATTERIES etc., for meeting present load.	Dynamos Batteries etc., for meeting additional load of fans in 3rd class Coaches	Total for PRESENT LOAD Conditions including addl : equipment required.		
1	2	3	4	5	
	Rs.	Rs.	Rs.	Rs.	
CAPITAL COST					
1. Capital cost per 100 Mail and Express trains	96,00,000	32,00,000	1,28,00,000	24,00,000	
2. Capital cost per 100 Slow trains	64,00,000	32,00,000	96,00,000	24,00,000	
3. Capital cost of spare equipment and plants	24,00,000	9,60,000	33,60,000	4,80,000	
4. Total for 200 trains	1,84,00,000	73,60,000	2,57,60,000	52,80,000	
ANNUAL CHARGES					
<i>Interest and Depreciation</i>					
1. Interest at 3½% on (4)*	6,44,000	2,57,600	9,01,600	1,84,800	
2. Dep : on Dynamos and switch-gear	3,42,200	1,36,900	4,79,100	..	
3. Dep : on Batteries	17,33,300	6,93,300	24,26,600	..	
4. Dep : on Oil Engine Plant	..	..	..	3,08,900	
Total Capital charges interest and Depreciation	27,19,500	10,87,800	38,07,300	4,93,700	

Items	Existing System				Proposed system of Oil Engine Driven Gen : Sets (including addl : load of fans in 3rd Class Coaches.)
	Dynamos BATTERIES etc., for meeting present load.	Dynamos Batteries etc., for meeting additional load of fans in 3rd class Coaches	Total for PRESENT LOAD Conditions including addl : equipment required.		
1	2	3	4	5	
	Rs.	Rs.	Rs.	Rs.	
OPERATING CHARGES					
5. Fuel consumption of account of working of present T. L. System and Proposed Oil Engine System	5,26,000	2,95,000	8,21,000	7,03,400	
6. Lubricating Oil consumption	..	..	..	2,40,000	
7. Staff Wages	..	..	..	14,83,200	
MAINTENANCE					
8. Batteries maintenance	9,60,000	3,84,000	13,44,000	..	
9. Dynamos maintenance	2,75,000	1,10,000	3,85,000	..	
10. Overhaul of engines	..	..	..	5,28,000	
11. Running Stores spares for engines @ Rs. 450/- per engine per annum	..	..	..	1,98,000	
Total	44,80,500	18,76,800	63,57,300	36,46,300	
MISCELLANEOUS					
12. Fuel consumption on account of weight of present T. L. Equipment	4,68,000	2,33,600	7,01,600	..	
13. Loss of Revenue earning space of Brake in proposed system	..	..	..	* 12,80,000	
Grand Total	49,48,500	21,10,400	70,58,900	49,26,300	

* This item may not occur in practice. Saving Rs. 21,32,600/-. Return on Capital 40%.

APPENDIX

The following two points require special mention :—

- (1) During the transition period we will have to work the existing equipment either in conjunction with the new proposed system or as independent units.

There should generally be no difficulty in the case of the former, as certain coaches can be wired through and the equipped coaches can work as independent coaches just like Saloons, Mail Coaches, etc.

- (2) Where existing equipment are worked on 24 Volts only, the power required can still be supplied by having an oil Engine Set Generating at 24 Volt with suitable invertors and transformers on the trains for supplying

220 Volt Tubes or, if possible, having a 220 Volt Alternator & Rectifier on each coach to supply 24 Volts D. C. fans.

Details of this system will have to be worked out, but there is no technical difficulty.

Another point that arises would be the disposal of the existing equipment. Batteries have a life of 4 or 5 years and so naturally they will "Work off" in a few years. Regarding the Dynamos and other equipment now provided, the depreciation on their account is Rs. 3 : 4 Lakhs for 200 trains. If the Dynamos cannot be used as spares, then whole depreciation can comfortably be transferred to the account of Oil Engines thereby reducing the estimated saving of 40% to about 32%. Even at this figure the saving is very handsome.

— By courtesy The Indian Railway Engineer

Indo-Pakistan Railway Meetings Conclude

Satisfactory Decisions Reached

THE Indo-Pakistan Railway Stores Sub-Committee and the Standing Committee for Railways met at New Delhi from December 21 to 27, 1954, and discussed subjects, outstanding since partition, relating to the division and exchange of Railway assets and other matters connected with the settlement of transactions arising out of the interchange of traffic between the two countries.

Sri S. M. Hasan, Director General of Pakistan Railways, was the leader of the Pakistan delegation which comprised of Sri Mushtaq Ahmad, Financial Adviser (Communications), Sri S. A. Suhrawardy and Sri S. B. Azid, General Managers and other technical officers of the North Western and Eastern Bengal Railways.

The Indian delegation was led by Sri K. B. Mathur, Member, Transportation, Railway Board, and included



Photo shows the leaders of the Pakistan and Indian Delegations signing the agreed minutes at the conclusion of the talks in New Delhi on December 27. (L to R) Mr. S. M. Hasan, Director General of Pakistan Railways; and Sri K. B. Mathur, Member (Transportation) Railway Board.

Sri B. Arora, General Manager, North Eastern Railway, Sri D. P. Mathur, Director, Finance (Accounts), and Sri P. H. Sarma, Joint Director, Traffic (Transportation), Railway Board, besides a number of technical officers of Northern, North Eastern and Eastern Railways.

The agenda included a number of subjects connected with the Indo-Pakistan railway traffic. One of these to which the committee attached great importance was the

early completion of the exchange of service records of the railway staff. The discussions took place in an atmosphere of complete cordiality and satisfactory decisions were reached on practically all outstanding matters.

This is expected to ease the problems of Indo-Pakistan traffic and to provide the basis for future development of the same with better mutual understanding and confidence on either side.

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

Buy your tickets only at the proper place. The authorised offices are (i) the Booking offices at the railway stations, (ii) the Town or City Booking Offices, (iii) the out-Agencies, (iv) Travel Agents. Never buy tickets from any other source as that may lead you to trouble. Please note that tickets are not transferable.

Buy your tickets in the proper time. You can avoid unnecessary excitement and trouble if you come to the station in good time, that is at least half an hour before the scheduled departure of your train. The Time Tables of the Railway are on sale at Booking Offices and Bookstalls.

Buy your tickets in the proper manner. Queue up at the Booking Window and you can get your ticket easier and quicker than by crowding at the counter.

By handing in the *exact fare in good coins or currency* you get the ticket easier and quicker, and save for yourself and the Booking Clerk time and trouble.

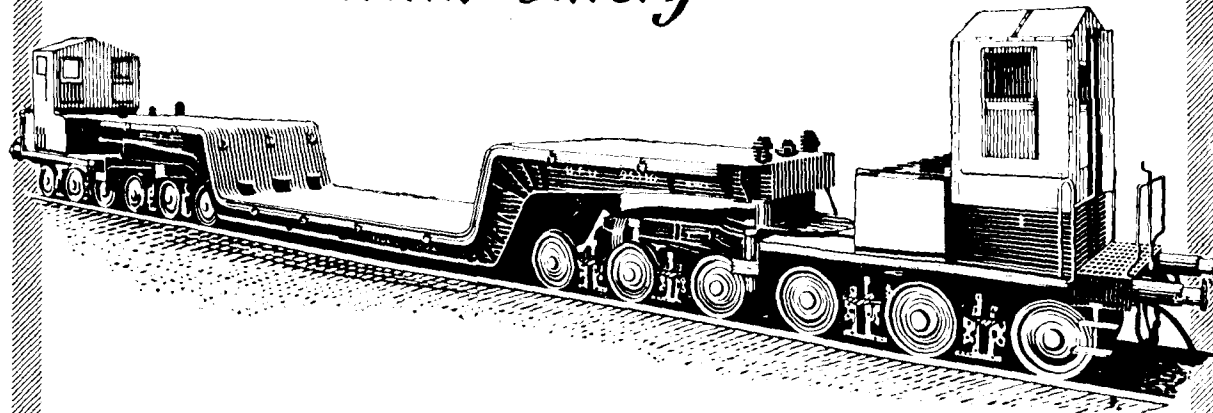
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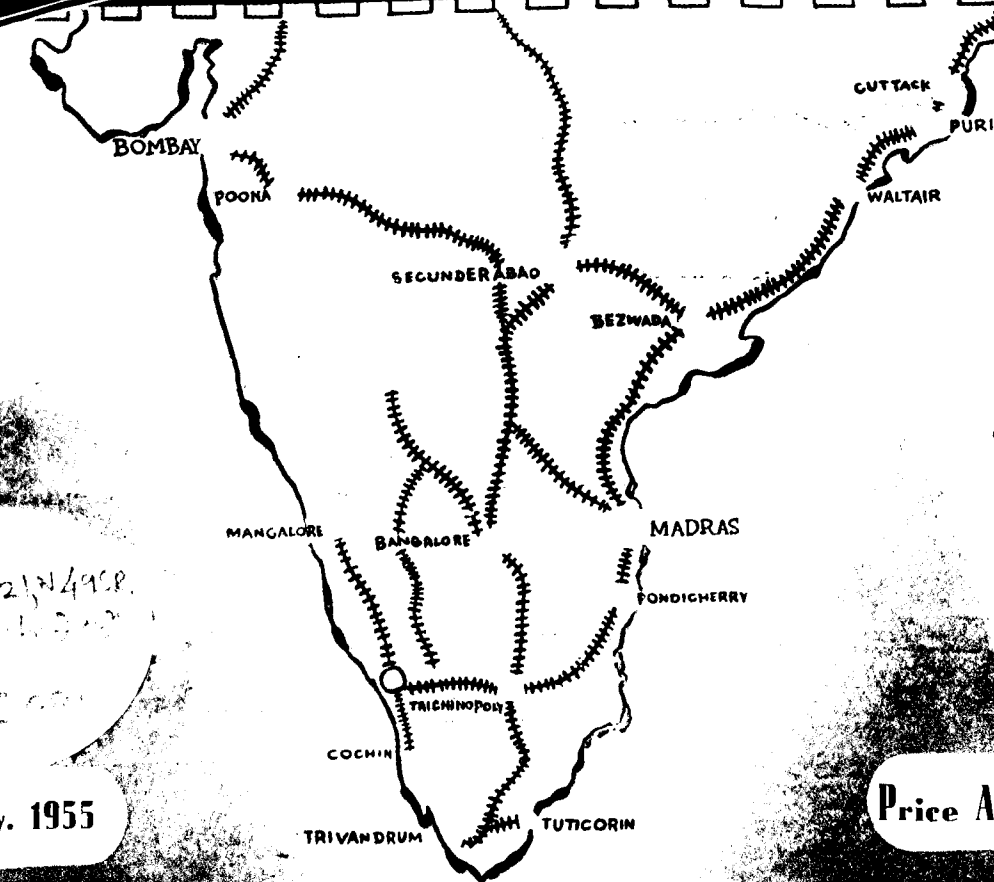
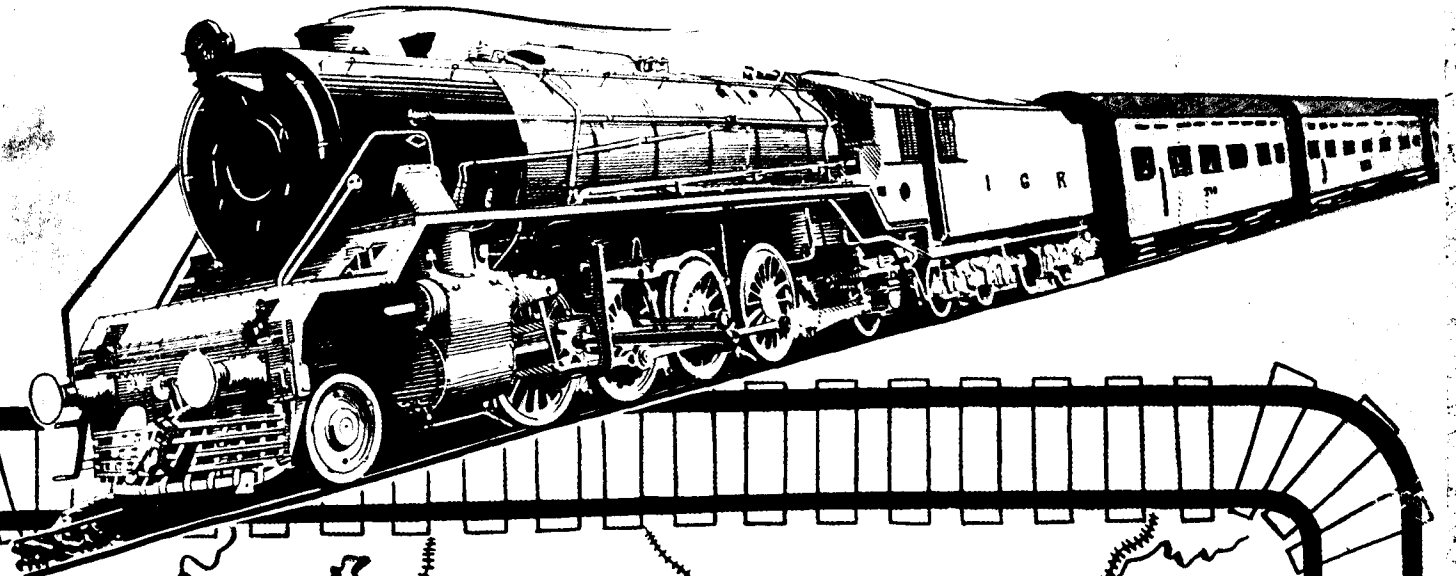
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SOUTHERN RAILWAYS

Magazine



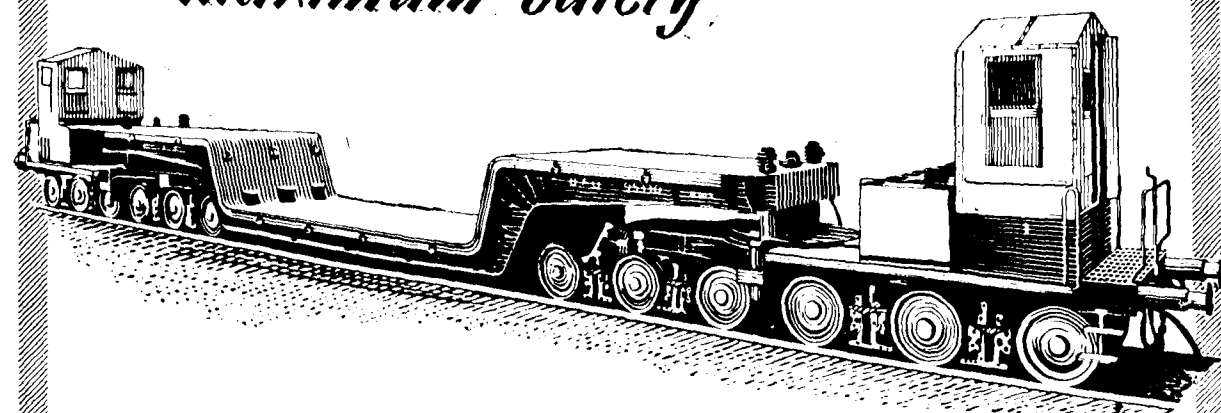
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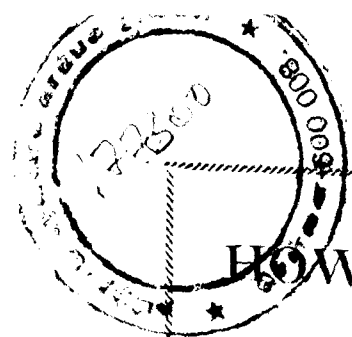
Editorial Notice

The Editor invites contributions to the Magazine on a variety of topics—short stories, technical features written in simple English understandable to the laymen. Aspects of Railway Working, places of tourist interest, News from home line, activities on Railway Institutes etc. All copy should be brief and typed as far as possible.

Photographs illustrating social functions, sports events, scenic spots etc. are also invited. All contributions should reach the Editor not later than 5th of each month. Rejected Mss. will be returned provided sufficient stamps for postage are enclosed. No responsibility will be borne for copy lost in transit.

Views expressed in this Magazine should not be taken as having official authority.

All correspondence should be addressed to The Editor, "Southern Railways Magazine," Post Box No. 17, Tanjore, (South India).



HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I and II Class) or Seat (Inter and 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 four 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 by the Public Relations Officer, Southern Railways Magazine)

SOUTHERN RAILWAYS MAGAZINE

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FEBRUARY

ISSUED
MONTHLY

THE STEEL AGE

EIGHT years after our having achieved independence, we are at the threshold of taking rapid strides in increasing our steel output. But, are we getting near our mark in industrialising ourselves? Have we computed our steel requirements? Have we rationalised our manufacturing programmes? Have we developed sound technique and efficiency in "Production" Shops? Have we "Production" Organisation? Have we Mechanical Engineers specialised in production technique and system? Have we developed our foundries and smithies to produce 'quality' products? Do not "Forge & Foundry" needs be right up to their correct place in their equipment and methods?

Are we conserving all our resources to make ourselves self-sufficient in regard to "steel and Machinery"? Mounds and Mounds of steel and cast iron scrap are at the ports, under and awaiting loading to foreign countries; wherein lies the defect in our 'control' and 'licensing' organisation. Did we not in 1937-40 witness the great debacle of selling all our 'scrap' just to find them transformed to "Arms and Ammunition"? Can we, however, be complacent now?

Are we training Production Engineers, Planners, Jig and Tool Draftsmen? Is there not considerable waste in that huge sums of money are spent in providing for "uneconomical" allowances in 'forging' and 'castings'—just to remove them off on machines? Of what avail are 'Precision' machines, if we allow waste to continue in 'forgings' and 'castings'? Have analysis been made of rejected castings, defective heat-treatment on forged costly steel products and failures of metals?

Take, for instance, Railways. Thousands of drawbar failures occur. Have we done the right thing to reduce the incidence? Have we analysed the enormous repetition work done in Railway Workshops in Non-ferrous Foundries on account of rejections due to defective castings, frequent renewals of wearing parts caused by absence of properties resistant to wear and tear?

In a nut-shell, have we laid stress on quality control—both as regards sound manufacturing technique and on the correct specification and quality of raw materials? Assessment of indigenous capacity by a Committee—and recently another Committee for the Railways with "grandiose" terms—have been appointed. But, what can such Committees achieve at this 'stage' of India's industrial economy?

What we require is concentrated training of personnel at all levels, conservation of resources, raw and semi-finished, and a regimentation of policy to improve "quality"; select men of

the right type and not only those “whom you know” and really those who have “initiative and experience” and do not shine in “ignorance and indifference” which go hand in hand with “yes, Sir”, to everything the politicians say, and “keep little trouble” in the works.

Now, another trend has developed. The I. C. S. (I. A. S.) have ‘burrowed’ into industrial management. Take the decision taken recently in connection with control of the great potential Neyveli Projects for development of Lignite. Will half-a-dozen I. C. S. Officers sitting at a table produce results? Is it heartening to an Engineer? The same can be said of ‘steel’ projects as well. The public have a right to know how personnel are selected and why, as in advanced countries, Engineers are not posted at the helm of affairs to produce and control, instead of dogging at the doors of an ‘administrator’. This is neither the right, nor the economical way to progress, prosperity and preservation!!

“FIELDING” DEEP DRAWING PRESSES

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Railway Minister's Address to All-India Transport Users' Conference

RS. 20 CRORES TO BE SPENT ON AMENITIES
IN NEXT SEVEN YEARS

ADDRESSING the All-India Transport Users' Conference, the Union Minister for Railways and Transport, Sri Lal Bahadur Shastri, said that there were ample indications that Government were doing their best to provide all reasonable efforts and amenities to the travelling public. He said that during the next seven years the Railways would spend over Rs. 20 crores on the amenities programme and he hoped that by the end of that period the target for the provision of minimum amenities at almost all the stations would have been achieved.

Sri Shastri said that the users of the railways had to be co-operative in the matter of maintenance of the amenities already provided. He said a more helpful attitude, especially in third class, would go far towards better cleanliness of coaches in running trains. The Minister called for a friendly approach and a helpful attitude on the part of the travelling public. Stressing the importance of the human element on both sides, the staff as well as the passengers, he said that he was glad to note a change in railwaymen's attitude towards the passengers and the public.

The following is the full text of Sri Shastri's speech :

“I am glad to have this opportunity of saying a few words to the friends assembled here. Our Railways are one of the biggest undertakings of the country, which touch the daily lives of perhaps the largest number of people. Their problems of transportation are numerous and of a difficult and complex character. The human problems connected with their working—I refer to the vast number of railway users with diverse requirements and tastes to be satisfied—are no less numerous, difficult and complex. With a total route mileage of 34,406 the Railways cover the length and breadth of the country and the volume of traffic they carry to serve the needs of our immense population is indeed of astronomical dimensions. I shall quote a few figures which are of special interest in this connection. During 1953-54 Indian Railways carried 1,220 million passengers and 99 million tons. Taking the distances, over which they were moved, Indian Railways did 37,549 million passenger miles and 29,493 million ton miles. To effect this, Indian Railways operated 112 million passenger train miles and 69 million goods train miles during the year.

It can be easily realised what it means to deal with such huge numbers and how important it is to cater to the national requirements of rail transport properly. The responsibility is indeed heavy and Railways have to do a great deal to make up the leeway which exists today on account of our legacies from the past when little concern was shown, at any rate, to the real patrons of the Railways—those who paid the largest revenues.

PUBLIC CO-OPERATION

It is indeed encouraging that in this big task imposed on the Railway undertaking non-officials should also come forward to offer their co-operation and play a useful part. I have, therefore welcomed their formation of Passenger Relief Associations and have in my own way tried to encourage and assist them. It is naturally desirable that there should be central direction in this respect, so that the resources of various sister organizations in the country are pooled in order that they may be able to serve more effectively. These Passenger Relief Associations should sit together and ponder over two or three matters which are essential for proper functioning. They have to decide on their principal objectives and their organizational set-up at various levels. They must also consider how they should make themselves truly representative bodies and define what their exact functions should be. You will agree that it is essential that your House should be set in order first.

The importance of providing minimum amenities in passenger trains as well as at stations is obvious enough. For the first Plan period each Railway was asked to draw up its programme of amenities and not only have they prepared the schemes, they have also them. For the Second Five-year Plan the Railways will be asked again to draw up their programmes from now on.

The main items to which special attention has been paid are adequate supply of water, better lighting, raised platforms, covering of station platforms, improved station buildings, larger and improved waiting halls and retiring rooms, better catering arrangements, fans in third and inter class compartments, improved design of coaches and provision of sleeping coaches. There are some other items also but I need not enumerate them here.

DEFINITE IMPROVEMENT

I do not propose to deal with these items in detail but you will, I am sure, endorse the claim that there has been a definite improvement in all these directions. For

supply of water, besides providing water coolers at big stations, special arrangements are made during summer on all other stations and additional staff are also appointed. An experiment has been made on the Northern Railway of carrying water in the train itself for supply to passengers in addition to what is provided at stations themselves. I have also suggested the sinking of wells or tube wells, if possible, at stations where there is dearth of water supply from other sources. The number of coolers will also be gradually increased.

For better lighting, there are general instructions that wherever electricity is available in the adjoining town or area it should be taken for use at Railway Stations.

Improved waiting halls are being built but their design is now being slightly modified so that they are not used as a passage for entering into the station and the platform. A separate passage for the purpose will henceforth be provided in order to ensure greater privacy to passengers.

BETTER THIRD CLASS COACHES

Improved designs of Third, Inter and Second Class coaches will now be worked to in the future. The widening of seats of Third Class coaches is being considered, as also the provision of blue bulbs for use at night. The feasibility of the construction of more spacious lavatories in Third Class compartments is being examined. Second Class coaches will also have better seats and be fitted with reading lights and shower baths. I have also suggested that a Second Class coach should be specially designed for short distance passengers at night so as to afford relief to long distance passengers from being disturbed at night as well as save the former the inconvenience they have to put up with at present. The idea is that the coach should have seats in the form of chairs so as to accommodate a larger number of passengers than would be the case if used as a sleeper.

The "sleeping" coaches provided in the *Janata* and a few other trains have been greatly appreciated by Third Class travellers. The number of such trains will be gradually increased provided they are sufficiently patronised. I know the top bunk in these coaches is very inconvenient, but I hope passengers will not have to face that inconvenience in the new sleeping coaches. As I have already stated, blue bulbs will be provided as well as a wash basin outside the lavatory. The same arrangements in regard to these two items will be made in the long distance direct bogies attached to fast trains.

Early steps are being taken to improve catering arrangements on the Railways. The rates have been lowered and a standard menu has been fixed. But I am thinking of the other steps which need be taken to improve upon

the present standards. I am particularly keen that cleanliness and wholesomeness are ensured in the food supplied by vendors, that is other than from dining cars or refreshment rooms. I hope to have necessary measures taken in this direction very early.

REMODELLING OF STATIONS

The work on remodelling of stations, and raising and covering of platforms is proceeding according to the programme chalked out by different Railways. Similarly, fans in Third and Inter classes are being installed rapidly. 35,500 fans have already been installed by June 30, 1954.

During the next seven years we would be spending over Rs. 20 crores on the amenities programme and I hope that by the end of that period we shall have achieved our target in so far as the provision of minimum amenities is concerned at almost all the stations.

I trust it will be appreciated that these works have to be carried out according to a scheduled programme and the time lag involved should not make us impatient. Every effort will, of course, be made to execute the works speedily. We should not perhaps also forget the fact that some of these amenities may lose their urgency and importance when the frequency of train services has increased or when important lines have been electrified.

From what I have already stated you will, I am sure, see ample indications that Government are trying their best to provide all reasonable comforts and amenities to the travelling public. It is with a view to making sure that proper attention is accorded to this programme that we appointed senior officers on all the Railways with the rank of Deputy General Managers to deal with matters relating to passenger amenities. From what I have so far seen, these officers have already begun to make a useful contribution in their field of work.

USERS' RESPONSIBILITIES

An equally important point for consideration is the proper maintenance of the amenities that are provided. The station staff have, no doubt, to see to it that cleanliness is preserved, that the surroundings are not made dirty, that the floor is not damaged and that the service regarding supply of water, food, etc., is up to the standard laid down. But the users of the Railways have to be specially and equally co-operative in this matter. Unless they respond, the efforts of the staff alone will not succeed. In waiting halls, water is spilt in all places, even where there are basins and taps available; there is spitting and waste matter thrown wherever the

passengers sit. Taps are left open, the lights and fans are not switched off and the flush is not used.

These are some of the things about which users themselves have to pay attention. It is even more annoying to see outsiders, who are not travelling passengers, using the halls and the bath rooms, etc., and making them dirty.

Similarly, in the matter of dealing with begging and unauthorised hawking, co-operation from the passengers themselves should be available if the Railway staff so want it from them. A more helpful attitude specially in Third Class will go far towards better cleanliness of coaches in running trains. The Station Master who will, no doubt, keep an eye on these things, is also now being encouraged to make the stations and their surroundings more pleasant and attractive. I have seen some small stations, where, without much expenditure, the stations have been made to look green, neat and beautiful.

Overcrowding has gone down very much but wherever it exists, steps are constantly being taken to reduce or end it. As many as 787 new trains have been introduced and extended during the last three years. In this connection, I would make an appeal to all intending passengers, that is, they should travel light as far as possible and should not clutter up compartments with their heavy luggage pieces. I am sure your Association can effectively influence public opinion in this matter as well.

HUMAN ELEMENT

I have talked about our programme of work and the amount we propose to spend on it, but as I said before, the important factor is the human element on both sides, the staff on the one side and the passengers or the users of the Railways on the other.

I know the Railwaymen have to bear a heavy brunt in this respect and I am glad to note a change in their attitude towards the passengers and the public. They are working with a new zest and trying to create a changed environment. On many occasions they have had to put up with indignities without retaliation and have quietly performed their duties. I am happy to hear of some cases in which the staff were extremely helpful and while they alone should have been the rightful recipients of compliments and bouquets, I am glad I also came in for a share of these with them.

Railwaymen have ample opportunities to serve the public. It is so pleasing to one's soul to render

assistance to others who need it; in fact, it raises one in one's own estimation. Material gains one cannot and should not ordinarily deny to oneself, but there is something else over and above these. It will be our greatest misfortune if we do not look beyond our own interest and perform our duty in a true spirit of service.

Your Association can play an important part in moulding public opinion. You can indeed help to encourage the sense of confidence amongst the staff for doing the right things. If there is a complaint it should certainly be recorded or referred to the higher authorities, but the public should take care that the prestige and dignity of the worker are not injured or impaired in any way. Politeness and courtesy should not be regarded as weakness and there should be no exhibition of brow-beating on the part of any individual, group of party.

EDUCATING PUBLIC OPINION

May I also point out the fact that you can do much to educate public opinion in the matter of preventing thefts and losses we sustain of Railway property in running trains or in vehicles when stabled. The loss to the Railways is a loss to the general public as it is their own undertaking. For example, on the Eastern Railway this has assumed serious proportions, and it is, therefore, urgent that besides what the Police and the Watch and Ward may do to stop it, the public should also be educated to take a serious view of the matter and help in creating a strong public opinion against such anti-social practices.

Conditions have now changed considerably since the advent of freedom. It would be a mistake to consider that those who are in the Government service do not realise the significance of this tremendous change. Non-official bodies should not, therefore, be always critical of them. What is required is a friendly approach and a helpful attitude—which in general terms can be said to be a non-violent approach. If your members and workers try to work in the spirit of bossing over others or as supervising their work they will fail in their noble mission. I want you to develop a constructive approach and a helpful and co-operative manner. Trust begets trust and I am sure you and the Railways will get on well in the larger interests of the people as well as of the Administration.

I wish you and your Conference all success.

Railways Provide Increased Transportation

PASSENGER TRAFFIC RECESSION ARRESTED

AN over-all increase in the volume of transportation provided and a reversal of the declining trend in passenger traffic are two of the features of railway working during 1953-4 brought out in the Annual Report of the Ministry of Railways, which has just been published.

The report deals with several other features of railway working during 1953-4, covering subjects like provision of increased amenities for passengers, opening of new lines, labour relations etc.

The gross traffic receipts of the Government railways during the year amounted to Rs. 274.29 crores, an increase of Rs. 3.73 crores over the 1952-3 receipts. Passenger earnings totalled Rs. 100 crores and goods earnings Rs. 147.18 crores, the balance of receipts amounting to Rs. 27.11 being contributed by parcels, luggage and other miscellaneous sources of revenue.

The Ordinary Working expenses during 1953-4 amounted to Rs. 201.47 crores, or Rs. 13.51 crores more than during the previous year. The Appropriation to Depreciation Fund was Rs. 30.36 crores, including Rs. 36 lakhs chargeable to capital, being the depreciation on the capital assets of the Chittaranjan Locomotive Works. Payment to worked lines as their share of net earnings amounted to Rs. 28 lakhs. The operating ratio during 1953-4 was 85.06 per cent as against 80.80 per cent in 1952-3.

After meeting all charges, including the Appropriation to Depreciation Fund, the net revenue on the results of working for the year amounted to Rs. 36.92 crores, out of which Rs. 34.36 crores were paid to the general revenues as dividend under the Revised Convention. The net surplus for the year, the whole of which was allocated to the Development Fund, amounted to Rs. 2.56 crores only, as against Rs. 13.19 crores in 1952-3 and Rs. 28.34 crores in 1951-2.

MORE TRAFFIC HANDLED

The total volume of goods traffic handled, inclusive of non-revenue traffic, recorded increases, both in regard to tonnage and net ton-miles. The tonnage originating during the year increased by one million to 99.4 million tons, and the ton-miles increased from 28,961 million in 1952-3 to 29,493 million in 1953-4.

The recession in passenger traffic observed during 1951-2 was halted during the year under report. The

total number of passengers and passenger-miles increased from 1.212 million and 37,396 million to 1,220 million and 37,549 million respectively.

Notwithstanding these increases both in the number of passengers and passenger-miles, the passenger earnings recorded a slight fall due mainly to the effect of the continued shift towards lower class travel and increased concessional traffic during the year 1953-4.

NEW OPERATING RECORDS SET UP

The number of additional passenger train-miles run per day on the Indian Railways on April 1, 1954, increased to about 3,357 on the broad gauge and 5,771 on the metre gauge over those operating on April 16, 1953. In regard to goods services, however, the train mileage decreased by 1.32 per cent as compared to the previous year.

The average freight load hauled by each goods train, however, increased by 12 tons on both the gauges, resulting in the net ton-miles per train engine-hour, recording an increase from 4,951 in 1952-3 to 4,965 in 1953-4 on the broad gauge and from 1,929 to 1,993 on the metre gauge. Although there have been set-backs under certain factors of operation, it is gratifying to note that past records since 1947-8 have been broken under freight tons originating, freight ton-miles, train-miles and freight earnings. Efforts were continued during the year to improve railway operation. An Efficiency Bureau was set up in the Railway Board for undertaking investigations in specific problems in the field of railway working and to assist the Railway Board in judging the economics of operation.

HIGHER GOODS EARNINGS

The above comparisons have, however, to be viewed in relation to the economic conditions prevailing in the country, as these determine the volume of transportation handled, which in turn affects the level of railway earnings. The economic conditions during the year were characterised by over-all improvement. Increased confidence in the future of the country's economy was encouraged by Government's economic policy pursued under the Five Year Plan, and the increased assistance rendered to the private sector was reflected in the increased domestic industrial production. Assisted by a good monsoon, agriculture recorded a substantially larger output.

The increase in domestic production, which reached a new record level, helped to improve the volume of goods earnings notwithstanding the decreases in the value of

international trade and in the quantity of imports during the year under review. Goods earnings rose from Rs. 143.81 crores in 1952-3 to Rs. 145.39 crores in 1953-4. The improvement in goods earnings was brought about mainly by a change in the composition of traffic and by the longer leads of the revenue-earning traffic which averaged 321.4 miles in 1953-4 as against 314.7 miles in 1952-3.

The average receipts per freight ton-mile amounted to 11.3 pies as against 11.2 pies during 1952-3 and the average earnings per passenger-mile decreased to 5.18 pies from 5.23 pies in the previous year.

RAILWAY USERS' BODIES SET UP

The National Railway Users' Consultative Council, which was established during the year, held its first meeting during October 1953. The Council made recommendations to Government on important policy questions, including vending, catering, bookstall contracts, social guides, ticketless travel etc.

On the Railways, the Railway Users' Consultative Committees, representative of all local interests, were set up at divisional/regional and headquarters levels. During the year in all 87 meetings of these consultative committees were held to discuss matters affecting the users within their respective jurisdictions.

The Indian Railways celebrated their centenary on April 16, 1953. The main function was held at New Delhi and similar functions were held at all railway headquarters and railway divisional and district stations. To enable people at other places to see the more important items of interest exhibited at the Centenary Exhibition in New Delhi, these were taken out on two special Exhibition Trains, one on the broad gauge and the other on the metre gauge. These proved to be very popular and up to the close of the year under report they had visited 142 stations, were on exhibition for 421 days and 1,600,000 persons had seen them. Between them, these trains had covered 20,000 route miles by the end of the year.

PASSENGER AMENITIES

Provision of amenities to make rail travel more comfortable continued to receive the close attention of railway administrations. Amenities included modern type of carriages, fans and fittings, improvements in train lighting, opening of new stations and provision of waiting rooms and halls, electrification of stations, raising of platforms, improvements in catering arrange-

ments and better sanitation on station premises and in passenger carriages.

During the year, 8,014 fans were fitted in Third Class and 1,162 Inter Class coaches. Reservation of seats in Third Class for long distance passengers in compartments earmarked for the purpose, intensive drives and surprise checks to ensure opening of booking offices in time and to check over-charging of passengers by the booking clerk were continued. Supply of clean drinking water to passengers (including electrically-cooled water at 115 stations) was another amenity which continued to receive close attention.

The safety of passengers in trains, particularly women passengers, was given due attention and additional safety measures were introduced.

CAPITAL EXPENDITURE

The total capital outlay on March 31, 1954 amounted to Rs. 878.45 crores on all Indian Railways (including lines under construction), of which Rs. 869.30 represented the capital-at-charge of the Indian Government Railways. The balance of Rs. 9.15 crores was the capital raised by companies and district boards.

The total route mileage of all railways in India at the end of the year was 34,406, of which 33,852 miles are under Government management. The balance of 554 miles represents the mileage of minor railways under the management of non-Government agencies.

NEW LINES AND OTHER WORKS

During the year the Barsi Light Railway (202.57 mile-long narrow gauge lines) was purchased by Government and merged with the Central Railway with effect from January 1, 1954.

Besides, a length of 144.24 miles was opened, of which 51.8 miles represent new lines and 92.44 miles represent restoration of lines dismantled during the last war. At the end of the year, a total of 715.93 miles was still under construction, including the Khandwa-Hingoli link (187.23 miles), Quilon-Ernakulam line (96.55 miles), and the restoration of Utraita-Sultanpur-Zaffarabad line (136.46 miles), besides a dozen other lines.

STORES PURCHASES

Indian Government railways purchased stores valued at Rs. 90.03 crores during the year, of which the value of indigenous material amounted to Rs. 64.43 crores. Stores worth Rs. 12.17 crores were imported direct,

while Rs. 13.43 crores worth of foreign stores were purchased through agents in India.

The value of railway equipment and stores ordered by railways during the year amounted to Rs. 105.86 crores, of which Rs. 48.19 crores worth of stores were ordered directly by the railways. Railway equipment and stores worth Rs. 27.52 crores were ordered by the Railway Board, while orders for stores worth Rs. 28.93 crores were placed through the Ministry of Works, Housing and Supply. The balance of the orders were placed through other Ministries.

SETTLEMENT OF CLAIMS

The railways settled 376,680 claims during the year under review compared to 365,215 in 1952-3. The number of unsettled claims at the end of the year stood at 68,859 as against 71,149 at the end of the previous year. The average time taken in the settlement of claims was 68 days as against 71 days during 1952-3.

The claims prevention drive was continued during the year. A senior retired police officer was appointed in July 1953 as Security Adviser to the Railway Board to study the working of the Watch and Ward Department and suggest measures to improve the security organization on the railways to minimize pilferages and thefts of goods from railway premises and running trains. He has submitted certain preliminary recommendations which were under consideration at the end of the year.

MORE STAFF QUARTERS BUILT

The total number of employees on open lines, permanent and temporary, was 964,061 on March 31, 1954, as compared with 927,522 on that date in the previous year.

Salaries, including allowances, provident fund and gratuity paid to the staff of Government railways totalled Rs. 135.31 crores, as against Rs. 126.27 crores during the previous year. The increase in the cost of staff is due to the increase in the number of staff, annual increments, contribution to provident fund, special contribution to provident fund, gratuities and increased allowances due to the merger of a part of dearness allowance with pay.

During the year 5,325 quarters of type I/A meant for Class IV staff and 1,523 quarters of types II/B, III/C and IV/D mainly for Class III staff were constructed,

besides 58 units of open or temporary types and 42 flats for officers on the different railways.

The railway administrations continued to take active steps to develop canteens, and to establish and enlarge the activities of co-operative societies for distribution of consumer articles.

CORDIAL LABOUR RELATIONS

Relations between railway administrations and labour continued to be cordial. The two premier railway labour organizations in the country, the All-India Railwaymen's Federation and the Indian National Railway Workers' Federation agreed to merge into a single all-India body—the National Federation of Indian Railwaymen—on April 9, 1953. The permanent negotiating machinery set up with effect from January 1, 1952 with a view to maintaining contact with labour and resolving disputes and differences which may arise between them and the administration, functioned satisfactorily during the period under report.

Under this machinery, an *ad hoc* Tribunal was set up consisting of Sri Sankar Saran, retired judge of Allahabad High Court, representatives of the Federation and of the Railway Board being permitted to present their cases on certain specified issues. The Tribunal had its first sitting on December 4, 1953 and at the close of the financial year, detailed particulars were awaited from the parties.

The total number of man-days lost as a result of strikes in workshops, running sheds, and other similar establishments of Indian Government railways during 1953-4 was approximately 0.008 per cent of the total man-days worked.

RAILWAY CORRUPTION ENQUIRY COMMITTEE

A committee of members of Parliament was constituted by the Minister of Railways in October 1953 to enquire into the prevalence of corruption on Indian Railways, with Pandit Kunzru as Chairman. He was succeeded by Acharya J. B. Kripalani when he resigned on being appointed as a member of the States Re-organization Commission.

The committee had begun its work and issued questionnaires to elicit the views of railway users and had started collecting information for their investigation at the close of the year.

Some Aspects of Wimet Tungsten Carbide Tools

METALS were first machined with high-carbon steel, a metal which can be heat-treated to relatively high hardness but loses its hardness rapidly when heated to temperatures above 300 degrees centigrade. Not only is the hardness of carbon steel at this temperature low, but on cooling to room temperature it remains low. For this reason, low cutting speeds are necessary in order that the temperature at the cutting edge shall not exceed the temperature at which the hardness of the tool drops rapidly. The development of the alloy tool steel compositions containing first chromium and then increasing proportions of tungsten, molybdenum and other alloying elements, resulted in big improvements. While no harder than carbon steels, their advantage lies in the fact that they retain their hardness to a much higher temperature. As shown in the accompanying graph they lose hardness seriously only at temperatures over 600 degrees centigrade. It has been known for a long time that the carbides which occur as a minor constituent in steels are very hard, and that another carbide, tungsten carbide, is amongst the hardest substances known. Efforts have been made to cast carbide, but their extremely high melting point and the brittleness of the resulting substance rendered it unsuitable for use as cutting tools. It was in the methods of powder metallurgy that the solution was ultimately found. Small particles of tungsten carbide were cemented together by a metal of lower melting point, cobalt, resulting in an alloy harder than any known tool metal which retained its hardness during and after being subjected to high temperatures. This hardness varies between thirteen hundred and seventeen hundred Vickers Diamond Hardness. It has since been found that other hard carbides, in particular titanium carbide, confer special and very useful properties on the alloy, and by varying the composition of the carbide and other elements, a wide range of grades is produced to deal with the increasingly wide field of application now evident. Cemented carbides can be classified under two main headings, Tungsten Carbide and Titanium tungsten Carbide.

Tungsten Carbide is used for those materials having relatively high abrasion characteristics, such as irons and bronzes which, generally, do not impose high cutting pressures by the separation of the chip from the workpiece. Instead, the function of the carbide is to resist the wear induced by friction.

Titanium Tungsten Carbide is basically Tungsten Carbide but with Titanium added during manufacture. The effect of this addition is to reduce the hardness of

the carbide, but it also supplies another characteristic which resists the tendency for chips of ductile material to "weld" to the carbide. Titanium Tungsten Carbide is intended, therefore, for cutting steels.

Literature is available showing the range of Wimet cutting grades now being produced and the tools now obtainable with recommendations for their use. When considering the application of Wimet cutting tools these recommendations will assist in determining the best tool and grade for job. By understanding the basic principles controlling cutting tool design, production engineers, shop supervisors and operators will be better able to achieve the higher production which correctly designed and applied carbide tools can bring.

DESIGNING CARBIDE TOOLS

We deal here principally with design of single point tools, beginning with the nomenclature, but it should be appreciated that although different terms are used the same principles of design apply equally to milling cutters or any similar multi-tooth tools. In fact all the features in a turning tool have their counterpart in a milling cutter blade, so that a milling cutter may be described as a rotating holder carrying a series of single point turning tools.

HAND OF TOOL

A certain amount of confusion is often encountered regarding the definition of a left-hand and right-hand tool, off-set or cranked.

A left-hand tool is one which has a cutting edge, cranked or off-set, on the left-hand side of the tool when viewed from above, with the cutting end of the tool towards the viewer.

CUTTING SPEED

Cutting speed is usually quoted in feet per minute and is the distance the surface of the workpiece has travelled past the tool, or the tool has travelled past the workpiece in that time. If the circumference of the workpiece in a turning operation is multiplied by the number of revolutions of the work spindle in one minute, we obtain the cutting speed. This does not apply of course to shaping, or planing. In these cases, the cutting speed is the actual traversing speed of the machine stroke.

Depth of Cut is the distance from the unmachined surface to the machined surface.

Feed is the incremental travel of a tool or workpiece per revolution or stroke of tool or workpiece, designated in terms of inches per revolution, or inches per stroke.

Approach Angle of a single point tool is the angle between the side of the shank and the cutting edge. The effect of chip pressure at the start of a cut is a major factor in the choice of the shape of a tool, and in order to obtain the lowest possible unit pressure, the cutting edge should be as long as practicable. The length of the cutting edge is determined by the approach angle, which may be as much as 45 Degrees.

CHOICE OF APPROACH ANGLE

Chip pressure *per unit of length* is at its maximum when a tool with zero approach angle is used. This shape of tool produces a chip with thickness equal to feed per revolution, but a tool with an approach angle and cutting at the same depth of cut, has to resist the same total cutting pressure, but has a lower cutting pressure per unit of length. The chip is thinner although of the same cross-sectional area.

PLAN TRAIL ANGLE

The plan trail angle on a turning tool is the clearance between the workpiece and the trailing edge of the tool. It should be small to provide maximum resistance to pressure at the tool point in the direction of travel.

The Wickman standard heavy duty turning and facing tool is designed with small trail angles so that maximum resistance to cutting pressures is provided for both turning and facing operations.

FRONT TO BACK ANGLE

The provision of a negative front to back angle on WIMET Tools induces a shearing cut which tends to guide the chip in a direction away from the workpiece, the lowest point of the cutting edge being at the point of deepest cut. This principle applies to tools with any approach angle and possesses the following advantages.

The chip, in being parted from the parent metal, tends to curl away from the surface of the workpiece and avoids damage to the finish of previously machined surfaces. An increased angle of approach also increases the pitch of the chip-curl so that an increase in the depth of cut may require an increased approach angle to provide sufficient pitch on the chip-curl to prevent it fouling the work. Any tendency for the point of a cutting tool to dig in is lessened when a front to back angle is employed, and results in minimised front clearance wear, as

compared with a tool which has a cutting edge higher at the point of deepest cut.

CUTTING RAKE

Cutting rake or top rake can be described as the angle which parts the chip from the workpiece and should not be confused with the front to back angle. It is measured in a plane approximately at right angles to the cutting edge, but the chips do not necessarily flow in that direction since the combinations of front to back angle, approach angle and cutting rake, can produce different dispositions of the top surface of the tool.

DETERMINING CUTTING RAKE

The cutting pressure exerted on a turning tool is generally the influencing factor determining cutting rake. Aluminium alloys require very little horse-power to part the chip from the workpiece so that cutting pressures are light and high positive rakes are suitable. On the other hand, high tensile nickel chrome steels require more horse-power, and cutting pressures are, therefore, heavy. In such cases negative cutting rakes are necessary in order to provide a cutting edge able to withstand the high pressures.

The breakdown of a cutting edge invariably begins on the front clearance and an appreciation of the effect of cutting pressure will also assist in choosing cutting rake. If the top rake were acute, the cutting pressure applied by the chip would have a twisting effect on the shank forcing the tool into the work and causing additional rub on the front clearance. This twisting effect would be minimised if a reduced positive rake or a negative rake were employed under similar conditions.

PRIMARY AND SECONDARY CUTTING RAKES

Wimet engineers have for long advocated the use of primary and secondary rakes, and it has now become common practice to employ this system in order to obtain the advantages of both negative and positive rakes. For example, when cutting a high chromenicked steel with a tensile strength of something over 70 tons per square inch, longer tool life is obtained with a negative top rake of about 3 degrees. Since the horse-power consumption with this rake is high, arising out of the friction under high pressure between the chip and the surface of the tool, it is good practice to grind the top surface of the tool with a primary rake land of 3 degrees negative immediately behind the cutting edge, and an 8 degrees positive secondary rake across the remainder of the surface. The primary rake stiffens the cutting edge, and the secondary rake reduces the pressure between the chip and the cutting tool, allowing the chip to flow

freely over the tool face with consequent saving in power. The width of the primary rake should normally be four times the feed.

In general machining, this practice can be used with considerable advantage on the majority of steels, other than mild steels, particularly for roughing cuts on forgings and intermittent cutting. A difference of only 2 degrees between the primary and secondary rakes will release power which can then be more usefully employed in increasing the metal removal rate.

CLEARANCES

Grinding wheel life can be increased by the use of secondary clearances under the tip to allow for the grinding of the tip only.

The secondary clearance angle should be 2 degrees to 4 degrees greater than the clearance required on the tip. This means that if the tip is reground with 4 degrees clearance it will be necessary to set the grinding machine table between 6 and 8 degrees when grinding the clearance on the shank.

Considerable economy in cost of grinding wheels is effected since if the recommended wheels for Wimet grinding are used on the shank, loading of the wheels will result, necessitating frequent redressing, leading to excessive wheel wear.

MILLING CUTTERS

Radial Rake: Radial rake on a milling cutter is equivalent to cutting rake on a turning tool. Positive radial rakes have been proved suitable for cast-iron and steels up to 45 tons tensile strength, whereas certain other materials require reduced positive rakes, or negative rakes.

Helix Angle: Helix angle on a milling cutter is equivalent to front to back angle on a turning tool. The milling cutter has a negative helix angle and is intended for use on materials which induce high cutting pressures. Materials in the low tensile range may be cut more efficiently with positive helix angle, and the range of Wickman cutters includes some types for this purpose with positive helix angle.

CHOICE OF MILLING CUTTER RAKES

Milling is a form of intermittent cutting and it is generally desirable when dealing with such an application to dispose the blade in the cutter body in such a way that the initial impact on the blades is directed away from the cutting edge.

Maximum resistance to impact can be achieved by the use of a negative helix angle, in combination with a positive radial rake, as in the case of the Wickman 'Multimill', or by a combination of positive helix angle and negative radial rake, as applied to the Wickman 'Hevimill'.

BEVEL ANGLE

Bevel angle on a milling cutter is equivalent to approach angle on a turning tool. Experiments and experience suggests that a bevel angle of 15 degrees on a face milling cutter results in optimum metal removal rate on normal workpieces, but where extreme rigidity is present, the bevel angle can be increased to the maximum of 50 degrees as in the Wickman 'Hevimill'. Remember, the wider the bevel angle, (or approach angle in a turning tool) the thinner the chip produced and consequently the lower the unit pressure along the cutting edge.

CHIP BREAKERS

Most metals possess characteristics which cause the production of a continuous chip during machining. For easy chip disposal, and to protect the operator from injury, the continuous chip must be either curled or broken into short lengths. Chip breaking can be carried out by increasing the feed to obtain a larger cross-sectional area (feed times depth of cut) which causes the chip to break. Alternatively, there is the chip breaker formed or ground into the tip itself. Chip breakers vary in width, dependent upon the feed and depth of cut.

Where extreme difficulties are encountered in the breaking of chips, various methods of chip flow control can be applied in the form of deeper and wider grooves than those associated with chip breakers, with modifications in the form of blending radii and inclination of step. These are chip *curlers*. As so many variables, such as degrees of ductility, feeds, speeds, depth of cut and diameters of workpiece enter into this subject, correct form can only be resolved by the tool user.

TOOL SETTING

Wimet standard tools are made with a small front to back negative angle, and consequently the point of the tool should be set just below centre, with the front to back angle intersecting the centre line half-way in the depth of cut.

In recessing and plunge cut turning, setting is rather more critical when the front to back angle is positive, since the effect of setting the tool point above or below centre is to modify the cutting rake and front clearance.

A tool with a positive front to back angle should be set on the centre line of the work.

In the boat-type of tool holder is used, care must be taken when setting the tool to see that the shank is set horizontal, otherwise the front to back angle and clearances are affected.

FEEDS

In determining feed rates, we should consider just what happens when a tool enters the cut. Immediately the cutting edge touches the workpiece, spring in the tool and the elastic resistance to penetration of the tool into the workpiece causes an initial rub, until the machine forces a penetration by the cutting edge. Gradually, but very quickly of course, the tool is able to take the full feed but during this initial rubbing, prior to penetration, damage has been caused to the front clearance. This is why a tool producing components with a relatively short cut does not produce the same footage of cutting as a tool used on a job of greater length.

The life of a tool, therefore, is determined by the number of starting cuts during its life, or the number of components rather than the amount of surface area machined. A practice in general use is to provide a trailing edge, overlapping three feed distances, to smooth out the cut marks and improve the finish produced. It will, of course, be recognised that this practice produces the rubbing effect previously mentioned, where

the feed, or the depth of cut, is below the economic minimum, and some sacrifice of tool life is normally expected when this practice is followed.

Every material has an optimum cutting speed that will give the maximum tool life for the maximum metal removal rate, and this is determined by taking a check-cut at various speeds; the lowest speed which shows sudden improvement in finish is that which should be normal machining operations.

As it is not so necessary in finishing cuts to consider the effect of cutting pressure, speeds can be increased to maximum.

Little can be done about obtaining a uniform finish throughout a facing cut unless a stepless speed variation drive is employed in the machine being used, although speed is maintained at a more uniform rate by previously determining at what diameters the revolutions per minute should be increased.

BORING SPEEDS

Generally on internal work where single point tools are used, cutting speeds of about two-thirds of those used for turning are employed. This is because a boring tool is not as well supported below the cutting edge as a turning tool and is consequently not able to withstand the same cutting pressures. The feed should be reduced, however, with due regards to the need to avoid rubbing.

Western Railway shortly to collect oral evidence regarding corrupt practices prevalent on the Railways. The Committee will collect such evidence from Railway and Police officials, Representatives of public bodies like Chambers of Commerce, trade associations, Railway Passengers' Associations, Railway Labour Unions, Members of the Union Parliament and State Legislatures, as well as other individuals who may wish to appear before it.

The Committee will hold meetings at Jaipur on February 9, at Ajmer on February 10, at Mensana on February 11, at Rajkot on February 12 and at Gondal on February 13. Those seeking interviews with the Committee may contact its camp office at the stations concerned.

ENQUIRY INTO AIR ACCIDENTS

The Government of India have appointed Sri N. S. Lokur, Chairman, Air Transport Licensing Board, to hold formal investigation into the two accidents to the Indian Airlines Corporation's Dakota aircraft which occurred near Gauhati on January 21, 1955 and near Nagpur on February 2, 1955.

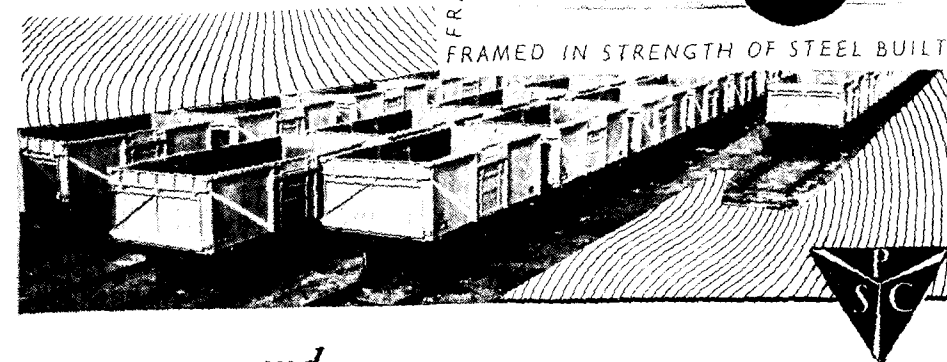
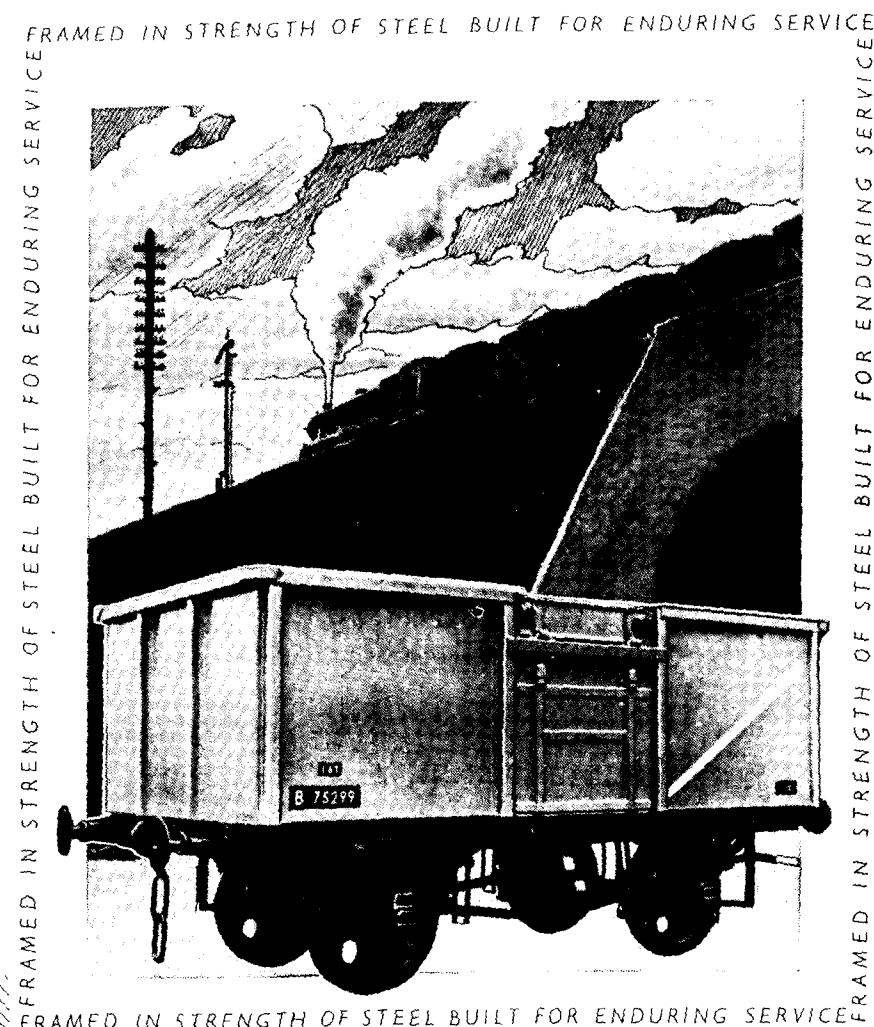
Sri Lokur will be assisted by a panel of assessors consisting of Sri K. L. Puri, Director of Aeronautical Inspection, Civil Aviation Department, and Captain K. Vishwanath, Divisional Operations Manager, Air India International.

RAILWAY CORRUPTION ENQUIRY COMMITTEE TOUR OF WESTERN RAILWAY

The Railway Corruption Enquiry Committee is undertaking a tour of the metre gauge portion of the

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MODERN TOOL ROOM MACHINERY

By F. Fuchs, V. D. L.

A series of articles will be published in the Journal of the Indian Apprentice Engineers, Eastern Railway Workshops, Kanchrapara.

Article No. 1. The Precision Toolroom Boring & Milling Machine HURTH V10a combines in a single machine tool three different cutting operations which are of equal importance for the toolroom as well as for the construction of jigs and fixtures:

- (1) Vertical Milling, using the longitudinal traverse of the worktable which can be tilted in two directions.
- (2) Downfeed Milling, using the longitudinal traverse of the worktable and the graduated downfeed of the cutter spindle.
- (3) Jig Boring, using the continuous spindle downfeed which can be varied in extremely small steps.

This wide range of usefulness of the HURTH V 10a enables even the most intricate workpieces to be machined to very close tolerances at one set-up. The machine fully meets the requirements made of a boring and milling machine used in the manufacture of tools, jigs and fixtures, gauges, moulds, punches, and pressing dies. In small lot a long-run production, too, the HURTH V 10a has proved its efficiency. Its range of usefulness in every conceivable field of mechanical production can be further extended by using it in combination with a variety of attachments.

SPECIFICATIONS

Worktable area	11 3/4" x 39 1/4"
Longitudinal traverse of worktable (power and hand operated)	max. 15 3/4"
Transverse traverse of worktable (hand operated only)	max. 9 1/2"
Vertical adjustment of knee (power and hand operated)	max. 14"
Tilting range of worktable (to front and rear)	150
Width of three T-slots	.632"

Largest size of tool shank received by spindle Nose	1.26" dia. or Morse No. 3 or ISA 40 or 32 mm dia.
13 Spindle speeds	45, 63, 90, 125, 180, 250, 355, 500, 710, 1000, 1400, 2000, 2800 r. p. m.
10 Downfeed rates of spindle (using the crank mechanism)	.002"—.020" p.trav.
9 Speeds of spindle head slide (using the crank mechanism) traverses per min.	2-2.8-4-5.6-8-11.2-16-22.4-31.5
9 Boring feed rates of spindle	.22"—.31"—.44"—.63"—.88"—1.24"—1.77"—2.48"—3.54" p. m.
6 Table longitudinal feed rates	5/8"—1"—1.9/16"—2 1/2"—4" 6 1/4" per min.
6 Speeds to circular table	6.8—68 r. p. m.
Vertical travel of spindle (down, power and hand operated; up, hand operated)	max. 3-15/16"
Spindle head traverse (by crank mechanism)	max. 5-29/32"
Distance, spindle nose to table	max. 25-3/4"
Diameter of tilting table	19-3/4"
Spindle and gearbox motor	2.2 kw—1400 r. p. m.
Table feed motor	.3 kw—1400 r. p. m.
Knee elevating motor	.6 kw—2800 r. p. m.
Over-all height of machine	73"
Space required	71" x 53"
Weight of the machine net approx.	4300 lbs.

ACCESSORIES—TOOLS—ATTACHMENTS

Standard equipment of the V 10a

Complete electrical equipment for standard voltage three-phase current.

- 1 Plug receptacle (with protective condenser) for machine lamp.
- 1 Complete coolant system, including immersion pump.
- 1 Stieber quick-action chuck, hand-operated, with spring collect 3/16" (5 mm) dia.
- 1 Dial Indicator for worktable zero adjustment in horizontal position.
- 1 Set spanners — 1 Instruction Book.

Special equipment of the V 10a

- 1 Swivel table, model ST 500, indexing by 15-deg. intervals, 19 1/4" dia.
- 2 Dial indicators with mounting brackets for work by co-ordinates, using gauge blocks.
- 1 Circular Table, model RV 315, 12-3/8" dia. also with index plate attachment.
- 1 Universal Dividing Head with tailstock, Model LT 10, for use with index plates and index bolt.
- 1 Swivel-type machine Vise, Model LST. 2, max. gap. 3-15/16".
- Self-centring Vises, Model LZ3, for clamping round work.
- 1 Face milling Cutter, model MK 110, with carbide tipped blades 4-21/64", for cast iron, including arbor.
- 1 Set of clamping sleeves model SP 1/4"—1" dia. for cutters having cylindrical shanks.
- Adapter sleeves, model MH, Morse Nos. 1—3 for quick action chuck.
- 1 Drill chuck model BF 10 for cutting tools up to 25/64" shank dia.
- 1 Boring Head model AK 2, for hole up to 4-21/64" in dia.
- 1 Universal dial indicator for accurate locating of work.
- Keyway and slot milling cutters, for use with the down-feed milling feature.
- 1 End mill gauge model FPL for checking cutting edges on keyway and slot milling cutters.
- End mills for jig boring work, model STS, with Morse Taper 5 16"—1-9/16" in dia.
- 1 Machine lamp, with universal joint arm.

THE CUTTER SPINDLE OF THE V 10a.

The spindle is the most vital component of any machine tool. A Spindle of expert design therefore is

essential to accurate work. The design of the boring and milling spindle of the V 10a is based on many years' experience in spindle construction, extensive research work, and shop tests of the most exacting nature.

Lasting accuracy is ensured by two design features; the massive construction of the machine which virtually eliminates distortion under load, and the extremely long spindle quill guided in a precision-bored hold in the spindle head. True running of the spindle is guaranteed by the use of a carefully selected double-row roller bearing on the lower spindle end.

From the gearbox the spindle is driven through a multi-layer flat belt running over a tightening idler. Proper selection of cutting speeds to suit the work diameter and the material to be cut is made possible by the provision of 13 spindle speeds covering an extremely wide range of between 45 r. p. m. and 2800 r. p. m. In order to increase belt pull in cases where low spindle speeds are used in combination with large diameter cutting tools, a 4-to-1 planetary reduction gear has been provided within the spindle pulley. The spindle is completely relieved of belt forces, and the spindle pulley is independently supported by its own bearings. In order to facilitate the changing of tools, the spindle can be locked.

For each spindle speed nine different boring feeds are available, this enabling the most favourable conditions to be selected for any particular job. For example with the smallest possible spindle speed of 45 r. p. m. boring feeds range from .005" to .080" per revolution, while the maximum spindle speed i. e., 2800 r. p. m., feeds range from .00008" to .0012" per revolution.

For the purpose of locking the spindle quill in any desired vertical position during face milling and similar operations, an adjustable concentric-action quill clamping device has been provided. The special design of this clamping device excludes the application of lateral forces on the quill and thus prevents premature wear of the quill guide hole in the spindle head.

The spindle nose is arranged with National standard taper 40. As a rule, cutting tools, such as twist drills, end mills, for jig boring work, face mills, boring heads, etc., are held in the hand-operated true running Stieber chuck enabling tools to be changed in a few seconds without using a spanner.

**WORKTABLE WITH GAUGE BLOCK
MEASURING EQUIPMENT**

The worktable of the V roa has been carefully designed to meet the many and varied requirements of tool-room practice. In contrast to conventional milling machine worktables, it serves the dual purpose of holding the work in position and of enabling accurate measurements to be made. While the worktable slide can be adjusted in longitudinal, transverse and vertical directions, the clamping plate proper can be tilted 15° to the front and to the rear, respectively. In addition a circular swivel table 19-3/4" in diameter with index positions spaced 15° can be placed on the worktable. Besides manual adjustment, the worktable slide has six different power feeds in either direction, these feeds ranging from 5/8" to 6 1/4" per minute.

The guide ways of both the worktable and the cross slide serve as reference axes for work by rectangular co-ordinates, while the circular table, model RV 315, when placed on the worktable, enables work to be performed by polar co-ordinates.

The worktable as well as the cross slide can be adjusted in their respective directions of movement either by means of rules and large-size graduated collars reading .001" or with the aid of gauge blocks, the latter affording greater accuracy. The machine is fitted with gauge block measuring equipment, the gauge blocks being brought into contact with dial indicators reading .0005" correct settings being indicated by the pointers registering with the zero marks.

A push-button controlled elevating motor affords rapid and convenient vertical adjustment of the knee.

YOUR MAGAZINE

The Southern Railways Magazine offers you a variety of topics—short stories, pictures, historical, humorous articles, news, technical railway engineering in its various aspects every month. It only costs Rs. 3 per year. For Railway personnel Post-Free Fill this in and become a subscriber to-day itself.

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Better Railway Operation Position

RAIL USERS' COUNCIL CONSIDERS PROBLEM

MEMBERS of the National Railway Users' Consultative Council at their meeting in New Delhi expressed satisfaction at the improvement made in the operation position of the Indian Railways during recent months. The Council was told that both on the broad gauge and metre gauge goods loading during the second half of 1954 had recorded an increase compared to the corresponding period in 1953.

The meeting was presided over by the Minister for Railways and Transport, Sri Lal Bahadur Shastri, and was attended among others by Sri Satya Narayan Sinha, Minister for Parliamentary Affairs, Sri O. V. Alagesan, Deputy Minister for Railways and Transport, Sri Shah Nawaz Khan, Parliamentary Secretary to the Railway Minister.

COPING WITH INCREASED INDUSTRIALISATION

In reply to questions by Members of the Council, it was stated on behalf of the Railway Board that the increased load expected to result from greater industrialisation during the Second Five Year Plan period had been taken into full consideration in making plans for future Railway transport capacity.

The Railway Board had also made the necessary arrangements for moving raw materials required in connection with the new steel plants.

ARREARS LIQUIDATED

In a memorandum on the operating position submitted to the Council by the Railway Board, it is pointed out that prior to the commencement of the busy season, arrears of traffic required to be moved over the Assam rail link and for destinations in the South reached *via* Bezwada. Demands for movement to destinations on the broad gauge sections of the Eastern, Northern, Western and Central Railways, the memorandum points out, are being fairly met. On the broad gauge of the Southern Railway, however, it is stated, there are heavy arrears of traffic in rice and iron ore involving movement

over Bezwada-Madras and Guntakal-Madras sections where capacity is restricted.

On the metre gauge Railways, although the loading in recent months has been better than in previous years, the memorandum says, there are certain areas and routes where demands have not been met satisfactorily.

The Council was informed that the capacity over the Bezwada-Madras line had recently been increased from 350 to 370 wagons per day, and with the arrival of more engines it would further be increased to 420 wagons per day in the first instance and to 500 wagons per day later.

STEPS TO INCREASE TRANSPORT

Several steps have been taken to improve the availability of transport with the existing facilities, the Council was informed. For instance, in the metre gauge sections of the Northern region transshipment of traffic *via* different junctions had been rationalised, ensuring an even flow and better regulation of traffic and usage of wagons.

Due to floods the traffic for Assam was completely restricted for some time during 1954, but steps are being taken to increase the availability of transport. To improve the metre gauge wagon availability, several adjustments in the routing of traffic have been made.

EXPRESS GOODS TRAINS

To speed up long-distance goods movement, Express goods trains have been introduced on all the main trunk routes, namely, Bombay-Shalimar, Bombay-Madras, Bombay-Delhi, Madras-Shalimar and Delhi-Howrah. These trains run to fixed schedules.

A close check is also being maintained by every Railway on the transit time of traffic movement between certain specific important points.

On receipt of wagons and locomotives already on order and with the completion of the various line capacity works, the Council was informed, the transport position would continue to improve progressively.

British Locomotives for World's Railways

OVER 400 EXPORTED TO INDIA IN FIVE YEARS

SINCE the war, Britain's locomotive industry has exported to all parts of the world locomotives and component parts to the value of no less than £100,000,000, says an article in a special trade and transport issue of the *British Trade Journal and Export World*, just published.

Today Britain can offer deliveries of locomotives as speedily as any other country. During the last five years the industry has exported no fewer than 405 locomotives to India, 468 to Africa, 395 to Australia, and 356 to other parts of the world. These were all main-line locos, some of the largest ever to leave Britain.

There have also been numerous orders for Diesel locomotives; these include 30 for Brazil, 25 for Ceylon, 94 for Ireland, and 75 for the Netherlands. Electric locomotives have also been produced in increasing numbers, and these include very large main-line locomotives for South Africa, Spain and Brazil. In 1953, no less than 93 per cent. of the total production of the industry went overseas.

The article recalls that one of the largest contracts ever placed for railway equipment was awarded last year to a British firm (Metropolitan-Vickers). The Central Railway of Brazil ordered 200 complete railway coaches, to be built and equipped in Britain, and 100 sets of electrical equipment to fit into coaches being built in Brazil. The contract, financed in part by an International Bank loan of \$12,500,000, was worth about £7,000,000.

U. K. MASTER PLAN

Referring to the new 15-year plan to re-equip and reorganize Britain's State-owned railways, the article observes that oversea buyers interested in this field will watch with interest implementation of various aspects of what has been called the master plan for British Railways. The £1,200 million programme, which will include extensive schemes for electrification, more Diesel locomotives, re-planning of stations, and improvement of rolling stock and the permanent way, may, by the time it is completed, set new standards of modern railway practice which will serve as a model for the world.

The potentialities of gas turbine and atomic power for propulsion are not being overlooked.

ACCIDENT TO TRAIN ON N. E. RAILWAY

The following telegrams of sympathy have been sent to the General Manager, North Eastern Railway, Gorakhpur, in connection with the accident to 450 Down Passenger train between Bhojepura and Saithal stations on the North Eastern Railway at about 7.35 hours on February 7, 1955.

FROM THE PRESIDENT OF INDIA

The President is distressed at the news of the deaths and injuries resulting from the derailment of 450 Down Passenger train between Bhojepura and Saithal stations on the North Eastern Railway, on the morning of February 7, 1955. He desires that his sympathy be conveyed to the bereaved families and to those who sustained injuries in the accident.

FROM SRI LAL BHADUR SHASTRI, MINISTER OF TRANSPORT AND RAILWAYS

The news of the derailment of the 450 Down Passenger between Bhojepura and Saithal stations of the North Eastern Railway on the morning of February 7, 1955

has come as a shock to me. Please convey my sincere condolences to the families of those who lost their lives and sympathy to those who were injured in the accident.

FROM SRI O. V. ALAGESAN, Dy. MINISTER OF TRANSPORT AND RAILWAYS

I am pained to hear the loss of life and of injuries caused by the derailment of the 450 Down Passenger train between Bhojepura and Saithal stations on the North Eastern Railway on the morning of February 7, 1955. Please convey my sympathy to the injured and to the relatives of those killed in the accident.

FROM THE RAILWAY BOARD

The Railway Board are grieved at the sad news of the casualties resulting from the derailment of the 450 Down Passenger between Bhojepura and Saithal stations on the North Eastern Railway on the morning of February 7, 1955. Please communicate to the injured and to the families of those killed their deepest sympathy.

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

Buy your tickets only at the proper place. The authorised offices are (i) the Booking offices at the railway stations, (ii) the Town or City Booking Offices, (iii) the out-Agencies, (iv) Travel Agents. Never buy tickets from any other source as that may lead you to trouble. Please note that tickets are not transferable.

Buy your tickets in the proper time. You can avoid unnecessary excitement and trouble if you come to the station in good time, that is at least half an hour before the scheduled departure of your train. The Time Tables of the Railway are on sale at Booking Offices and Bookstalls.

Buy your tickets in the proper manner. Queue up at the Booking Window and you can get your ticket easier and quicker than by crowding at the counter.

By handing in the *exact fare in good coins or currency* you get the ticket easier and quicker, and save for yourself and the Booking Clerk time and trouble.

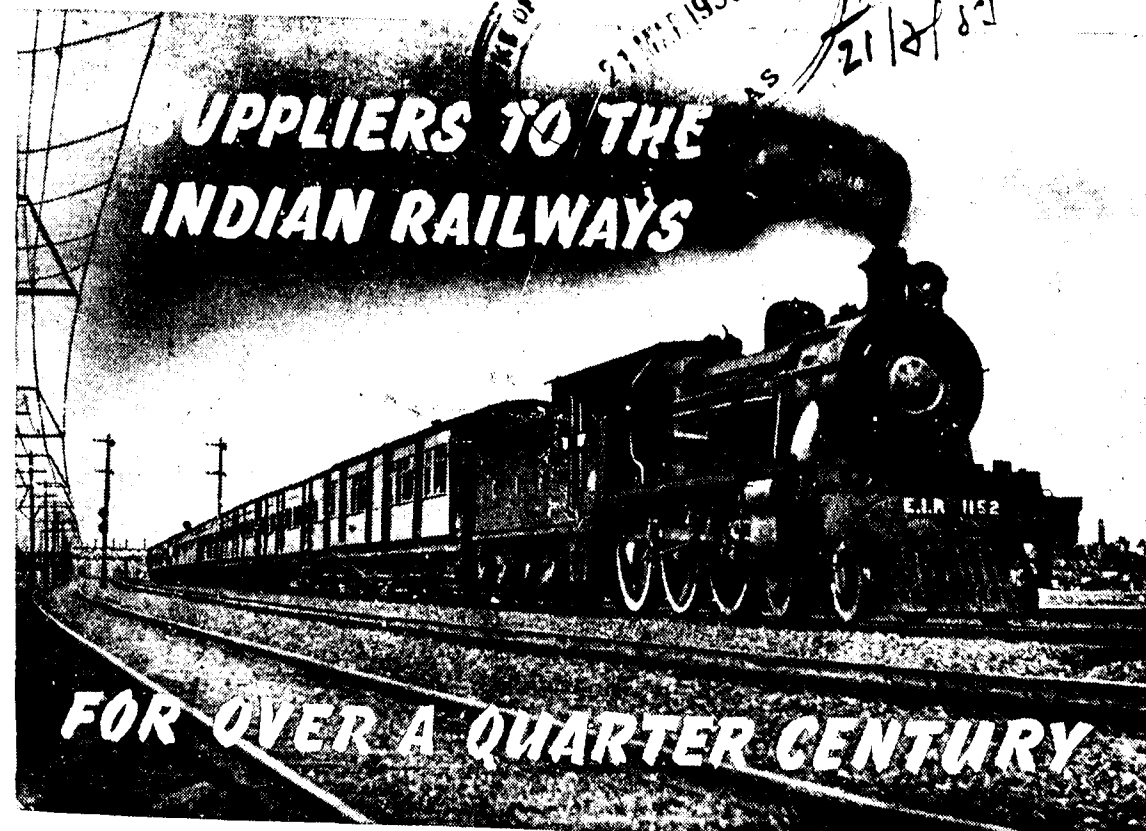
Check up your ticket and money before leaving the counter and draw the attention of the Booking Clerk to any discrepancy you may notice.

(Inserted in the interests of Travelling Public)

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