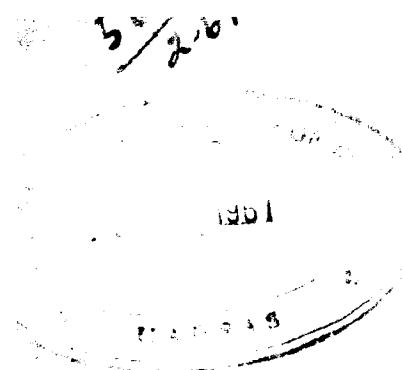




1951

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Railway Week Supplement

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What the Railways Expect from the Public

IN the last quarterly issue of this magazine the editorial was on the subject of "What the public expect from the Railways". In this we indicated all the things which the public expect from the Railways and how far the Railways fall short of the public demand. If the public has certain rights as tax-payers and passengers from the railways, it must be conceded that the railways have certain expectations from the public and these we will now outline and explain.

The first and most important thing that the Railways expect from the public is the correct payment of the fares for their journeys. After all the life blood of the Railways are their earnings and these are obtained from passenger fares and goods charges. By not paying this correct dues under both these heads the Railways lose a considerable amount of revenue which if pooled together for all the railways would amount to many lakhs and even some crores of rupees.

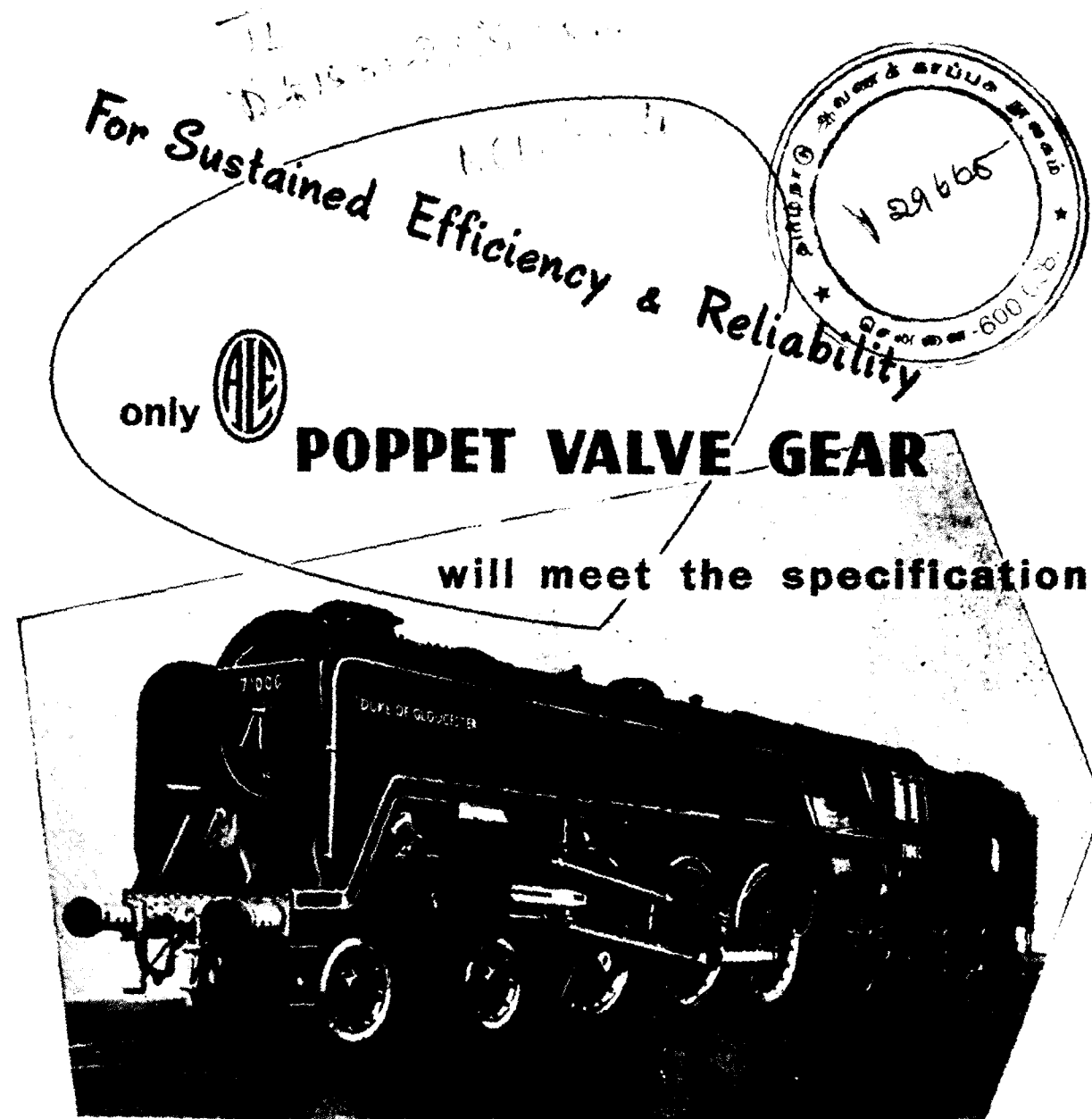
Because of the rush of traffic especially in the suburban trains a very large number of people travel without purchasing tickets, depending upon their cunningness in evading the ticket collector at stations and the travelling ticket collectors on the trains themselves. Further a large number of railway travellers, especially in suburban trains buy a lower class ticket and travel in a higher class, hoping to hoodwink the travelling ticket collectors.

Further people coming to the stations to meet their relatives and friends or to see them off are expected to buy platform tickets but very few of them do so, expecting in the rush to evade the ticket collector who cannot possibly check all tickets.

Similarly in booking their luggage or their goods passengers and merchants by means of bribery and corruption get their weights shown less to what they are, hoping therefore to evade the travelling ticket inspector or goods inspector. Through these anti-social methods of the public the Railways lose a tremendous amount of money. It is because the Railways are a Government concern and monopolistic at that that they can bear this heavy loss, which would have driven a private firm to bankruptcy in less than a year.

In purchasing tickets and booking goods the public is expected to queue up at the right counters and not crowd round it, to the detriment of all. Further the booking clerk of the Railways expect an amount to be paid within reasonable reach of the fare. The booking clerks carry a reasonable amount of change but if thoughtless people tender a hundred note each time they want to purchase a five rupee ticket that change would be denuded very quickly to the detriment of those people who follow.

Railways, to safeguard their interests, employ travelling ticket collectors who after examining the tickets desire to inspect and weigh your luggage in case they suspect it to be shown underweight. While it is admitted that for one that is caught with excessive



British Railways Standard Class 8, 3-cylinder, 4-6-2 Type Locomotive designed for heavy express passenger services. Steam distribution is by A.L.E. Rotary Cam Poppet Valve Gear with duplex outside drive to the camboxes of the outside cylinders. This system, which incorporates British-Caprotti principles, ensures optimum cylinder performance over extended service-free periods, an effective aid to improved traffic-handling capacity with fuel economy and higher locomotive availability.

Photograph by courtesy of British Railways.

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weighed luggage fifty escape detection, they should not complain that they are charged high extra charges.

The travelling habits of our Indian people are most reprehensible. They at all times carry excessive luggage and worst of it is that they want to take it all with them in the compartment. What with heavy boxes and trunks and huge big beddings and numerous pots and pans the compartment soon gets scuttled, and there is hardly any room to move. The Railways expect the public to book their heavy luggage and entrust it to the custody of the guard. Very few people even in upper classes ever do this with the result that travelling in railway compartments sometimes becomes an absolute nightmare of discomfort.

While travelling, the Railways and their servants expect common courtesy but the words "please" and "thank you" seem to be absent in the dictionary of railway travellers. While they expect and complain bitterly of the want of courtesy of railway servants they themselves are most intolerant and aggressive in their attitude to railway servants.

Cleanliness in Railway compartments is a serious draw-back with our Indian public. It is very seldom that compartments and especially the lavatories are kept clean and hygienic. Knowing that a number of people have to use the same latrine on a journey a little consideration for others should induce a person in flushing a lavatory after use, but this is very seldom done, with the result that most lavatories stink, after even a short journey. Further the eating habits of our people are obnoxious. They usually bring their own foods for the journey tied up in paper or cloth bundles or even in containers but after they have eaten they throw the left-overs on the floor of the compartment instead of out of it. The result is that usually our railway compartments, be they upper or lower class are infested with vermin of all sorts, many kinds of ants, bugs etc. Although the railways have often to resort to fumigation of a compartment if it is badly infested, they hardly succeed in complete elimination, because these verminous creatures breed very rapidly and reinfest the compartment in a short time. The shocking and disgusting habit of eating the betel leaf and spitting all over the compartment both inside and outside and leaving unsightly marks which are difficult to eradicate is another habit which the Railways expect the travelling public to refrain from.

Apart from the compartments of railway carriages, most of the waiting rooms at stations are left in an unsanitary condition by our travelling public whereas with a little thought and consideration for others they could be kept clean. The furniture is often broken and the chairs in particular have their cane seats ripped off due to misuse.

Talking of destruction the upper class compartments in Suburban trains are often left in a disgraceful condition. The rexine covers of seats are cut and ripped so as to make them unsuitable for sitting. This is often the result of vandalism and sabotage. Some dismissed railway servants to pay a grudge against the railway and he does it when nobody is looking by wanton destruction. Pilfering is nowadays a very common habit and things like bulbs, switches, brass items like water cocks, taps are stolen wholesale from railway compartments. In many cases the safety bolts and clips which are

meant for the safety of passengers particularly at night are deliberately damaged or removed with the result that doors or windows cannot be closed and safety becomes non-existent.

While on the subject of safety it has now become a common habit to hang on the outside of railway compartments of Suburban trains and in spite of the fact that there are so many accidents non-fatal and fatal, the habit persists. Another habit which makes for the lack of safety is the public crossing railway lines at stations. They do not use the correct entry or exit gates but prefer to dodge the ticket collector by going to the opposite end of the platform and leaving the station by crossing the railway lines.

Dining cars and refreshment rooms at Railway stations are provided by the Railways as an amenity to the public and nowadays the meals are even subsidized. However the public generally are reluctant to make use of this amenity with the result that dining cars and refreshment rooms run at a heavy loss and as a consequence the food preparation deteriorates and sets up a vicious circle in the catering department of the Railways.

The Railways as a rule get a considerable amount of work done on contract. In the Civil Engineering Department, earth works, excavation and filling, structural work, building construction etc. is done on contract. Normally tenders are invited and the contract awarded to the lowest tenderer. Very seldom are there contracts carried out to specifications laid down, and by resorting to bribery and corruption, inferior quality of work is accepted. This also applies to the Mechanical Department where the Railways buy a very large amount of raw material and finished material. Purchases are supposed to be made to specifications and drawings supplied by the Railways to contractors. More often than not inferior quality of material is supplied and accepted by the Railways for some financial consideration. This does not of course mean that all railway staff is corrupt and it would be wrong to tar them all with the same brush but it is the few who stoop to corrupt practices who ruin the name of the Railways. While the contractors often complain that they have to bribe and corrupt in order to get the work done—their goods accepted, they must share for the introduction of these corrupt and anti-social practices.

On many railways it has become a habit to pull the alarm chain and thereby bring a train to a standstill. On enquiry in the compartment where the chain is pulled no one will point out the culprit and so while he gets away from the penalty to be imposed the train is unnecessarily delayed. On suburban trains, frequent pulling of the chain is resorted to for trivial reasons, and the work of punctual running of trains is impeded.

The Railway provides free amenities like sweepers at certain stations to clean out the compartments and latrines and also cold drinking water during the hot weather but the travelling public makes scant use of these facilities.

Beggars on trains are a frequent nuisance to everybody and notices are displayed to discourage beggars and hawkers in trains and complain about them. However very few people complain and do not even co-operate with the Railway staff in getting rid of them.

Metaphorically any stick is supposed to be good enough to beat the railways but the railways could with equal right and justice quote to the public at large the biblical saying "let those of you who are not guilty of any of the faults indicated above cast the first stone."

NORTHERN RAILWAY LOOKS AHEAD

By P. H. Sarma

General Manager, Northern Railway

IN a vast country like India, with its present system of transport, a cross-section of the country's economy is reflected in the Railways. The demands for rail transport from time to time, their quantum and urgency, are largely indices of economic trends in the country in general.

Even the Railways' ability to meet those demands is part of the general economic direction, for the one is integral to the other, and if a developing economy is not to be hamstrung for lack of transport, an increase in the Railways' capacity to carry traffic must be planned in advance, to run ahead of the economic growth. Planning on the Railways is done with this end in view.

The Northern Railway has just reached the end of its Second Plan and is on the threshold of the Third Plan. It is, therefore, opportune to take stock of what has already been done and of the tasks which lie ahead.

INCREASE IN TRAFFIC

The magnitude of the problem facing the Northern Railway can be observed from the increasing volume of traffic that it has been called upon to carry. Seven years ago, in 1953-54, this stood at some 14 million tons; by 1959-60, the last completed year for which figures are available the volume of goods carried had risen cent per cent, to over 28 million tons.

The character of this traffic has changed and is still changing, with more of coal and steel and the products of increasing industrial activity in the country. With the increase in population, the number of passengers carried has gone up during this period, till today the equivalent of 40 per cent of the country's total population is transported over the Northern Railway every year.

Further, the per capita income has increased, there is more prosperity, the habits of our people have changed, and each passenger now travels on average distance 10 per cent longer than he used to.

(Continued on page 54)

The traffic is carried by trains, hauled by locomotives, run over different sections of the Railways. Separately and taken together, these determine the Railway's ability to carry the traffic.

Taking the last factor first, the density of traffic over various sections of this Railway has gone up tremendously during recent years. Where, seven years ago, 2953 ton-miles were carried over every mile of the broad gauge sections of the Northern Railway, the figure has now gone up to 5077 ton-miles representing an increase of 72 per cent in the density. On the metre gauge sections, the increase in traffic is even more spectacular, the rise in the density of traffic during this period being 100 per cent.

DEVELOPING LINE CAPACITY

It is obvious that there is a limit to the number of trains which each section of this Railway can carry economically and efficiently. There are many ways of increasing this capacity to move more trains. Where a single line cannot cope with the increase in traffic, doubling of the section becomes necessary. Some 300 miles of broad and metre gauge single line sections of the Northern Railway were, for example, taken up for full or part doubling in the Second Plan.

Other ways to increase capacity are to open new crossing stations, to remodel marshalling yards and to improve signalling and communications so that more traffic can be handled faster.

Finally, the fleet of wagons, passenger coaches and locomotives has to be augmented to cope with the increasing traffic; this requires expansion of workshops and sheds to keep those locomotives and wagons fit for service. Provision of all these additional facilities was included in the Second Plan for the Northern Railway.

An expenditure of over Rs. 14 crores was incurred on works for increasing the line capacity. Signalling has been improved; workshop capacity for repair and maintenance of locomotives, passenger carriages and

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Worthington Corporation enters Transportation Field announces New Self-Starting Automatic Unit

WORTHINGTON Corporation (U.S.A.), one of the nation's largest suppliers of air conditioning, refrigeration and heavy industrial equipment, has announced its entry into the transportation field with the introduction of a refrigeration-heating unit engineered for truck, railroad and trailer use.

The unit is also adaptable for use on smaller boats carrying fish or other perishable commodities.

Export sales of Worthington's new transportation equipment will be handled through the firm's International Operations Air Conditioning Products department.

The new truck unit incorporates a number of attractive benefits, according to Worthington sources. It is provided with a self-starter and thus requires no external starting power. It is exceptionally light in weight, weighing as much as 300 pounds less than other units of similar capacity. It requires 50 percent less space than other units.

The Worthington refrigeration-heating unit is completely automatic. Temperatures anywhere from minus ten degrees (F) to 75 degrees above can be automatically maintained regardless of changing ambients. The unit was completely tested for a year prior to its introduction.

The entire unit consists of a diesel-engine-driven condenser section and a separate evaporator section. A Mercedes Benz 108 cu. in. 1,800 r.p.m. high speed—

1,200 r.p.m. low speed engine is used. A 40-gallon fuel tank is standard equipment and a 75-gallon tank is available.

The whole condensing unit including the diesel engine can be removed from its housing for ease of servicing. The unit slides out on rails.

The condensing unit can be mounted below a trailer body longitudinally or transversely on either the curb or road side. It may also be mounted internally for container-type applications. The evaporator unit is mounted at the front of the trailer.

Air circulation is provided by two fans with separate 12-volt DC motors assuring high volume under all conditions. The dual fan design also provides a safety factor. Failure of one fan or motor will not affect the other fan.

An automatic defrost system is controlled by thermostat setting and is triggered by frost build up on the evaporator coil. When it goes into operation, the fans are stopped and the refrigeration system works as a heating unit until the frost is melted.

All components are designed to give the lowest possible center of gravity when installed. This eliminates the need for special trailer reinforcements to carry the additional weight.

The new Worthington unit can also be used independent of a trailer as a stationary, emergency or temporary source of refrigeration for cold storage facilities.

Purchase of Rail Sleepers from Kashmir

It is a fact that the Northern Railway has negotiated with the Forest Department of Kashmir for the purchase of 10 lakh sleepers, said the Deputy Minister of Railways, Shri S. V. Ramaswamy in a written reply to a question by Shrimati Krishna Mehta in the Lok Sabha on 23rd November, 1960.

The Deputy Minister added that the Railway Board had approved of the proposal to purchase 10 lakh broad gauge units from Jammu and Kashmir during the period November 1, 1960 to October 31, 1961 at the existing rates. However, formal approval of the Jammu and Kashmir Government was awaited.

An Important Announcement

- We have great pleasure in announcing to all our Readers and Advertisers that we are incorporating the following Supplements as usual on various aspects of **RAILROAD ENGINEERING** in our **1961 Annual Number** to be released by the end of August 1961.
- Advertisers desirous of buying advertising space in any one of the Supplements should intimate the fact to the Technical Editor (Advertising Branch) on or before 20th July 1961. We can accept only a limited number of advertisements due to space restrictions.
- Technical articles or write-ups concerning Engineering Products would be published free of charge and twentyfive reprints would also be supplied without any charges. For other details please address your enquiries to the **Technical Editor, INDIAN RAILWAY ENGINEER, Flats 17 & 18 "Ashoka" (Second Floor) 15, Ghodbunder Road, Santacruz West, Bombay-54 (India).**

DETAILS

1. Diesel Engines, Steam, Electric, Diesel-Electric, Diesel-Mechanical, Diesel-Hydraulic & Industrial Locomotives Supplement
2. Railcar, EMU Coach, Carriage & Wagon Supplement
3. Buffers, Brakes, Bushes, Couplers & Shock Absorbers Supplement
4. Wheels, Tyres, Axle-boxes, Ball-Bearings & Springs Supplement
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TECHNICAL EDITOR

Torque Converters for Railway Traction Applications

By Lt. Col. L. F. R. Fell

Manager - Railway Traction Department

AS projects involving torque converters are now becoming more numerous and wide-spread, so more and more people in Service and Sales departments throughout the world are finding themselves concerned with this new equipment. Whilst it is obviously impossible to circulate detailed design and experimental reports to all who might be interested, it was felt that a need could be served by publishing at regular intervals a Newsletter giving a brief resume of the work which has been carried out, or is in progress, in the various departments at Crewe.

It will be assumed that the reader is familiar with our publication TSD 710 and hence can appreciate the distinction between the CF, DF and CO types of converter. These machines are, in general, similar to the original Twin Disc converters; Twin Disc adhere to the same nomenclature of designation as ourselves.

CONVERTERS FOR RAILCARS

Design Work

This machine was designed originally for use on British Railways railcars. It is based on the Twin Disc DF design and is similar to the DF machine back to the rear turbine bearing.

The double freewheel assembly was designed by Rolls-Royce. It will be seen that the forward freewheel serves the same purpose as the freewheel in the DF machine, that is to say it allows the turbine member of the converter to remain stationary when running in direct drive, the rear freewheel is in the output drive and permits the output shaft to over-run the engine and converter. The freewheel units themselves are of robust design and are of the cam and roller type, having eleven individually sprung rollers each. The ordinary DF machine has one freewheel only; this has twenty-two rollers set in a sprung cage.

Since our first entry into railway business we have fervently advocated the use of the double freewheel for

the following very good reasons. It allows economical operation through judicious costing, it prevents engine damage due to overspeeding down gradients, it provides a safety disconnection in the unlikely event of engine failure or seizure and finally it enables a much easier change to be made from hydraulic to direct drive. The change can be made with the engine at idle and with the output freewheel over-running, hence the duty demanded of the clutch plates is mild in the extreme.

As a result of both our own running experience and the experience of operators, we have made some detailed design changes to the DF and DFR types of machine. In the main these consist of niceties such as changes of hardness and material and reducing stress raisers wherever possible. Whilst such alterations are not spectacular in themselves they contribute to the increased reliability of our products. Experimental work has shown that it is desirable to maintain the clutch application oil pressure at about 140 p.s.i.; thus ensuring a slipfree drive at very low engine speeds and also providing a rapid take-up of the clutch during changes from converter to direct drive. The increase pressure was achieved by making a modification to the relief valve in the clutch oil pump supply line.

In applications where a reverse gearbox is attached to the rear of the converter we now install an oil cooler to ensure that the clutch oil is not heated to an objectionable temperature by the gearing. The converter has been modified to provide an inlet and outlet to an oil cooler and the cooler itself can be supplied as an appendage to the main converter fluid heat exchanger.

REVERSE GEARBOX

It has become clear that operators are by no means agreed on the most suitable type of reversing gearbox for railcar use. For those adherents of the frame mounted reverse box we have recently designed a unit which can be bolted directly on to the back of a

converter. The prototype box has been built and is undergoing test at the Crewe factory.

In the design of this new reverser we have sought to produce a robust and reliable unit. Before the design was commenced a close study was made of the failures experienced by users of similar reversers by other manufacturers.

The designed capacity of the box is 300 h.p. at 2000 r.p.m. Lapped spiral bevel gears are mounted in pressure lubricated bearings. Large diameter pinions have been used so as to give modest rotational speeds. At the rear of the box gear drives are provided for a Woodward Governor and tachometer.

OUTPUT SHAFT GOVERNOR

In applications using the F, CF or CO types of converter where the vehicle has a low rolling resistance there is a danger that the converter might be run at an output speed beyond the upper 70% efficiency limit with the engine rack fully open. There are cases where this could occur and it would be difficult for the driver to appreciate that anything was amiss. In conjunction with C.A.V. we have designed an output shaft governor which will begin to close the engine rack at some predetermined output speed and hence prevent damage by overheating. The governor is essentially a gear type oil pump driven by the output shaft of the converter. Oil from this pump is fed to a unit mounted on the engine fuel pump governor and is arranged so that at some predetermined pressure the rack will begin to close.

This governor is being designed so that it can be used as an output shaft speed controller. A duty could arise where it would be desirable that the driver should be able to select a fixed output shaft speed regardless of the fluctuating load. In this case the driver would control the governor setting and the governor would adjust the rack to give a constant output speed within the capacity of the engine. Such a device could be useful on a hump shunting locomotive.

The first output shaft governor unit received from C.A.V. is now running on the test beds at Crewe.

CLUTCH DEVELOPMENT

Much work has been done in testing the clutches of the DF converter. Continuous periods of 'Hot Shifting' have been carried out in order to ascertain the

effect on the clutch plates. Tests have been very encouraging and are continuing.

As a result of this development work we have now increased the maximum torque ratings for our DF and DFR machines as follows:

For the 10,000 series DF machine we now limit the maximum input torque to 750 lb. ft. This limit is subject to the proviso that the clutch oil is cooled if a reverser is fitted and that some indicating device is used to ensure that clutch oil pressure is always present. Further, for the DFR machines we are prepared to raise the limit to 800 lb. ft. for 10,000 series converter and to 900 lb. ft. for an 11,500 converter provided the machine is protected from torsional vibrations by a suitably damped spring drive.

We have for some time been running experimental converters at 1000 lb. ft. input torque.

We are now able to consider individual applications which require 'Hot Shifting' of the converter clutches. However, these must be referred to the Railway Traction Department for consideration by our engineers at Crewe who will deal with each case on its merits.

* * *

PROTOTYPE RAILCAR

We have now had a torque converter railcar in regular passenger service for some months. This vehicle was built as the prototype to a production batch of railcars. On completion, it was made available to Rolls-Royce for a specialised development and to allow us to gain some running experience. As a result of this, several modifications have been made. The control system has been modified in details and further attention was necessary to achieve a desirable degree of silence and smoothness. The engine mountings were changed and the exhaust system modified.

Throughout the initial projecting stages of the prototype vehicle, we kept in mind the high vertical accelerations imposed at railjoints and crossings. Later, we were able to measure these accelerations, together with the effect they had in inducing torque variations in the prop-shaft.

A maximum vertical acceleration of 40g was obtained at the bearing cap of the driving axle; A

HENSCHEL AT THE 1960 HANNOVER MACHINE TOOL EXHIBITION

Henschel exhibited the following examples from their wide production range in Hall 1, stand 1203:

1. Henschel-Ryder No. 8 Vertical Multi-spindle Automatic—particularly suitable for mass production, which calls for compact, easily operated, versatile machines for long runs of such components as flywheels, brake drums, differential housings, multi-stage pulleys, etc. The Henschel-Ryder which can be equipped with numerous attachments for turning, copy-turning, drilling, reaming, thread-cutting, milling, facing and shaping, aroused considerable interest among visitors.
2. The improved version of the Henschel Gear Shaper, Roeber design, for generating gears up to $17\frac{1}{4}$ " dia., tooth thickness up to $3\frac{1}{2}$ ", modulus 7. Its special feature is the new cam control which greatly increases the flexibility of the electro-hydraulic controls to suit the properties of each workpiece. This, as well as other improvements to filters and hydraulic system and better vibration-free running, further shorten the gear shaping cycle.
3. The "URSOMAT" Double-Spindle Taper-Cutting and Copying Lathe whose central swivelling headstock permits the turning of inner and outer tapers of equal included angles in the production of valves and fittings to a degree of precision which frequently does away with the need for re-grinding valve plug and housing seating faces.
4. A special-purpose machine for drilling cycle hubs with two-multi-spindle workheads drilling into the workpiece from either side. Components are automatically fed from a magazine to the indexing drum where they are automatically clamped. Finished workpieces are discharged via a chute. Brief interruption of feed produces short swarf lengths.
5. A machine assembled from the wide range of Henschel standard units, built on the unit construction system, incorporating: spindle unit, rotary table unit and base unit. This standard assembly forms the basis for many versatile combinations to suit a large variety of applications and can be built up into fully-automatic special-purpose machines and complete transfer lines.
6. Four spindle units in various sizes, seated in robust, generously-dimensioned bearings to permit drilling from the solid, opening out, milling and similar work.

propeller shaft fitted with strain gauges was used to measure the torsional variations within the shaft. It was found that a very high torsional of constant frequency was excited at each rail joint. Damping in the system was small and the whole transmission vibrated at the one node natural frequency. The vibration persisted almost without decay between impulses, and its frequency was of course, independent of railspeed, although its magnitude increased as the railspeed increased and hence the forcing impulses became greater.

It was immediately apparent that a means of isolating the impulses from the clutches and free-wheels of the converter unit must be sought.

A flexible rubber coupling was introduced at the end of the prop-shaft. This reduced the stiffness of the system and hence the frequency, but had little damping effect. Weights were added to the final drive in order to move the centre of percussion over the axle. This had little effect.

Finally, a propeller shaft of very low stiffness was used. The shaft was a torsion bar surrounded by unstressed tube; The relative angular movement between the shaft and its sheath was used to provide the required amount of damping by filling the annular space with a viscous fluid.

This reduced the amplitude of the vibration to 20% of its original value and was considered to be a satisfactory solution to the problem and will be used in a refined production form on future installations.

Doubling of Line Between Ratlam and Nagda Stations on Western Railway

Partial doubling of Ratlam-Nagda line consisting of two sections viz. Ratlam to Bangrod (six miles) and Birwania to Nagda (five miles) was sanctioned in March 1958 at an estimated cost of Rs. 79.79 lakhs. The work on the remaining portion between Bangrod and Birwania (14.5 miles) was also sanctioned in October 1960 at an estimated cost of Rs. 101.55 lakhs. The former has already been opened to goods traffic and is expected to be opened to passenger traffic in March 1961. The latter work is expected to be completed by December 1962. This information was given by the Deputy Minister for Railways, Shri S. V. Ramaswamy, in a written reply to a question by Shri Damar, in the Lok Sabha, on 18th November 1960.

F I R E S

By R. G. Hardikar

Dt. Electrical Engineer (Steel Foundry)

CHITTARANJAN LOCOMOTIVE WORKS, CHITTARANJAN

HAD I taken a couple of minutes longer to emerge out of the carriage bathroom I might not have lived all these 20 odd years to write this article. It was a hot April morning. Nearing beer time. The carriage in which I was travelling, at full speed, was the 5th or 6th from the engine of the mail train. I started doing my bed, bending by the lower berth of the coupe with my back towards the two 12" wall-mounted fans. I heard a sudden "ting" from behind. I turned round and was attracted by a lighted cinder flying out of the fan at the back of my left shoulder. It landed on the pillow. The pillow slip started smouldering. I smothered it with my wet face towel. I had just then finished my shave and wash. I was the sole occupant. The glowing cinder from the loco entered through one of the slots of the ventilator and struck the revolving blades and fell on the pillow below.

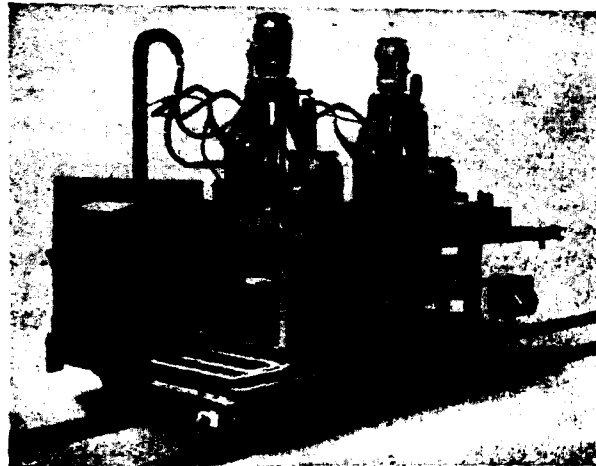
Some couple of years ago an armed sentry outside a locked Cash Office noticed an electric light go out. This happened a little before changing guard at zero hour (Saturday/Sunday). The outgoing company had entered this fusing of the lamp in their Log Book. Some three hours later another sentry from the second company reported emergence of thick smoke from the strong room (also locked) inside the Cash Office. The fire fighting squad, led by two Gazetted Officers, discovered a biri stump deep in the pile of heavily card-board bound Registers inside the strong room. Could the biri have been planted there? The strong room was locked at 16.45 hours on Saturday. Over 10 hours before the emergence of the smoke and 2½ hours after the fusion of the metal filament and bursting of the electric lamp.

Just imagine what would have happened either to the carriage or to the Cash Office had there been no eye witness available to smother the burning matter and timely put out what would have been a blazing fire in a matter of minutes. Being one of the members of the 3-man Fact Finding Enquiry Committee which enquired into the second of the two incidents narrated

hereabove, I have no doubts in classifying the causes of these two fires as purely "accidental".

But the cause of fire that gutted a motor garage in Bhowanipore (Calcutta) some years ago because one of its mechanics was fool hardy enough to locate or look for trouble under the bonnet with a naked light, most certainly cannot be argued by any defence counsel however clever and smart to be as "purely accidental". A well trained and properly recruited mechanic would never have given cause for this fire resulting in loss of life and valuable property. More serious from the point of view of sheer negligence, than this garage fire was the fire which broke out round about 02.00 hrs. in an IOW's godown in a Divisional Headquarter. The officially estimated damage due to this fire, also detected in time, luckily was a little under four figures. The fire was attributed to charging of automotive batteries without the knowledge of the electrical department. In this engineering department's godown there was timber (scantlings), cotton waste, umbrellas and benches for push trolleys, empty and half empty tins of ready mixed paints, oils, varnishes and methylated spirit. There was understandable unwillingness on the part of the engineering department to hand over this battery charging to the electrical department. The accredited specialists for such work. And what excuse can there be for a similar fire on the very same organization, but at another headquarter's station, after a span of hardly half-a-dozen years? By this fire inside a motor garage, where battery charging was being done within 100 feet of petrol tins, a lac of rupees-or-more worth of assets were gutted and had to be written off. The responsibility for these two fires can most certainly be fixed. It rested with the inspecting authorities. Not only that; but one has to admit that these two fires ought never have been given the cause to occur. They have been caused both by ignorance and lack of forethought.

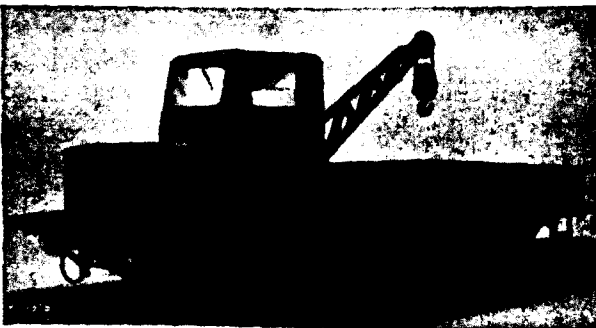
Ignorance has to be eradicated by a high powered drive and campaign at all levels. On being asked by

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a breathless Works Manager who had run fast 200 yards or so to put out a rising fire inside a boiler shop the Nepali watchman standing there on the spot calmly answered that he did not press the fire alarm as he thought "It was meant for Fire Drills only". And meant not to be pressed in the event of actual fire. In another instance a Foreman, transferred from Power House to Workshops replied that he did not segregate inflammables from combustibles in his Stores as the orders to do so were received by him when he was in the Power House. He did not think that those orders were applicable to Workshops as well. Official records will bear me out that a Divisional Operating Superintendent (Class II) on being called upon to report by his Senior Deputy General Manager on the Fire Fighting facilities available in Goods Sheds and Parcel Godowns in his Division mentioned that "the water was green" at a certain Station but failed to report on the distance, quantity available in summer and winter, etc.

The experience gained during the war years as a civilian railwayman in A. R. P. duties first in Chittagong and later on in Trans-Brahmaputra Danger Zone has left no doubt in me that men give better account of themselves if they are first trained in their specific duties in a language they understand. Supervisors are trained in First Aid and their increment is withheld if they fail to pass the First Aid Examinations. Why not train all supervisors, and not necessarily only those of Fire Fighting squads, in fire fighting too. Advanced countries educate school children in how to cross roads in big metropolitan cities so that they can stand up to the inevitable hazards of the road. Training in fire fighting can be begun in schools & carried on to Trade Apprentices & Apprentice Mechanics. They must be taught how to prevent & fight fire.

Doubling of Balharshah - Vijayawada Line

The deputy Minister of Railways, Shri Shah Nawaz Khan said in a written reply to a question by Shri T. B. Vittal Rao in the Lok Sabha, that the doubling of 25 miles portion between Vijayawada and Yerupalayam had been approved at an anticipated cost of Rs. 265 lakhs. Shri Shah Nawaz Khan added that the necessity of further doubling would be considered when the pattern of traffic development became clear.

DIESEL ENGINE RATINGS FOR LOCOMOTIVES AND RAILCARS

By An Engineering Correspondent

ROLLS-ROYCE diesel engines have been specially developed for railway traction applications, and experience in service has demonstrated that this development has been successful in conferring long reliable life. We recommend that our railway traction engines be overhauled when 9000 hours have registered on the engine service counter.

On shunting duties these 9,000 engine service counter hours (or mobile hours) are equivalent to about 16,500 shift hours, during which a locomotive would have a driver allocated to it; or to about 13,750 hours if deductions are made for meal breaks and light running to and from the sheds. On single-shift working this represents seven years' service, or proportionately less for two- or three- shift working.

In railcars on ordinary services with maximum speeds of 70 m.h.p. and gradients of up to 1 in 50, these 9000 engine service counter hours are equivalent to 250,000 miles.

The engines can be left working longer than 9,000 e.s.c. hours. However, we recommend overhauls at 9,000 hours to ensure a satisfactory life without unexpected breakdowns. Engines can be overhauled an indefinite number of times, and certain parts such as crankshafts can last up to the third overhaul.

Normal attention is required during the 9,000 e.s.c. hours, but this is limited to top decarbonizing at 3,000 e.s.c. hours, changing the injectors at 1200 e.s.c. hours and to periodically replenishing oil and cleaning filters and so on. All of this can be done whilst the engine remains in the locomotive or railcar.

To give this life of 9000 e.s.c. hours in railway traction service, our diesel engines are adjusted to give the output powers. These power ratings, which are shown for 85°F and 500 ft. above sea level, are well below the powers at which we supply similar engines for automotive and other less arduous duties.

REDUCTION OF POWER IN ADVERSE CONDITIONS

Increases in temperature, humidity or altitude

decrease the weight of air drawn in by the engine. The first effect of this would be to give an over-rich combustion mixture, reducing the power and raising the thermal stresses. However, a commensurate reduction in the supply of fuel is made by adjusting the engine at the factory to suit the conditions foreseen. This further affects the power output, and the total reductions of horse-power for different conditions are :—

1. Naturally Aspirated (C4N, C6N & C8N) or Supercharged (C4S, C6S & C8S) Engines
 - (a) Air Inlet Temperature: deduct 2% for each 10°F (5.6°C) above 85°F (29.4°C)
 - (b) Altitude: deduct an additional 3.5% for each 1000 ft. (305 m.) above 500 ft. (152.5 m.)
2. Turbocharged (C6T & C8T) Engines
 - (a) Air Inlet Temperature: deduct 3% for each 10°F (5.6°C) above 85°F (29.4°C).
 - (b) Altitude: deduct an additional 0.7% for each 1000 ft. (305 m.) above 500 ft. (152.5 m.)

The reduction for turbocharged engines at altitude is less because the turbocharger is not mechanically coupled to the engine, so it can speed up when the air is less dense. Turbocharged engines are therefore particularly suitable for use at high altitudes.

The additional deductions for humidity can be read from the tables. More than 6% reduction for humidity is rarely justified by conditions anywhere.

It is usually unnecessary to make a deduction for both the maximum altitude and the maximum temperature together, because the highest temperatures usually occur only in the lowlands.

An engine that has been adjusted for the worst conditions foreseen can still be used at 85°F and 500 ft. The power will be found to be then reduced by only about half the amount of the reduction to be expected under the worst condition.

Percentage Reduction of Power for Atmospheric Humidity at Various Temperatures

Ambient Temp. °F	10	20	30	Percentage Humidity						
				40	50	60	70	80	90	100
85						0.5	1.0	1.5	2.0	2.4
90					0.4	1.0	1.6	2.2	2.7	3.3
95				0.2	0.9	1.6	2.2	2.9	3.6	4.2
100				0.7	1.5	2.2	3.0	3.8	4.6	5.3
105			0.3	1.2	2.1	3.0	3.9	4.8	5.7	6.6
110			0.7	1.8	2.8	3.8	4.9	5.9	6.9	8.0
115			1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6
120		0.4	1.7	3.1	4.5	5.9	7.3	8.6	10.0	11.4
125		0.8	2.3	3.9	5.5	7.1	8.7	10.2	11.8	13.4

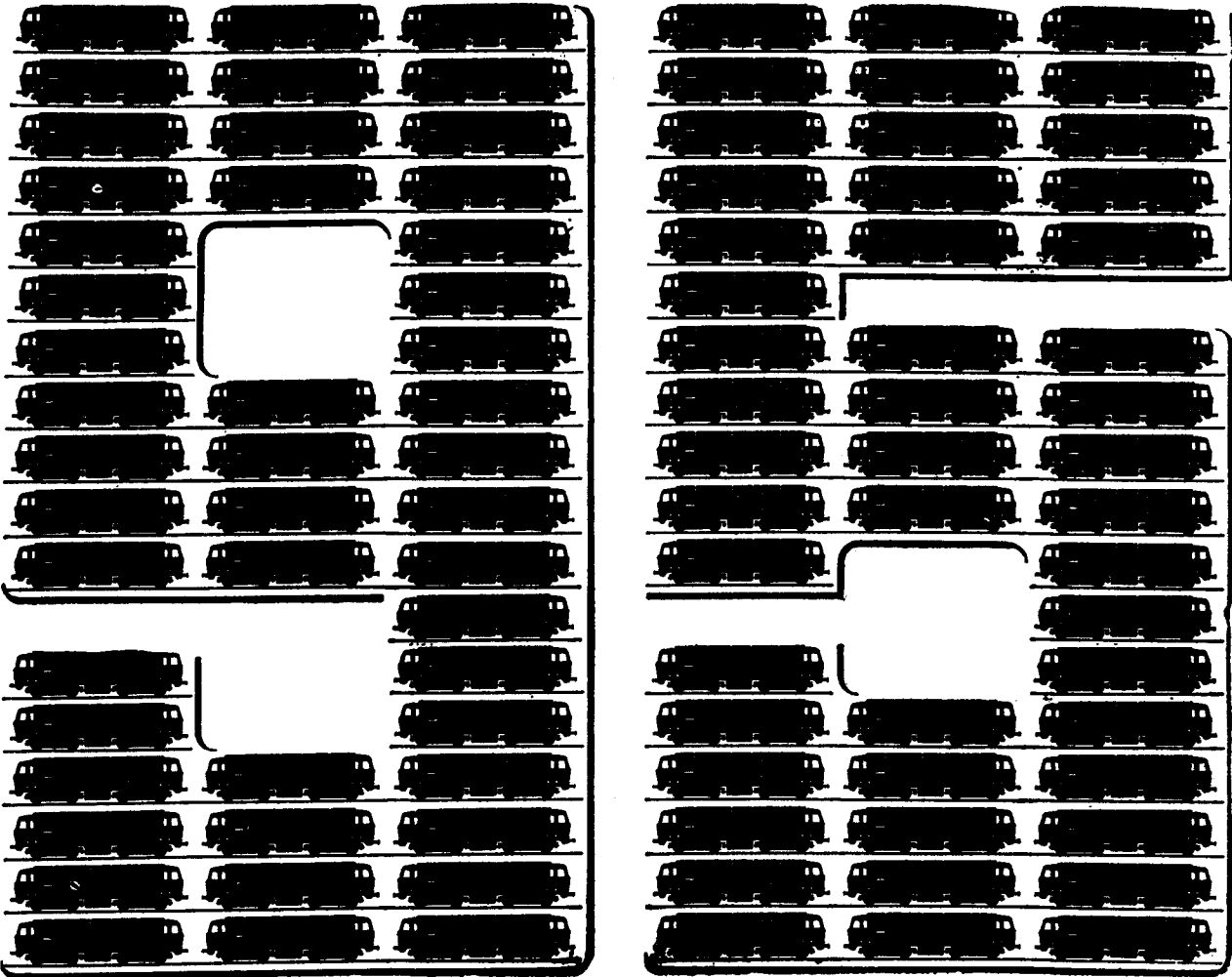
Ambient Temp. °C	10	20	30	Percentage Humidity						
				40	50	60	70	80	90	100
30					0.1	0.6	1.2	1.7	2.2	2.7
32					0.4	1.0	1.6	2.1	2.7	3.3
34				0.1	0.8	1.4	2.1	2.7	3.3	4.0
36				0.4	1.2	1.9	2.6	3.3	4.0	4.7
38				0.8	1.6	2.4	3.1	3.9	4.7	5.5
40			0.2	1.1	2.0	2.9	3.8	4.7	5.5	6.4
42			0.5	1.5	2.5	3.5	4.5	5.4	6.4	7.4
44			0.9	2.0	3.0	4.1	5.2	6.3	7.4	8.5
46			1.2	2.4	3.6	4.8	6.0	7.3	8.5	9.7
48		0.3	1.6	2.9	4.3	5.6	7.0	8.3	9.6	11.0
50		0.6	2.0	3.5	5.0	6.5	7.9	9.4	10.9	12.4
52		0.9	2.5	4.1	5.8	7.4	9.0	10.6	12.3	13.9

HIGH-SPEED COMPUTER

Assembly of a high-speed BESM-2 electronic computer has been completed at the computing centre of the Leningrad branch of the USSR Academy of Sciences' Institute of Mathematics.

One of the best of its kind in the USSR, this computer does nearly 10,000 arithmetical operations per second on an average, which is 100 times faster than the widely-used Ural mathematical machine. The experimental computer can with the aid of an arithmometer complete up to 2,000 arithmetic operations in a 7-hour workday.

The new machine will shortly be adjusted. It will go into operation next year.



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BETTER RAIL TRAVEL

By K. Swarup

(Chief Administrative Officer, Integral Coach Factory, Madras)

ONE of the results of World War II was an increase in traffic making abnormal demands on transport capacity. Faced with the problem of coping with the unprecedented increase in passenger traffic, accentuated by the depleted and overaged stock and the inadequacy of capacity in railway workshops for manufacture of coaching stock, the Government of India decided that a separate railway coach building factory should be established to enable the Indian Railways to become self-sufficient in the matter of passenger coaches. The Integral Coach Factory at Perambur was accordingly set up as a commitment under the First Five-Year Plan, with technical collaboration of the Swiss Car & Elevator Manufacturing Corporation, Ltd., Switzerland. The initial capital outlay for the Shell Factory was Rs. 7.35 crores and a further sum of Rs. 3.69 crores was sanctioned during the Second Five Year Plan for putting up a Furnishing Annexe. The Factory including its furnishing annexe and the township covers an area of about 500 acres and at present employs over 7,000 workers.

DESIGN OF THE COACH

In the earlier years the design of railway stock was inspired by the road vehicles of that period. It was soon found, however, that the railways could cope with heavier loads, and the evolution of railway rolling stock tended towards increased capacity together with the provision of comfort—a factor which was ignored till then. The constantly increasing speeds also made greater strength of coaches imperative. The growing competition from road and air transport forced the railway to revise its passenger service policy, which has resulted in the appearance of passenger coaches of light construction.

The Integral coaches produced in this Factory are of the modern light-weight all-welded steel construction, designed to give the maximum comfort and safety to the railway passengers. Being 7 tons lighter than the conventional coaches of 42 tons, considerable economy is effected in operational costs, as more number of integral coaches can be hauled per train, thus reducing the overcrowding in trains. Another

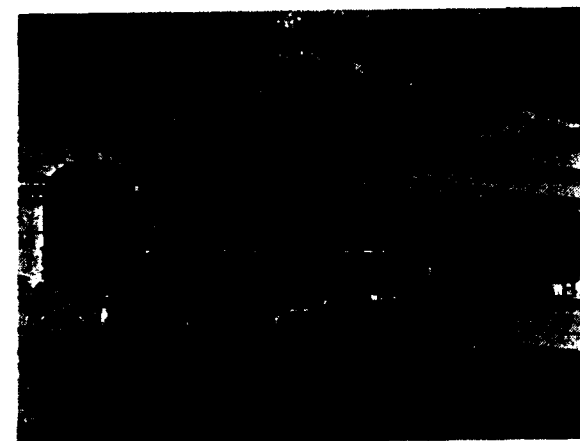
important feature of this coach is its anti-telescopic end construction. The ends being plastic, i. e. designed to carry less stresses and strains, get buckled in the event of an accident, thus absorbing most of the collision energy and reducing the possibility of the carriages telescoping and causing risk to passengers. This special feature has been subjected to trials and the two photographs below will illustrate what happens in the event of collision or telescoping. The carriage is also designed for improved riding by provision of shock absorbers, spherical roller bearings, special design of springs, etc. The inside of the coach is sprayed with limpet asbestos to provide insulation against heat and sound.

The interior design is so planned as to afford maximum comfort to passengers. Unlike the previous



Some of the amenity fittings provided in our Third Class Sleeper Coach.

third classes, the integral coach has been split up into 8 compartments, each compartment providing seating capacity for 10 passengers. The upper luggage rack provides enough room for carrying luggage that our passengers are accustomed to carry. On the top is again a light luggage rack, where small articles could be kept. Similarly, luggage racks have been provided on the corridor side. The provision of these extensive luggage racks would ensure that the floor and the seats will be free for occupation and moving about, thereby giving more comfort to the passengers.



Third Class Integral Coach ready for despatch.

Each compartment has been provided with two fans to give sufficient air to all the passengers. The compartments are well-lit to enable passengers to read at night time if so desired.

The seats and back rests were originally well curved to provide comfort to long distance passengers, but have now been made flat increasing the width from 19" to 22" to enable passengers to spread their bedding and make themselves more comfortable.

Lavatories are also well equipped and have all the modern amenities like wash hand basins, mirrors, squatting pans, lotah holders, towel racks, etc.

PERFORMANCE DURING THE SECOND PLAN PERIOD

- (i) *Increased Output:* According to the Technical Aid Agreement with the Swiss collaborators, this Factory was to achieve its maximum production of 350 coach shells a year, in progressive stages, in the 5th year from the start of production.

Production was inaugurated by the Prime Minister on the 2nd October, 1955 and since then, year after year, the performance improved and in each year the record of the previous year was broken. The 1000th coach was turned out early in 1960—far ahead of schedule. The comparison of the targets and the actual output during the five years of production is indicated in a chart given below.

- (ii) *Improved efficiency:* The efficiency of the Shops has been increasing from year to year as the men have been gaining experience and skill. The manhours spent on each coach shell have come down steadily from about 19600 at the start of production to about 8600 in the latest batch. The present manhours compare very favourably to those taken for similar coach production in Europe. Efficiency is expected to further increase as a result of the Incentive system of payment which has been introduced in I. C. F. from January, 1960.
- (iii) *Reduced cost:* The unit production costs in the I. C. F. have been coming down steadily from the initial Rs. 186 thousands to the present about Rs. 80 thousands inclusive of overheads and depreciation.
- (iv) *Self-sufficiency:* Before the I. C. F. went into production, most of our coaches and underframes were imported from abroad and considerable amount of foreign exchange was required to meet the demands of the Indian Railways. In the 13 years since our Independence, the Indian Railways have become self-sufficient in their railway coach requirements and not a single coach is now imported.

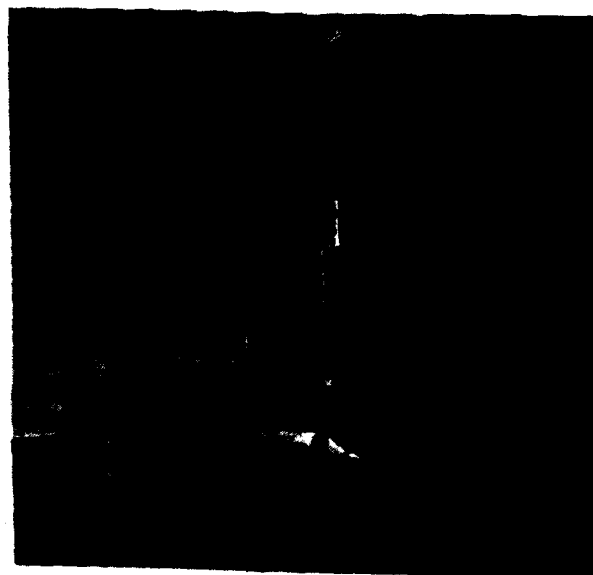
- (v) *Diversified production:* The original idea was that the I. C. F. would produce only a standard shell, which could be furnished to any class of coach required. With the rapid industrialisation of the country and resulting higher standard of living of the masses, the demand for better amenities and comforts also increased. While laying stress on the improvement of amenities and comforts to third class passengers who constitute the bulk of the traffic on the

Indian Railways, this Factory has also now geared up for meeting the varied requirements and standards of the travelling public by designing different types of coaches. The types of coaches produced till the end of the Second Five Year Plan are indicated below :

Type of coach	Number
'T' (Integral)	1047
'TLR' (Integral)	121
'TCN' (Integral)	150
'T' (Conventional)	115
'TLR' (Conventional)	150
'F' (Integral)	155

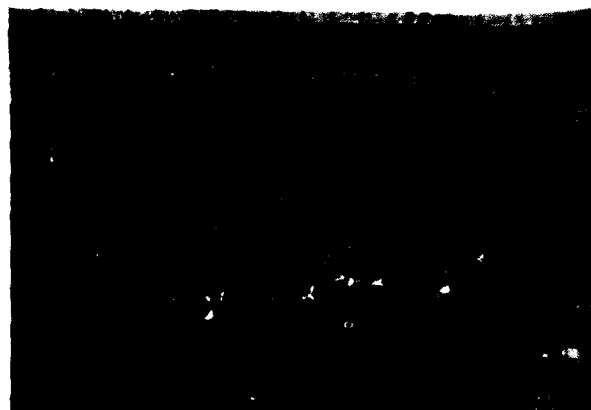
To give an idea of the amenities and comforts provided in these coaches, the interior layout of the various classes of coaches is shown in the sketches.

- (vi) *Export market*: Having achieved self-sufficiency for the Indian Railways, this Factory is now tapping the export markets. The I. C. F. has already quoted against Pakistan and Argentine Tenders for coaches. In Pakistan, we were the lowest out of the 7 countries that competed in the global tenders and in the case of Argentina, quotation for I. C. F. coaches



An interior view of a First Class Coach recently built by I. C. F.

was the second lowest out of 28 tenders received from 15 different countries. The results of these tenders are not yet known but the very fact that the cost of I. C. F. coaches is competitive in the world-market proves that the Government undertaking can run efficiently and earn the badly needed foreign exchange for the country.



The two photographs above will illustrate what happens in the event of collision or telescoping.

PROPOSALS FOR THE THIRD FIVE-YEAR PLAN

- (i) Encouraged by the excellent performance during the Second Plan Period and the good teamspirit existing amongst all grades of staff at I. C. F. this Factory has embarked on the ambitious plan to produce 3735 coaches during the Third Five-Year Plan commencing from April 1961. This programme includes coaches even for the Metre Gauge, Electric Multiple Unit Stock and also Diesel Railcars required for the Indian Railways. The proposed programme is as follows :

Type	B. G.	M. G.	N. G.	Total
Ts.	23	1198	—	1221
TLRs	235	—	—	235
Fs.	462	—	—	462
FTs.	592	—	—	592
Motor & Parcel Vans	—	343	—	343
Motor Vans	—	73	—	73
EMU (12 ft. wide trailers)	612	—	—	612
Railcars	67	120	10	197
Total	1991	1734	10	3735

- (ii) The construction of the Permanent Furnishing Factory is now in full swing. Rs. 1.5 crores out of Rs. 3.69 crores has already been spent in the II Plan and the balance of Rs. 2.19 crores will be spent during the III Plan to complete the Permanent Furnishing Unit. By providing a furnishing unit, all the shells that would be turned out from the Shell Unit will be furnished and made available to the Railways without any loss of time. It will also enable standardisation and providing better comforts to the passengers.
- (iii) For full working of the Second Shift which will enable obtaining further increases in production, extension of certain workshops and additions in machinery and plant at a total cost of Rs. 45 lakhs is envisaged during the III Plan.
- (iv) The factory has built a Staff Colony provided with about 841 units of

quarters. Another 257 units are programmed to be built in the Second Shift scheme. Further, in view of the acute shortage of accommodation in this part of the Madras City it is proposed to build 500 more staff quarters during the III Plan at the rate of 100 per year at a total cost of Rs. 52.5 lakhs. Thus, the number of quarters provided in the Staff Colony would be nearly doubled at the end of the III Plan.

- (v) Since October 1955 when this Integral Coach Factory first stirred into productive life, its story has been one of continuous development and growing productivity. The object with which this factory was set up has been more than fulfilled. Having achieved self-sufficiency in matters of passenger coaches for the Indian Railways this factory is now looking forward to building coaches for the export market. Our cost as well as quality in production is very competitive and we have full hope that very soon we will be able to get orders from some foreign countries for their coach requirements and thus become one among the foreign exchange earners for India.

PUBLIC ENCOURAGEMENT AND CO-OPERATION

It is not for me to indulge in self-praise, but it can perhaps be said with a measure of truth that this factory has already come to be looked upon as a shining symbol of India's industrial development in post-Independence period. Thousands of visitors from this country and from abroad went their way through this factory in appreciation of our efforts. We are continually striving to improve the layouts and provide more and more comforts and amenities to the passengers, and hope that our efforts in this direction will also be appreciated by the public and they will co-operate with the railways in maintaining these integral coaches well. Our experience of today when costly fittings and improved finishes are removed or spoiled by vandalism discourages us from further improving our finish. I, therefore, beseech the public to treat these coaches as their own property and look after them well.

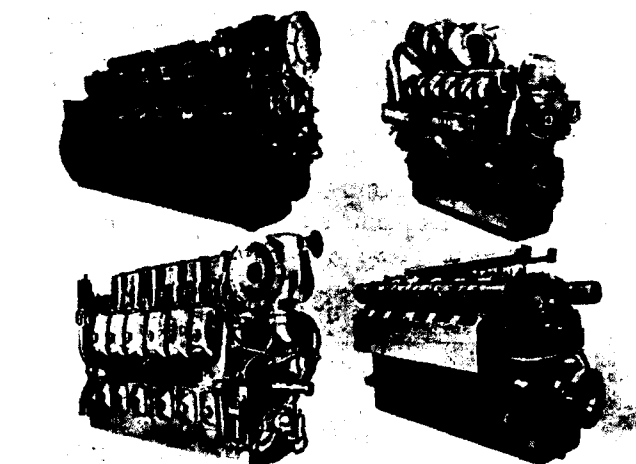
Paxman-Alco Agreement

ON the 18th November 1960, it was announced in a statement about the agreement reached between Davey, Paxman & Co., Ltd. of Colchester, England (a member of the Ruston Group), and Alco Products Inc. of New York, which will be made public on November 28th. In this statement the reciprocal agreement which has been made between these two Companies for the manufacture and sale of each other's diesel engines in certain markets is outlined. We are now able, however, to give you some additional background to this announcement and further details of how this agreement will operate in practice.

Alco Products Inc. (formerly known as the American Locomotive Co.) is one of the largest builders of locomotives and locomotive diesel engines in the U.S.A. Alco locomotives have played a major part in the dieselisation of American Railways and have also found a ready sale in other parts of the World. Apart from their use in locomotives, Alco diesel engines have found numerous industrial, oilfield and marine applications, and have reached a very high state of development covering a power range of from 900 to over 3000 b.h.p. in 6, 12 and 16 cylinder models of 9 in. bore. Alco engines can also operate as dual fuel engines burning natural gas (or other gaseous fuel) with pilot injection.

Davey, Paxman & Co., Ltd., of Colchester has specialised for many years in compact medium and high speed, vee form, diesel engines. The Paxman 7 in. bore range of diesel engines, and the high specific output 7½ in. bore Ventura range developed from it, have established a world-wide reputation in traction, industrial, marine and oilfield applications and cover a power range from 150 to 2300 b.h.p.

The agreement between these two Companies has been inspired by their mutual appreciation of the emphasis that present day conditions give to the need for



Top left: ALCO 12 CYL.
9 in. Bore Engine
Series 251

Top right: PAXMAN 12 CYL.
7½ in. Bore Engine
Ventura

Bottom left:
ALCO 6 CYL.
9 in. Bore Engine
Series 251

Bottom right:
PAXMAN 12 CYL.
7 in. Bore Engine
Series Rph

co-operation between Companies whose products and markets are complementary. Such co-operation is not only advantageous from a selling point of view but also enables the product range of the collaborating Companies to be extended without involving duplicated costs in design and development.

Paxmans will therefore manufacture and sell Alco designed engines in their traditional world markets, as covered by the Ruston Paxman sales organisation.

Correspondingly, Alco will have the right to sell and make Paxman engines of the Ventura and other types in the U.S.A. for all purposes, including applications in American equipment for export and in locomotives of sizes other than now manufactured by Alco.

DIAL GAUGES

The Indian Standards Institution has prepared a draft specification for Dial Gauges. The draft standard deals with commonly-used dial gauges of unit of measurement 0.01 mm. and also gives information on high accuracy dial gauges required in the inspection of machine tools. The draft specification

will shortly be put into wide circulation to manufacturers, consumers, technologists and others interested, for their critical comments and suggestions for improvement. The comment will be given due consideration before finalizing the draft as an Indian Standard.

FROM STEAM TO ELECTRICITY

By H. D. Awasty

General Manager & Chief Engineer
Railway Electrification, Calcutta

Shri Awasty outlines the progress made by the Railway Electrification, Calcutta, in the execution of its Electrification Scheme on certain sections of the Indian Railways.

The main purpose of electric traction is to provide increased line capacity on the sections serving steel plants at Rourkhela, Tatanagar, Burnpur and Durgapur to carry raw materials including coal and iron ore to the plants and take away the finished products.

THE Ministry of Railways have taken a bold decision to replace steam with electric traction to the maximum extent possible within their financial and technical man-power resources.

An independent administration known as the Railway Electrification has been set up for executing the scheme on the railways.

To move the growing traffic on our trunk routes, either new lines have to be constructed or facilities provided on existing lines to quicken the movement. One way of increasing line capacity is to replace steam by electric traction.

Increase in line capacity means that on a given section more passengers and more goods can be carried than is normally possible in the existing conditions. Railways, elsewhere having large mileage under electric traction, estimate the consequent increase in their line capacity of 50 per cent. The actual increase realized depends upon a large number of local factors.

ADVANTAGES OF ELECTRIC TRACTION

Electric traction is cheaper than steam traction in running and maintenance costs. A steam locomotive requires good coal. On the other hand, a large thermal stations supplying power to electric locomotives is specially designed to use low grade coal.

An electric locomotive can draw almost an unlimited supply of energy from the overhead electric conductors while negotiating a rise, whereas a steam or diesel locomotive must wholly depend on its own limited capacity. An electric locomotive makes full use of its weight for the purpose of

developing adhesion between all its wheels and rails and therefore draws much heavier loads than a steam locomotive of a similar weight, but which cannot make use of its full weight for the purpose of developing adhesion between wheels and rails.

A steam engine has an overall thermal efficiency of 4½ per cent as against an overall efficiency of 14 per cent of an electric locomotive. In other words, coal consumption in steam traction is about three times more than that used to produce power for electric traction.

LOWER RUNNING COST

The cost of maintenance of an electric locomotive is generally about 1/3rd of the maintenance cost of steam locomotive. As regards the running costs, an electric locomotive not doing any useful work on line does not draw any electric current, but an idling steam locomotive on line cannot but use coal and lubricants.

As regards the comparative cost of operation much depends on the cost of coal in the tender and the cost of electric energy from power station. This comparison is already favourable to the use of electric energy in most parts of India. As more hydro electric plants get commissioned, the cost of energy will reduce still further.

A lot of working time in a steam locomotive is spent in coaling and watering. It takes time to get up steam while an electric locomotive can pick up speed almost immediately. All things considered, the availability of an electric locomotive may be as high as 2½ times that of a steam locomotive. While a steam locomotive may on an average earn 100

miles a day, an electric locomotive on an average will earn 250 miles.

These being some of the considerations, all progressive railways in the World are replacing steam by diesel or electric traction, depending upon the availability of oil or electric energy in their countries.

DIFFERENT TRACTION SYSTEMS

There are a number of electric traction systems some using direct current, others employing alternating current. There are various voltages and in the case of alternating current, different frequencies and either single phase or three phases.

We have 1500 V direct current, 3000 V direct current, 20,000 V a. c. 50 or 60 cycles per second or 16 $\frac{2}{3}$ cycles per second frequency and 25,000 V a. c. single phase on industrial frequency of 50 cycles per second.

The last system has now been adopted as standard by a number of West European countries, the United Kingdom, U. S. S. R. and China. The Indian Railways have also standardised on this system.

The Railways have satisfied themselves about its technical soundness as well as their ability to take remedial measures in connection with its adverse effects on neighbouring telecommunication systems. The problem of harmonics and degree of unbalance due to single phase load on the 3 phase supply system was thoroughly investigated by net work analysers in U. K. and France and found to be well within the limits acceptable to power supply authorities.

HIGH VOLTAGE CURRENT

High Voltage enables conductors of small cross-section area to be used. Their own weight as well as the wind load is comparatively light. Consequently the supporting masts and their foundations are also light. An alternating current loco, weight for weight, can draw more load than a direct current loco due to its better adhesive characteristics.

The alternating current substations are simpler and less in number over a given length than in the case of direct current. The cost of power supply arrangements is, therefore, much less. As against this, high voltage needs better insulation between live conductors and structures.

Bigger clearances for structures and better insulations cost additional money. High voltage alternating current has greater adverse effect on neighbouring telecom. Circuits which have, therefore, to be immunised by screening or removal to a safe distance.

The single phase traction load, unless within certain limits, leads to unbalance between different phases of the supply system. Even with regard to the choice of frequencies, there are arguments in favour of both sides.

The German Federal Railways still consider 16 $\frac{2}{3}$ cycles per second frequency as satisfactory but almost all other advanced railways are adopting 50 cycles per second. The main advantage of using the standard industrial frequency of 50 cycles per second is that it completely eliminates costly converting equipment at the substations.

These and many other factors had to be taken into account by the Indian Railways before deciding upon the future standard. It was a most difficult decision but the growing consensus of opinion amongst the highest technical authorities favours 25,000 alternating current single phase 50 cycles per second system.

PROGRESS OF ELECTRIFICATION

In India, upto the end of the First Plan, electric traction on 1500 V direct current obtained on 246 route miles around Bombay and Madras, mainly to carry suburban traffic. By 1958, Howrah to Burdwan on the Eastern Railway main line together with Sheoraphuli-Tarakeswar branch with a route mileage of 88 was electrified on 3000 V direct current. This was thus the first section to be completed in the Second Plan.

In July 1958, the Planning Commission approved of electrification on the new alternating current system of about 674 route miles during the Second Plan on the Eastern and South Eastern Railways. The section approved on the Eastern Railway was Durgapur to Moghalsarai on the Grand Chord. The section approved on the South Eastern Railway were Asansol to Sini; Kharagpur-Tatanagar-Rourkela and Dangoaposi to Rajkharswan.

The Sealdah Division of the Eastern Railway with about 200 route miles approximately was also approved for electrification but early in the Third Plan.

STEEL PLANTS

The main purpose of electric traction is to provide increased line capacity on sections serving our steel plants at Rourkela, Tatanagar, Burnpur, and Durgapur to carry raw materials, that is, coal, iron ore etc. to the plants and take away the finished products.

The setting up of two new steel plants, at Durgapur and Rourkela and the proposed increase in the output of the two existing steel plants at Burnpur and Tatanagar, has imposed an appreciable strain on the transport capacity of the Eastern and South Eastern Railways in this area.

The finished products to be transported by rail from these four plants are expected to be about 4.47 million tons per annum by the end of the Second Plan. By the end of the Third Plan period, one more steel plant would be set up at Bokaro and the anticipated traffic offering would increase to 7.39 million tons per annum.

Each ton of finished steel requires about 4 $\frac{1}{2}$ tons of iron ore, coal, lime stone and other materials. The resulting strain on the two Railway systems with steam traction would have been so great that electrification of the railways was the only practical and economical solution.

It has been decided that for the time being only freight trains would be hauled electrically. Later, when more locos become available, passenger trains will also be run electrically.

COORDINATION WITH OTHER AGENCIES

In this colossal task, some other Ministries are closely associated with the Railways. The Posts & Telegraphs, under the Ministry of Communications, is responsible for replacement of aerial circuits along the railway lines to be electrified. The safe working of these circuits which serve the country and not only the railways is of prime importance.

It is only after the Posts & Telegraphs Department complete the transfer of aerial circuits into screened underground cables that the overhead traction conductors can be energised.

The responsibility for supply to the railway of power at 25,000 V alternating current is that of a number of independent power supply authorities like Damodar Valley Corporation and State Electricity Boards of

Uttar Pradesh, Bihar, Bengal and Orissa Government.

The Central Water & Power Commission, under the Ministry of Irrigation & Power, coordinates the different power supply authorities. The final progress of electrification thus depends not only on the Railway Electrification and the open line railways but also on a large number of agencies outside the control of railways.

JOB WELL DONE

After about two years of study by the Railway Board Engineer an organisation for carrying out field work known as Railway Electrification was started in 1958-59.

The position of work, a little less than three years afterwards, that is, by March 31, 1961, was that the Railway Electrification had completed their work on the sections Durgapur to Nimiaghat a little beyond Gomoh on the Eastern Railway; Asansol to Sini; Bondamunda (Rourkela) to Adityapur (Tatanagar) and Dangoaposi to Rajkharswan on the South Eastern Railway.

Of these, Durgapur to Gomoh on the Eastern Railway and Dangoaposi to Rajkharswan on the South Eastern Railway are already in commercial operation.

The sections Chakradharpur to Adityapur (Tatanagar) and Sini to Asansol and Gomoh to Gaya would be energised in stages within the next three to four months. Once this is done, the steel plants at Tatanagar, Burnpur and Durgapur would be served by electrically hauled trains.

The work is not so advanced on the remaining sections Gaya to Mughalsarai on the Eastern and Tatanagar to Kharagpur on the South Eastern Railway. However most of the ancillary works are complete including yard remodellings, staff quarters, loco sheds and remote control centres.

Survey and design of overhead traction equipment and most of the layout plans of overhead traction equipment have been finalised. About 50 percent of foundations and masts have been put up. Stringing of copper conductors which is in hand, if could have been done much copper conductors much earlier but we presume it was proposed to keep this phase of work in step with power supply and replacement of aerial circuits by P. & T. cables. There are obvious difficul-

ties in leaving long lengths of copper conductors unenergised over long periods.

ELECTRIFICATION DURING THIRD PLAN

The Railways carry forward electrification of a number of lines to the Third Plan; for instance 400 track miles of Sealdah Division of the Eastern Railway, on which, as scheduled, considerable preliminary work has been done. The sections from Sealdah to Ranaghat and Dum Dum to Bongaon have been given priority.

Similarly, civil engineering works have been carried out on Madras—Villupuram Section of the Southern Railway. Igatpuri—Bhusaval section of the Central Railway has been surveyed and the question of unbalance on the supply system due to traction load on single phase is under investigation.

An entirely new section is the long Mughalsarai—Kanpur section. Here too, the Civil Engineering Survey is in hand. Coordination between Power Supply authorities and the Posts & Telegraphs Department, both at the Ministry level and Railway Administration level has been established; our requirements have been advised.

Our Chittaranjan Loco Works and the Integral Coach Factory, Madras are engaged in establishing manufacturing capacity of a.c. locos and a.c. EMUS, respectively.

Targets of completion will now be mutually decided upon but once again we shall fix for ourselves targets which will need all our capacity to attain them.

We are admittedly behind our targets of the Second Plan which were, as they should be, very high. We were out to do in three years what would have been adjudged on many foreign railways as a remarkable

feat, if accomplished in 5 years. Had these targets been attained our rate of work would have been higher than any other railway in the World including the French Railways who are pioneers in this system and who have a lead of about 10 years over us.

Our country is far less advanced industrially than others with whom we tend to compare ourselves. It takes almost a year to import vital components of our equipment.

Erection of overhead traction equipment needs track occupation. The proposed rate of progress in our targets would have needed about 8 hours of daylight blocking of lines which would have severely handicapped rail movement on our vital trunk routes.

RELIANCE ON INDIGENOUS SOURCES

Another point which should be borne in mind is that progress of electrification depends on the matching of work by many independent authorities and not by railways alone.

Perhaps a turnkey job by a foreign agency and under one Ministry may have made the targets attainable but at the cost of carriage of a few million tons of railway goods, crores of rupees and huge foreign exchange and at the cost of our growing indigenous industry supporting electrification schemes.

It may confidently be asserted that, unlike in many other projects of this nature, the indigenous manufacturers, big or small, were given full encouragement to develop themselves.

Indian manufacturers have already made d.c. electric multiple units for suburban traffic. Bhopal Heavy Electricals are busy manufacturing traction equipment. India would now soon be making its own a.c. electric locomotives and electric multiple units coaches.

METRIC SCALES FOR USE WITH DRAFTING MACHINES

The latest edition to the series of Indian Standard Specifications on Metric Scales being prepared by ISI in connection with the changeover to the metric system is IS: 1482-1960 Specification for Metric Scales for Use with Drafting Machines. Other standards published in the series cover metric scales for general purposes and metric scales for architectural purposes.

The present specification covers the requirements for metric scales of 50 cm and 30 cm lengths with four ratios, namely, 1:1, 1:2.5, 1:5 and 1:20 for use with drafting machines. A 50 cm scale and 30 cm Scale constitute a set. The specification does not cover the design and dimensions of the device meant for fixing the Scales to the drafting machine.

Research on Railways RDSO'S Contribution to self-sufficiency

By Qurban Singh

(Former Director General, R.D.S.O.)

The article indicates how the R.D.S.O. has rendered signal service to the Indian Railways in their efforts for progressive replacement of imported items of railway stores and equipment by indigenous products.

Functioning as the repository of the "know-how" of the technical departments under the Railways, that organisation has already prepared designs of a wide range of items from rolling stock and railway sleepers to massive bridges which have either been completed or are under construction. Its extensive research conducted in collaboration with a number of national scientific institutes in a number of fields has helped the Railways in becoming increasingly self-reliant in equipment and stores.

THE rapid strides made by the Indian Railways in research design and development has aroused considerable interest even in most advanced countries.

The recent visit of foreign railway experts organised by Economic Commission for Asia and Far East to study the Brahmaputra bridge construction involving several unique features, is an indication of the recognition of Indian Railways' advance in technical fields.

The Research, Designs and Standards Organisation is the repository of the 'know-how' of technical departments of Indian Railways.

The organisation has helped the Indian Railways in the production of railway materials and equipment, in accordance with standard designs, specifications and codes of practice. It has found solutions to numerous specific problems referred to it.

ORGANISATIONAL SET UP

The Research, Designs and Standards Organisation in its present form, with its three permanent wings, the Mechanical, the Civil and the Research, each under a Director, came into being in March 1957.

Its evolution as the central Standards Office dates back, however, to 1930. There were also the still earlier phases of the various standards committees under the Indian Railway Conference Association.

These mostly concentrated on evolving standards of moving dimensions and clearances of fixed structures, strength of bridges and track any types of locomotives, rolling stock and equipment, acceptable to Railways, a large number of them were Company managed. The Central Standard Office was called upon to prepare tender documents, specifications, schedules and drawings, when, in 1931, the tenders for rolling stock and equipment started being invited simultaneously in England and India.

FIRST RESEARCH WORK

The first research work undertaken was in 1935, which brought out the "Track Stress Research Report". Later, after the Pacific Locomotive Enquiry Committee had recommended extension of research work and dynamo meter car and oscillograph equipment and cars had been acquired by the Central Standards Office, the research and experimenting activities were extended, an initial Research Centre was set-up, followed by a comprehensive Research Centre at Lucknow, under a separate Director of Research in 1952.

The Committee of Engineers, presided over by Dr. A. N. Khosla, recommended the collection and analysis of a large volume of hydrological, meteorological and topographical data from Railways and other institutions in the country as well as the information regarding the practices obtaining in other countries. A fourth Wing has, therefore, been added, temporarily, to the R. D. S. O., since March 1960 for

these studies by putting under observation a number of railway bridges.

CENTRAL BOARD OF RESEARCH

The Ministry of Railways constituted last year a Central Board of Railway Research consisting of eminent scientists, engineers and industrialists of the country to advise on the programme of the railway research and development and to ensure coordination and cooperation with other sister institutions and manufacturers.

The achievements of the National Research stations and other research organisations are freely used for application on railways and any subject of original research, which Railways will like to be studied, are formed out to these research organisations. This will complete the set-up for ensuring full coordination in research and in advancement of technical knowledge, both for making India self-sufficient, to the maximum extent, in production of railway equipment and for achieving high efficiency and economy in the equipment produced.

In addition, a close contact is maintained with Research Institutions, Railway systems and leading manufacturers of railway equipment in all progressive countries of the world. Opportunity is also taken to send Railway Officers abroad to have first hand knowledge of work being done in other countries.

Officers of R. D. S. O. represent the Railways as members of a number of Committees set up by the Indian Standards Institution, National Buildings Organisation, other Government bodies and Ministries, on matters in which Railways may be interested. They thus get first hand knowledge of the view of experts from other branches, organisations and industrial undertakings on the subjects discussed.

RAIL SUB-COMMITTEE OF ECAFE

The Railway sub-committee of the Inland Transport Committee of the ECAFE, set up by the U. N. O. has so far made studies on important aspects of railway operation. These cover improved turn round of rolling stock, working of diesel locomotives, incidence and prevention of railway accidents, improved system of signalling in relation to speed, safety and increase in line capacity construction and maintenance of welded track.

These studies include collection and synthesis of

data received from the member countries and the discussions at the Railway Sub-Committee by experts representing the various countries and also for their final recommendations for adoption or trial in the constituent countries.

COLLABORATION WITH OTHER COUNTRIES

Indian Railways have the largest net work in Asia, with a well developed research and design organisation which has been working in close association and coordinating the work of the Indian Railways on the ECAFE

Indian Railways have offered facilities in its various institutions for training and also for undertaking research on problems of railway systems in South East Asia.

NEW DESIGNS ISSUED

The Mechanical wing of the RDSO is preparing completely new designs of rolling stock, a large number of which have already been issued to the indigenous builders. Locomotives, carriages and wagons of these designs are already under manufacture and in service.

The R. D. S. O. has started functioning as consultants to various public bodies in the country, such as Port Trust, large industrial corporations, ship-yards etc. Advice is being regularly given to them regarding the design, selection and purchase of rolling stock.

R. D. S. O. has also sent out teams of engineers to foreign countries offering them the technical 'know-how' pertaining to the design and manufacture of the rolling stock. The new standards locomotives have been designed to burn lower grade coals, so as to make the higher grade coal available for metallurgical use. Designs are also in progress for fitting of mechanical stockers and burning of oil fuel in our standard locomotives.

DIESELISATION WING

New diesel and electrical wings have been created in the R. D. S. O. The officers in these new wings are engaged in studying the developments abroad and building up basic data with regard to diesel and electric traction as also the salient features of different designs of diesel and electric locomotives.

These studies have proved to be of great value in framing our purchase specification for diesel and electric locomotives so as to obtain the most efficient and yet economical locomotives, with due regard to their future standardization.

SURI TRANSMISSION

Original work has also been done in respect of the hydraulic transmission used in diesel locomotives.

Seven prototype diesel locomotives incorporating our patented "Suri Transmission" are under manufacture in West Germany and the first locomotive has already been shipped.

The R. D. S. O. have already furnished a design for D. C. electric locomotives of 3600 H. P. which is under manufacture in Chittaranjan Locomotive Works. The design and manufacture of A. C. electric locomotives are also in hand.

DESIGNING RAIL COACHES

For over a century, the design of passenger coaches on the Indian Railways was on conventional lines: a wooden body on a separate steel underframe.

In line with the contemporary technological advance, the R. D. S. O. have developed integral designs of steel bodies coaches, which are now being produced in large numbers by mass production units like Integral Coach Factory, Hindustan Aircraft and Jessops. The Integral steel coaches are much lighter in weight, afford a far greater measure of safety to passengers during accidents, cost less in operation, repairs and maintenance and with the increase in the carrying capacity would mitigate overcrowding in passenger trains.

THIRD CLASS SLEEPERS

Considerable progress has also been made in the design of Electric Multiple Unit stock and diesel railcars, refrigerator fish vans and the III Class Sleeper Coaches. Similarly, the amenity of air-conditioning has also been extended to the III Class travelling public. Studies are in progress to provide even better travelling comforts and amenities to the travelling public at optimum train speeds.

BOX TYPE WAGONS

The rapid industrial development of the country

can only proceed if the movement of bulk materials and finished industrial products continues steadily at the required pace.

The tonnage to be moved during 1960-61 has increased by about one and a half times as compared to the position at the end of the First Plan. The increase in the volume of goods traffic to be moved during the Third Five Year Plan would be even greater.

It is not practicable to increase the line capacity at this rate and the only practical alternative is to increase the throughput from the available line capacity. This calls for heavier goods trains to be accommodated within the existing lengths of loops and higher speed for the goods vehicles.

Accordingly, the design of BOX type of wagons for the movement of bulk materials was developed, which permitted about one third extra train load over the existing length of loops.

Prototype of a gondola version of the BOX wagon is also being manufactured, which would permit the optimum intensity of track loading being achieved.

These gondolas would be employed exclusively for the transport of ore, particularly on the Kiriburu-Vizag and Bailadilla-Vizag sections for the export of iron ore to Japan, which is estimated to reach the target figure of 6 million tons per annum.

TANK WAGONS

The same principle of higher intensity of track loading has also been applied in the transport of oil and the type of Bogie Petrol Tank has been designed for transport of oil from Gauhati to Barauni over the metre gauge section, to ensure the maximum throughput from the available line capacity.

OTHER ITEMS IN HAND

In view of its significance in saving idle time of rolling stock, reducing loading and unloading costs and minimising damage to goods under transport, it is proposed to undertake the design of mechanical handling equipment in the R. D. S. O. and extend applications thereof for the particular requirements of the industry and at transshipment points.

It is also proposed to take up the formulation of standard specifications for machinery and plant,

particularly, machine tools, in order to ensure that the capital investment for a given production, operation or repair and maintenance task, is the minimum possible.

DESIGN FOR CAST IRON SLEEPER

India being very short of the conventional material, timber, for making railway sleepers, a sustained effort has been made, during the past few decades, to develop design of an efficient and economical cast iron sleeper. At present, about half the track mileage in India is laid with cast iron sleepers.

To meet the requirements of sleepers for the Third Plan, substantial quantities of steel sleepers will also be available from the new plant at Durgapur. Trials are also being made with several alternative designs of reinforced concrete sleepers, both plain concrete and prestressed.

I. R. S. RAILS

This organisation evolved the 90 lb. IRS section, giving greater strength vertically as well as laterally and some 82 track miles rails rolled to this section, in India, have been under trial for the last six years.

To handle the much heavier traffic densities, generated on trunk routes by rapid industrialisation of the country under the Five Year Plans, and also to meet the persistent pressure for speeds higher than the present maximum of 60 m. p. h., a new design of 105 lbs. IRS rail has been evolved.

Another modern development introduced is the extensive use of welded rails, of which nearly 2,000 track miles, with upto 210 ft. long rail panels, have already been laid.

Trials are also being conducted with half mile long welded rail panels, with special expansion joints at ends.

To enable non-stopping trains to negotiate station loops at 25 to 30 mph. speeds, cast-manganese steel crossings of 1 in 16 and 1 in 20 have been designed and arrangements are in hand for the progressive manufacture of these crossing indigenously.

PRE-STRESSED CONCRETE FOR RAIL BRIDGES

The newly developed techniques of making

pre-stressed reinforced concrete for girders, for use on railway bridges, have been successfully adopted on Indian Railways in the Second Plan period, particularly when steel was in short supply. To date, pre-stressed reinforced concrete girder spans, totalling nearly 30,000 linear feet, have been used on Indian Railways (B. G. and M. G.) or are in the process of being made.

The Bridges and Structures Section actively collaborated with the Engineers Incharge to finalise the design for the Rajendra Pul over the Ganga at Mokameh, which was opened in 1959.

Similar collaboration in design and in checking the data has been given for the Brahmaputra Bridge construction involving several unique features.

DESIGNS FOR STATION BUILDINGS

The Architectural Section designed a number of imposing station buildings built on Indian Railways during the two Plan periods. The New Delhi Stations, with its red sand stone facade, internal garden-courts and pools, spacious circling areas and modern amenities, presents a pleasing blend of Mughal architecture and current construction practices.

The 8-storeyed Churchgate Station of the Western Railway, the new station buildings at Ahmedabad and Jaipur are other examples of good aesthetic appearance, combined with functional efficiency and reasonable costs.

At present, a 14-storeyed office building for Eastern and South-Eastern Railway offices at Calcutta is being designed.

SIGNALLING EQUIPMENT

The reorganised Signal & Telecommunication section of R. D. S. O. has been engaged, since 1951, in the evolution of standard signalling equipment for Indian Railways.

Under the Second Plan, a special drive for maximum self-sufficiency in railway signalling equipment became necessary and so far as mechanical signalling equipment is concerned, a large measure of success in achieving self-sufficiency has already been attained.

Considerable progress has also been made in respect of electrical signalling equipment and

investigation of numerous designs and prototypes and some pilot installations have been made to permit detailed studies. Tokenless block instruments, double-line block instruments using coded impulses, high-frequency track circuits, power signalling and relay interlocking are some of the items under test.

For developing the capacity needed for the Third Plan at relatively less costs, about 250 track miles are to be equipped in the first instance with the imported Centralised Traffic Control, based on one of the most advanced systems of signalling so far evolved anywhere.

PERFORMANCE TRIALS

The Research Directorate also carried out extensive trials, both in laboratories and in the field, to determine the performance of locomotives, rolling stock, track, bridges, etc. and their components, and also of different fuels, lubricants and preservatives.

OTHER ITEMS UNDER RESEARCH

Progressive replacement of imported items of railway stores by indigenous products has also been the subject of research. An important example is the formulation of a cheap bitumen emulsion paint which has been found to be an effective preservative of steel against corrosion even in trying climatic conditions.

Waste products like coal ash, saw dust and lubricants are released by railways in abundant

quantities and their utilisation or reclamation is an important item of research.

The utilisation of coal ash in place of sand, where good sand is not available or is costly, is being progressively adopted for the preparation of lime mortar. Efforts are also continuing for manufacture of hard boards from saw dust in collaboration with the Forest Research Institute.

Reclamation of axle oil, which is released in large quantities, has also been taken up for study and a pilot plant is expected to be shortly erected at Chittaranjan for this purpose. The study of reclamation of lubricating oil from diesel engines has been started, in collaboration with the Defence Research Laboratory.

SOIL MECHANICS

Railway research has made satisfactory progress in the study of soil mechanics, which involves the determination of conditions for stability of banks, cuttings, and foundations of structures in the vast area served by the Indian Railways with widely varying types of soil.

A well-equipped laboratory has been established in Lucknow for studying soil characteristics and their safe bearing load.

Indian Railways have to cater for vast expansion and development to meet the requirements of the Third Plan and the Research, Designs & Standards Organisation has been keeping step with its contribution by evolving designs and processes which will make for greater efficiency.

NEW RANGE OF ACTIVATED CHARCOAL FILTERS

Alfred Bullows & Sons Ltd., of Long Street, Walsall, announce the introduction of a range of activated charcoal filters. These have been designed for use in compressed air systems where oil in the air stream is not acceptable. They are so effective that they not only remove all traces of oil from the air, but they also eliminate the smell generally associated with oil in aerosol form.

Each filter consists of an outer case and lid with a cartridge of activated charcoal and conforms to British Standards where applicable. Provision is made on all filters for four-point wall mounting.

The cartridge of activated charcoal removes oil from the air stream by adsorption and is therefore an expendable item which requires changing at intervals, dependant upon operating conditions. An average normal life of a cartridge element is 1,000 to 1,500 working hours.

Quick and easy cartridge replacement is one of the key design features. Air inlets are located in the bottom and air outlets at the side of the filters, so that when changing the cartridge it is not necessary to break the air connections. The lid, which is sealed with an 'O' ring is removed, cartridge changed and lid replaced.

Increasing Line Capacity on Southern Railway to meet New Traffic Demands

By F. P. Warrior

Engineer-in-Chief (Southern Railway)

The author furnishes details in regard to the various engineering works either completed or are under completion on the Southern Railway to increase line capacity. The sole objective to these efforts has been to cope with the increased traffic demands as a result of the developing economy of the country.

PROGRESS of industries and general rise in the economic level is best reflected in the demands on transportation. The demands on rail transportation in India has been heavy, indeed, necessitating various measures for increasing line capacity.

The Southern Railway has undertaken a big engineering programme which includes doubling of lines in congested sections, conversions from metre to broad gauge line, regrading lines to tackle heavier and longer trains and bridge construction works.

TRAFFIC PROBLEMS

The busiest sections on the Southern Railway are from Waltair to Madras, Madras to Jalarpet, Jalarpet to Erode and Raichur to Arkonam. Of these, the north-east line from Waltair to Madras is the main artery for the movement of traffic from north to south.

The demand for intake of wagons at Waltair has steadily been on the increase. Coupled with this the demand for loading in the Krishna and Godavari deltas have also been going up. As the intake from the Central Railway at Bezwada had also to be enlarged, large scale measures like doubling and regrading were necessary on the north-east line from Waltair to Gudur for the movement of traffic.

The Gudur-Renigunta metre gauge line had already been converted to broad gauge early in the Second Plan and as a result of this, diversion of some of the loads from Gudur to Arkonam via, Renigunta was envisaged.

This, in turn, together with the increased intake from Raichur threw a heavy burden on the section

from Renigunta to Arkonam for which purpose, doubling to the extent of 23 miles between Renigunta to Arkonam was also planned in the Second Plan.

DOUBLING OF LINES

Beyond Arkonam, with the two streams of traffic converging from Renigunta side and from Madras side, the intensity of traffic on the Arkonam-Jalarpet and on the Jalarpet-Erode section was expected to be heavy and for this purpose, doubling and regradings have been undertaken between Arkonam-Jalarpet and Jalarpet-Erode also.

The laying of a double line entails almost the same work as that of a new line especially when the present line is fully saturated with traffic and cannot be made use of for movement of construction materials for the new line.

In fact, now-a-days, with the heavy and continuous movement on the existing line, the laying of the double line with suitable connections at stations and junctions and signalling arrangements has become more complicated than that of laying a new line.

The need for careful planning is all the more apparent since not the least delay or interruption in traffic on the existing line can be allowed. Speed restrictions are also avoided to the utmost by keeping the line away where major bridges are to be constructed, so that the existing bridge foundations are not affected.

Still, in certain places, speed restrictions do become necessary, but this is kept down to the utmost.

On the Southern Railway, a total of 244 miles have been programmed for doubling during the Second Plan and of these, 144 miles were opened by 31-3-61. It is also expected that out of the balance, another 55 miles will be opened by middle of 1961. The work on the remaining sections are also on hand and in good progress.

BUILDING BRIDGE WORKS

In connection with these doublings, a total of about 1,000 new bridges have to be built, some of which are very major and difficult ones with deep well foundations, going upto 50 and 60 and below bed level, where divers have to work under water to feet the well seated on firm soil.

In view of the scarcity for steel in the early part of the Second Plan, particularly in respect of wide plates required for girders, pre-stressed concrete girder construction was adopted on a fairly large scale. They are all getting completed and the last one is expected to be opened by June, 1961. Amongst long pre-stressed concrete bridges the Bridge across Poiney river between Thiruvalam and Katpadi (length 1954') and the Bridge across Paillar river between Ulavappadu and Surareddipalayam (length 1480') deserve special mention.

BENEFITS OF CONVERSIONS

Some of the rich rice-growing areas in the Krishna delta are at present served only by the metre gauge. These sections are from Gudivada to Bhimavaram and Bezwada to Masulipatam. The growing needs of the rice traffic in this area made it necessary to improve the transportation by converting two sections into broad gauge.

In addition to improving the demands of the local traffic, this conversion will also provide an alternative route for the portion on the north-east line between Nidadavolu and Bezwada. Simultaneously with this conversion, an additional broad gauge line is also being laid between Guntur and Tadappalli so that the heavy passenger traffic between Guntur and Masulipatnam can be catered to by the broad gauge trains.

The provision of this broad gauge facility in the rich rice bowl of Andhra will be of great assistance to the people. This will also help in making the Bezwada yard more effective where already considerable improvement has been made with the provision of a hump yard for easy marshalling.

As a result of this conversion, the present metre gauge platforms will get converted into broad gauge platforms. This will provide increased reception and despatch facilities for passenger trains in the Bezwada yard.

OTHER ENGINEERING TASKS

The Gudivada-Bhimavaram conversion is expected to be completed by the middle of 1961 and Bezwada-Masulipatam by middle of 1962.

The laying of the broad gauge line from Guntur to Tadappalli together with a chord line between Tsundur and Venundla is also in progress. When these works are completed early in the Third Plan, alternative routes for the existing north east line between Nidadavolu and Tenali will be available easing considerably the traffic position.

In addition to these conversions, certain lengths on the north-east line in Waltair and Rajahmundry have been regraded to remove the stiff gradients. This has enabled working of longer and heavier trains.

PROPOSALS UNDER THIRD PLAN

An intake of 600 waltair at Wagons and 500 wagons at Bezwada has been planned for the Third Plan with this end in view, remaining patches between Tenali and Gudur are being doubled and so also the patches between Arkonam and Jalarpet.

On the West Coast line too, certain difficult portions which are at present proving to be bottlenecks are being doubled.

Making Rail Travel more Comfortable

By D. R. Khanna

General Manager, Central Railway

In spite of special emphasis having been laid on the development of goods traffic for the Five Year Plans and rapid rise both in goods and passenger traffic, the Central Railway has made a determined bid to make rail travel more comfortable.

In the article, the Central Railway Chief details the various measures taken by his Railway to ease the problem of overcrowding and provide a number of facilities to millions of its patrons.

IN this era of planned economy, the role of the Indian Railways has been obvious. As a major transport undertaking, the Railways have been called upon to provide in an ever increasing measure the sinews of efficient transportation to cope with the spiral of increasing traffic—goods and passenger.

In view of rapid industrialisation contemplated in the Second Plan, the requirements of goods traffic had naturally to be given an overriding priority over passenger traffic. The main emphasis in railways' planning was therefore on movement of goods.

A large number of Civil engineering works were therefore, undertaken during the Second Plan period on those sections of the Railway where the line capacity had been strained to its saturation point and where additional capacity had to be provided for coping with the increasing goods traffic.

Our ability to introduce additional trains was therefore determined to a very large extent by the pressure of goods traffic.

PASSENGER TRAFFIC

It would however, be wrong to give the impression that with the preponderant emphasis in the Second Five Year Plan on the requirements of goods traffic, the problems affecting passenger traffic have either been ignored or forgotten. The Railways have, indeed, given a good deal of attention to the problems of passenger traffic and have endeavoured to provide reasonable facilities for travel and to add to the comforts, however modestly, of the millions of passengers.

During the Second Plan, additional trains could be introduced only on these Sections where some spare

capacity was available. Some orientation in this policy would perhaps be possible in the Third Plan period when heavier (and longer) goods trains—with the special bogie type of wagons—would be run. The idea is to exploit the available line capacity to the utmost by running heavier trains instead of more trains. This policy would, to some extent, release some capacity for additional passenger trains where they are necessary and justified.

STEADY SPURT IN PASSENGER TRAFFIC

One aspect of our passenger service for which the Railways have been subjected to constant criticism is overcrowding. This criticism, however, does not take due notice of the fact that although quite a few measures have been adopted to mitigate overcrowding, the Railways have not been completely successful in catching up with the ever increasing spiral of passenger traffic. The authors of the Second Plan provided for a 15 per cent increase in passenger traffic during the Second Plan period over the 1955-56 level.

A striking picture of the trends of passenger traffic on the Central Railway is easily provided by following figures. In the year 1938-39 the Central Railway carried 66 million passengers, and this figure rose to 264 millions in the year 1955-56. The approximate number of passengers carried by the Central Railway in the year 1960-61 is 336 millions—nearly 550 per cent of what it was in 1938-39 and 136 per cent of what it was at the end of the First Five-Year Plan period! Likewise, passenger miles, which stood at 3.320 millions in 1938-39, rose to 7,186 millions in 1955-56, 8,515 millions in 1959-60, and would approximately be 8,846 millions in the year 1960-61. The passenger miles have increased nearly 320 per cent over the 1938-39 level and nearly 23 per cent more over the 1955-56 level.

ADDITIONAL TRAINS ON CENTRAL RAILWAY

It is obvious, therefore, that the rapidly increasing passenger traffic is more than what we have been able to cope with, in spite of the measures taken during the Second Five-Year Plan period.

The Central Railway had programmed for the introduction during the Second Plan period of 16 additional passenger trains. In July 1956, the Delhi-Madras Janata Express was converted from a bi-weekly service into a daily service. In February 1957, a Deluxe Express was introduced between Madras and Delhi, with air-conditioned First class and air-conditioned Third class accommodation. The Hyderabad-Howrah Express, which was introduced in October 1957, provides a direct fast service between Hyderabad, the capital of Andhra Pradesh, and the northern coastal districts of this State. In November 1957, after Bhopal became the capital of Madhya Pradesh, the Bhopal-Bilaspur Express was introduced in order to provide a convenient service linking up important far-flung cities in Madhya Pradesh. On 1st October 1959, the bi-weekly Bombay-Madras Janata Express was converted into a tri-weekly service and a year after a bi-weekly Janata Express between Bombay and Howrah via Allahabad and the Bombay-Nagpur Express was also introduced.

Additional passenger trains were also introduced during the Second Plan period on the Wadi-Secunderabad, Kazipet-Hyderabad, Kazipet-Balharshah, Bhusawal-Khandwa, Jhansi-Kanpur, Secunderabad-Mahbubnagar and Bina-Katni sections.

With the completion of the last stage of construction in December 1960, the entire Khandwa-Hingoli Metre Gauge Rail link was declared open to passenger traffic on January 2, 1961. We now have passenger services between Akola and Khandwa, and Akola and Purna on this Metre Gauge Rail link.

CHANGES IN TRAFFIC PATTERN

With the re-organisation of the States in 1957 and the location of the capital of Madhya Pradesh at Bhopal and of Andhra Pradesh at Hyderabad, the pattern of passenger services serving these capitals had to be re-orientated in order to fit in the changed demands of traffic.

In the case of Andhra Pradesh, convenient services to be provided between Hyderabad and the

coastal areas of Andhra Pradesh north and south of Vijayawada. Likewise, in the case of Bhopal, the capital of Madhya Pradesh, such distant points as Bilaspur and Indore had to be linked up by a fast passenger service serving the capital also. In the case of Maharashtra, an Express train was introduced between Bombay and Nagpur, particularly to meet the requirements of the Vidarbha area, and also in view of the State Legislature holding its winter session in Nagpur.

SHORTAGE OF ELECTRIC LOCOS

One of the major difficulties the Central Railway has had to contend with in respect of passenger and goods operation, was the shortage of electric locomotives on the Bombay division. Consequently proposals for the introduction of additional long distance trains in the division could not be progressed with. A number of steps were however, taken in recent months to overcome this shortage. The first was the transfer of five 3000 Volts D. C. locomotives from the Eastern Railway for modification and use on 1500 Volts D. C. The five locomotives, received from the Eastern Railway, have already been converted and brought into use on the Bombay Division.

Of the seven locomotives on order from Japan, two will be on replacement account and five will be the additional power that will be placed at the disposal of the Bombay Division. Of these seven, four locomotives have already been received and the balance would be available in April 1961. Ten locomotives are under manufacture at Chittaranjan and are expected to be available in the course of the year.

STEPS TO EASE OVERCROWDING

One of the measures which the Central Railway took during the Second Plan period and which helped to some extent in easing overcrowding had been to increase the loads of Mail and express trains from 12 to 13 coaches. This provided substantial relief on some of the most popular trains between Bombay and Calcutta, Delhi and Madras.

A large number of sectional coaches were introduced during the period, between important cities so that a convenient direct service was provided between such cities and the pressure on the through coach correspondingly reduced. In 1960-61, four such sectional coaches with Upper class accommodation and three Third class coaches were introduced.

MORE TRAINS IN THIRD PLAN

The Third Plan of the Central Railway envisages the introduction of a daily Express between Bombay and Secunderabad, between Hyderabad and Madras, between Bombay and Lucknow, a bi-weekly Janata Express between Bombay and Delhi, conversion of the present tri-weekly Bombay-Madras Janata Express into a daily service, a bi-weekly Janata Express between Bombay and Vijayawada, and an additional passenger trains between Bombay and Poona, Bombay and Nagpur, Khandwa and Kacheguda (Metre Gauge), Manmad and Dhond, Manmad and Janna, Poona and Nagpur via Dhond-Manmad, Bombay and Manmad, Poona and Sholapur, Itarsi and Bhopal, Itarsi and Allahabad, Amraoti and Nagpur, Bhopal and Agra Cantt., and between Dhond and Baramati. This is, of course, only a tentative scheme and the actual implementation would depend on the availability of line capacity, locomotives and coaching stock.

BOMBAY SUBURBAN TRAFFIC

The statistics in respect of the passenger traffic in the electrified Bombay Suburban area are interesting :

	1955-56	1958-59	1959-60	1960-61 (approximate)
No. of passengers Carried (in millions)	162	185	205	220
Vehicle Miles (in millions)	23.95	24.04	25.62	25.62

The figure of passengers carried (as anticipated) in 1960-61 would account for a nearly 25 per cent increase over the 1958-59 level.

With the steep increase in the traffic on the Harbour Branch, there has been a persistent demand for running all the trains on the Harbour Branch in the peak periods with double units. This has not been possible so far because of paucity of stock. Six units of Electrical Multiple Unit stock are expected to be made available in April 1961, and as many double units as possible will be provided then on the Harbour Branch service during the peak period.

9-CAR UNITS

The Central Railway is going ahead with the

scheme to introduce 9-car units as against the existing 8-car units in the Bombay Suburban main line sections. An order has already been placed for the manufacture of 28 third class trailer coaches so that the 9-car units could be formed. The first lot of eight of these coaches is expected to be delivered sometime in July this year and the balance by December 1961. This would provide some relief to overcrowding in the Bombay suburban trains. Proposals for lengthening of platforms, shifting of signals and overhead equipment structures are being progressed.

PASSENGER AMENITIES

The Central Railway has adopted recently a number of measures to improve conditions of travel. Additional booking windows are now being provided on Sundays and holidays at Ghatkoper and Mulund to cope with the pressure of Holiday traffic. A proposal to set up an automatic printing machine at Dombivli with a view to quick issue of tickets is also under consideration. The position at other stations is also being constantly observed.

The Bombay-Poona Janata Express train is now being operated with vestibuled rakes and the present policy is to provide all Janata Express services, as far as possible, with vestibuled rakes, except for the sectional coaches.

One of the most significant measures taken by the Central Railway (along with the other Railways) was the introduction of the new type Third Class Sleeper coaches—with accommodation for 75 passengers—on most of the important Mail and Express trains operating on the Railway.

Considerable attention has been given to the matter of providing at Victoria Terminus and other important stations adequate facilities for the reservation of accommodation for the air-conditioned, First, Second and Third Class passengers.

DEPARTMENTAL CATERING

Departmental catering, first introduced in 1956, has been further extended to selected stations and Dining Cars.

A non-official Catering Advisory Committee meets periodically and their advice is taken on various aspects of management of departmental catering.

SAFE DEPOSIT LOCKERS

Under a recently introduced scheme at Bombay-V.T. and Poona, passengers can deposit their valuables in lockers provided by the Railway on a nominal charge.

RAIL CONCESSIONS

The Central Railway follows a liberal policy in the matter of concessions in fares for railway journeys for several purposes to—

- (i) students including foreign students
- (ii) the Bharat Scouts & Guides
- (iii) Sportsmen
- (iv) Kisans and industrial workers for visits to national projects
- (v) persons taking part in voluntary service in Community Projects
- (vi) bonafide professional entertaining companies or parties
- (vii) persons attending the annual sessions of several all-India bodies of educational, cultural and social importance.

Concessional return tickets are also being made available during the Dusserah, Diwali and Christmas holidays and during the period from July to September to hill stations in India. Under certain conditions, concessions are also made available to blind persons, Cancer and Tuberculosis patients.

Nickel Silver Sheet and Strip for General Purposes & Copper Tubes for General Purposes

The Indian Standards Institution has prepared draft Specifications for Nickel Silver Sheet and Strip for General Purposes, Doc: SMDC 11(232) and Copper Tubes for General Purposes, Doc: SMDC 11(209).

The nickel silvers are a family of alloys composed of copper, nickel and zinc. A major property of these alloys is their colour which ranges from a soft ivory to silvery white, depending on the nickel content. These alloys have been used for centuries under a variety of names, the most common being German silver.

The Central Railway has been participating in the scheme of week-end excursions to Ajanta and Ellora caves sponsored by the Government of Maharashtra for the benefit of the Low Income Groups. The parties proceed from Bombay to Ajanta by rail via Aurangabad-Manmad. A broad gauge coach is placed at the disposal of the party and the entire "60-hour" trip costs the excursionist Rs. 60 per head.

A lot of planning and careful execution has gone into the tackling of the problem of summer exodus from Bombay and other spurts in seasonal passenger traffic. As against 471 special trains during the year 1958-59, 524 such trains were run in 1959-60. During the period from April 1960 to December 1960, 378 special trains were organised. As many as 50 Kisan specials were sponsored.

Despite several inherent difficulties such as interchange of stations, long distance run on single line, the Central Railway has shown improvement in punctuality performance. In January 1961 for instance, the punctuality figure for Mail & Express trains in B. G. stood at 79.3 as against 62.3 in the previous year. On metre gauge, it was 98.6 as against 93.6 in 1959-60. Passenger trains on B. G. & M. G. marked an improvement of 7.5 and 2.2% over the performance of the previous year.

It is indeed realised that much remains to be done, but it must also be said that what has been achieved so far in the sphere of passenger traffic is by no means unimpressive.

The "Promised Land" may yet be far off, but we are confident we are on the right road and that the ideal comfort in travel would soon be within our grasp.

However, they are known as nickel silvers in modern commercial practice. With the exception of cupro-nickels, these are the only alloys of copper that are white.

The draft standard for copper tubes for general purposes covers two grades of copper used for manufacturing copper tubes required for general purposes. For each application, the user will have to select the composition grade required and specify the outside diameter, thickness of wall and length of tubes.

RAIL TRAFFIC AND PERFORMANCE— SOME RECENT TRENDS

By S. K. Guha

Director of Statistics & Economic Advisor
Ministry of Railways

Shri Guha says that the Indian Railways have, by and large fulfilled the demands made on them as a result of industrial expansion and increase in agricultural production under the Five Year Plans.

With the aid of statistical data he has shown that the rail traffic has more than kept pace with the rise in industrial production in the country. He also has indicated the various measures the Railways have taken to effect economy in expenditure and promote operational efficiency.

A railway system in India originally designed by the British mainly for their military and administrative needs and to serve a predominantly agricultural economy had, with the independence of the country, to be switched on to the meeting of the needs of a developing economy under the impact of the successive Five Year Plans.

In the planned economy, the emphasis is on development on several fronts, more particularly on heavy industries, mining, agriculture and power as also progressive advance towards the goal of a welfare state.

The Indian Railways occupy a dominant position in the transportation system of the country and have, by and large, fulfilled so far the demands made on them consequent upon the expansion of output of the various industries and the increase in agricultural production. It may be of interest to see how the general pattern of traffic affecting earning and the levels of wages and prices influencing the cost of operation of the railways have been changing during the last decade.

RIISING TRAFFIC WITH INCREASING PRODUCTION

The traffic levels have been rising and the increases in freight traffic in the background of increases in industrial production may be seen from the figures quoted below:—

	1950-1	1955-6	1959-60	1960-1 (provisional)
Tons originating (millions)	91.4	114.0	144.2	154.0
Index	100	124.7	157.8	168.5
Ton miles (millions)	26,963	36,434	50,149	54,720
Index	100	135.1	186.0	202.9
Index of industrial production	100	122.4	151.9	167.5
(For the first 10 months)				

In the Third Five Year Plan based on the targets of increased production in the basic industries like coal, steel, cement and in agriculture and other spheres, the probable volume of originating freight traffic is estimated at 243.5 million tons subject to such modifications as may be found necessary in the light of subsequent developments.

The increase in passenger traffic during the Second Plan period alone has been of the order of 26 per cent and during the Third Plan period, provision has been made for a further increase of 15 per cent in passenger traffic.

SPURT IN FREIGHT TRAFFIC

In this context, it will be interesting to study the figures of rail traffic under selected commodities in

relation to their production during the last decade. The comparative figures for the years 1950-51, 1955-56 and 1959-60 for the major commodities which account for more than 60 per cent of the goods traffic are set forth in the table on page 38.

Even without going into the special characteristics of individual commodities, it will be readily observed that the bulk of the output of coal, cement, iron and steel, manganese ore, iron and other ores, paper, tea, jute raw has been transported by rail and further that the proportion of tonnage transported by rail under some of the commodities like cotton raw, cotton manufactured, sugar, etc. have shown a declining trend indicating some shift in the pattern of distribution of the traffic between the different modes of transport under these commodities.

CHANGING PATTERN OF TRAFFIC

One significant feature is that the pattern of freight traffic moving by rail now contains a larger proportion of industrial raw materials such as coal, ores and lime stone as will be apparent from the following data:

Percentage of tons originating of public coal, ores, marble and stone including limestone and dolomite to total tonnage originating of all revenue earning commodities.

1950-51	37.3
1955-56	37.4
1956-57	37.5
1957-58	39.6
1958-59	41.6
1959-60	42.3
1960-61 (estimated)	45.0

The broad tentative breakdown of the 243.5 million tons of originating traffic anticipated at the end of the Third Five Year Plan indicates that this proportion is likely to go up to 54 per cent in 1965-66. It will thus be seen that under the impact of planned development, there is already a marked tendency towards preponderance in rail traffic of low rated commodities.

This factor, coupled with the diversion, to some extent, of the high-rated commodities to other modes of transport, will necessarily entail a lesser rate of increase in the earnings compared to the increase in the volume of freight traffic. The traffic in coal, ores and stones including limestone and dolomite during 1959-60 in fact, accounted for 37.3 per cent of the revenue earning ton miles but contributed only 25 per cent to total goods earnings.

CARRYING LOW-RATED GOODS

It is well known that low freight rates are charged on coal and industrial raw materials to accord with the broad national policy of balanced industrial and economic development of the various regions of the country.

Separate ton mile statistics under 22 broad commodity heads which account for more than 75 per cent of the revenue earning traffic are available from 1959-60 and thus a broad idea of the financial effect of the low freight rates charged on industrial raw materials etc. can be had from the table below which summarises the average rates charged per ton mile for these 22 heads of commodities over the broad and the metre gauge railways.

AVERAGE CHARGE PER TON MILE

IN 1959-60

	(nP)	
	B. G.	M. G.
Coal for public	3.33	3.33
Grains	4.68	4.96
Oilseeds	6.93	7.79
Cotton raw pressed or unpressed	14.75	15.09
Cotton manufactured	16.02	17.63
Marble and stone	5.80	6.03
Salt	5.05	5.19
Metallic ores:		
(a) Manganese ore	7.19	6.79
(b) Iron ore	7.46	5.70
(c) Other ores	6.37	7.63
Mineral oils:		
(a) Oil fuel	9.64	9.59
(b) Kerosine oil	9.68	9.96
(c) Petrol	17.13	15.56
(d) Other mineral oils	9.97	9.95
Sugar	10.44	9.27
Cement	7.33	7.53
Cement manufactured products	9.81	10.04
Iron and steel wrought	9.48	10.5
Wood unwrought	6.30	7.58
Jute raw pressed or unpressed	14.75	17.73
Vegetable oils	9.34	10.30
Fruits and vegetable fresh	5.60	7.21
Other revenue earning commodities	6.83	8.49
Total revenue earning traffic	5.86	7.25

1959-60

1955-56

1950-51

	Production (000 tons)	Rail Movement (000 tons)	Proportion of rail movement to Production	Production (000 tons)	Rail movement (000 tons)	Proportion of rail movement to Production	Production (000 tons)	Rail movement (000 tons)	Proportion of rail movement to Production
Coal	32,307	30,423	94.2	38,226	35,337	92.4	17,028	44,616	94.9
Cement	2,613	2,432	93.1	4,487	3,956	88.2	6,828	6,058	88.7
Metallic ores other than manganese ore	3,655	3,007	82.3	5,464	4,373	80.0	8,677	8,558	98.6
Manganese ore	883	867	98.2	1,584	1,378	87.0	1,168	1,173	100.4
Iron & Steel	1,724*	2,707†	—	2,661*	3,665†	—	3,704*	6,602†	—
Foodgrains	50,235	7,682	15.3	66,494*	9,044	13.6	75,557*	12,287	16.3
Oilseeds	5,076	1,570	30.9	5,643	1,766	31.3	6,352	1,467	23.1
Sugarcane	56,150	2,774‡	4.94	59,587	3,408‡	5.72	75,038	3,141	4.19
Sugar	1,037	983	94.8	1,615	1,336	82.7	2,410	1,354	56.2
Cotton raw	714*	517	72.4	818*	730	90.3	782*	531	67.9
Cotton manufactured	498	465	93.4	715	548	76.6	738	394	53.4
Jute raw	586	463	79.0	712	512	71.9	804*	799	89.4
Jute manufactured	836	267	31.9	1,027	290	28.2	1,051	253	24.1
Salt	2,620	1,551	59.2	2,979	1,858	62.4	3,128	1,952	62.4
Tea	271	261	96.3	284	258	90.8	316	260	82.3
Paper & paper boards	215*	189	88.1	324*	256	79.0	366*	411	112.3

* Includes imports.

† Includes machinery etc.; hence proportion not worked out.

‡ Estimated.

The overall average cost of hauling a ton of goods taking all commodities together one mile (including interest) during 1959-60 was 4.44 nP. on the B. G. and 8.19 nP. on the M. G.

It will be seen that the average earnings fall short of the overall average cost of hauling a ton of goods one mile in the case of coal on both the Broad and the Metre gauges. The average earnings also fall short of the average costs on the Metre gauge in the case of grains, oilseeds, marble and stone, salt, metallic ores, cement, wood unwrought and fruits and vegetables fresh.

Although it is not strictly scientific to compare the average receipt from each commodity group with the overall average cost (inasmuch as the latter does not take into account the widely varying transportation characteristics for different commodities) yet the overall cost per ton mile enables a broad evaluation of freight rates in relation to railways' costs.

RISING PRICES AND WAGE LEVELS

Another notable aspect during the Plan period so far has been the rise in the price levels in spite of the increases in the agricultural and industrial production. The extent of price increases in important items of stores and materials consumed by railways with 1952-53 as the base will be evident from the following table:

Index numbers of prices of important stores consumed by railways—for the last week of March each year.

(Base : 1952-53 = 100)

	1956	1957	1958	1959	1960
Coal	101	121	130	132.7	135.2
Mineral oil	95	98	108	108.4	108.6
Iron and steel					
manufactures	126	132	145	144.6	148.2
Cement	98	113	129	129.2	129.2
Timber	117	116	115	119.0	139.5
Bricks and tiles	87	91	100	96.9	105.3
Paper and newsprint	95	100	114	115.7	108.1
Electricity	100	103	110	110.3	115.2

The overall index of wholesale prices with 1952-53 as the base increased from 92.5 in 1955-56 to 117.1 in 1959-60 (and further to 124.3 during the first 9 months of 1960-61).

Furthermore, the average cost per employee and the expenditure per head on staff welfare have been rising as shown below consequent upon the improvements in the wages as conditions of services of staff. The average cost per employee and the cost of staff welfare per employee are given below :

Year	Average cost per employee Rs.	Cost of staff welfare per employee Rs.
1950-51	1,263	34.04
1955-56	1,476	49.04
1959-60	1,660	72.45

The average cost per employee will go up further due to the implementation of the recommendations of the Second Pay commission, which is not reflected in the figure for 1959-60.

UNREMUNERATIVE SERVICES

In this context, it may be stated that the earnings and expenses for the two major wings, namely, coaching and goods services have recently been analysed in the Directorate of Statistic and Economic Adviser's Branch of the Railway Ministry and the results are set forth in a brochure entitled "A Review of the Performance of the Indian Government Railways (February 1961)" which had been circulated along with the Railway Budget documents. This analysis shows the proportion of expenses to earnings for coaching and goods services for all gauges combined to be as follows :—

Proportion of expenses to earnings
(Per cent)

	Coaching Per cent	Goods Per cent
1950-51	89.6	95.2
1955-56	98.5	90.7
1957-58	103.4	87.9
1958-59	107.5	89.6
1959-60	101.9	87.5

Barring the levy of passenger tax (the proceeds of which accrue to the states) there has hardly been any change in the basic passenger fare structure after April 1, 1951 except for minor adjustments in consequence of the introduction of telescopic fares on April 1, 1955.

The gradual increasing costs of the coaching services on account of rising prices and wage increases as also the expenditure on passenger amenities have had this result that since 1957-58 expenses have exceeded the earnings but the imposition of the passenger tax in September 1957 limited the scope for any further adjustments in the passenger fare structure to meet even the normal increases in costs.

It is significant that the overall adverse results of passenger services commenced in that year. As regards good services even though the proportion of expenses to earnings has declined from 1950-51, if allowance is made for the increases in freight rates, the improvement is only marginal.

In other words, the increase in expenditure has been higher than the effective increase brought about in the freight rates per ton mile or fares per passenger mile. This is unmistakably a reflection of the shift in the pattern of traffic moving by rail consequent upon the preponderance of low-rated traffic coming to rail without any corresponding increase in the high-rated commodities. There have also been unavoidable increases in costs arising from increasing wages, prices and users' amenities on one hand and the absence of increase in passenger fares and freight rates to correspond fully to such increases in the costs on the other.

STRESS ON ECONOMY AND EFFICIENCY

In the larger interests of the general economy of the country, the railways are continuously striving to effect economy in expenditure by various means including intensive utilisation of railway assets, such as tracks, locomotives and wagons.

Performance of Variable Speed Internal Combustion Engines for Automotive Purposes

With the object of providing a referee method for evaluating the performance of variable speed internal combustion engines for automotive purposes, the design of which has already been type tested, the Indian Standards Institution has published an Indian Standard Specification for Performance of Variable Speed Internal Combustion Engines for Automotive Purposes (IS: 1603-1960).

The standard specifies the performance requirements and tests for normally aspirated variable speed

The table below summarises the achievements of the three pronged operational drive launched by the Railways during the past decade. This table gives the number of wagons and engines on line for moving one million net ton-miles of goods per day during the four crucial years—1938-39 (pre-war), 1950-51 (pre-Plan), 1955-56 (eve of Second Plan) and 1959-60 (penultimate year of the Second Plan):—

No. of units required for moving one million net ton miles of goods per day.		
year	No. of goods locos (all traction) on line, B. G.	No. of wagons (in term of 4-wheelers) on line.
1938-39	66	2849
1950-51	56	2304
1955-56	47	1848
1959-60	39	1686

Similar improvements have been made in more intensive utilisation of the track facilities also, as will be seen from the following table showing million ton-miles moved per annum per thousand running track miles during the same 4 years:—

Year	Broad gauge
1938-39	749
1950-51	1212
1955-56	1572
1959-60	2056

It is apparent that in the years to come, the Indian Railways will be required to play an even more important role in the planned economic development of the country and there is little doubt that they will not be found wanting.

N. F. Railway to eliminate Traffic Bottlenecks

By Rattan Lall

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The author explains how despite initial difficulties and setbacks, the N. F. Railway has marched forward to undertake development of line capacity works and other improvements to break transport bottlenecks in the region. Reference is also made to the construction of the massive rail-cum-road Brahmaputra Bridge which will provide for speedier movement of men and material from the border state of Assam to the rest of India on its completion in 1962.

ALTHOUGH the North-east Frontier Railway is the smallest of all the Zonal Railways its problems are by no means small. Created in 1958 to tackle the special needs of the frontier region and to provide effective means of transport for men and material between Assam and the rest of the country, the Railway Zone claims five per cent of the total route mileage of the Indian Railways.

This portion of the Indian Railways has passed through various ordeals. Wear and tear of its permanent way and rolling stock was considerable during the last war. This was followed by partition which severed the rail link to Assam and a portion of West Bengal from rest of the country. Devastating floods raged in 1954 and 1955 affected the new Assam Link route, dislocating traffic for months together.

The Railway has successfully tackled the initial problems that once beset its path. With the completion of work on the Assam Link Route and opening of the Brahmaputra Bridge as well as the coming of broadgauge to Siliguri, it is hoped, that the major bottlenecks in the Railway will be eliminated.

Carved out from the bifurcated North Eastern Railway, the new Railway serves 300 tea gardens in West Bengal and 800 in Assam and constitutes their main mode of transport. Besides, it is the only outlet for petroleum and its products from the Digboi Oil Refinery.

The other principal commodities carried by the Railway are coal and timber from Assam and jute from Bihar and West Bengal. Its chief inward traffic is sugar, salt, food grains, pulses, tea garden stores and piece-goods.

ASSAM RAIL LINK

The Partition led to the formation of Assam Railway which had to begin from a scratch. The severance of rail links to Assam and West Bengal as a result of partition necessitated construction of Assam Rail links.

The alternative link was opened to goods traffic in December 1949 and passenger traffic in January 1950.

With the regrouping in April 1952 the Assam Railway became a part of the North Eastern Railway.

SET BACK AGAIN

The First Five Year Plan was mainly devoted to the task of absorbing the shock of the Partition. But just when the Railway was on its way to recovery, there was a fresh setback from the devastating floods mentioned earlier.

During the successive rainy seasons also the Link Route was ravaged by floods though not as seriously as those in 1954 and 1955.

Topographical conditions of the region are peculiar to itself and constitute a challenge to the ingenuity of those responsible for maintaining the train services. For most of its length, the line passes through sub-montane region and cuts across the drainage of the country at many places where a number of turbulent rivers from the Himalayans rush into the plains in their maiden fury, sometimes with a velocity of as much as 26 to 28 ft. per second.

Due to this factor, the railway track had always been subjected to repeated breaches. But whatever

might be the obstacles, stabilisation of this Link Route, which is the lifeline to Assam, has been a vital condition precedent to the development of its economy.

STRENGTHENING THE LINK ROUTE

To prevent recurrence of breaches, extensive work has been undertaken at an estimated cost of about Rs. 6 crores. The idea is not been to fight the rivers but to tame them. The main item of work required, therefore, is effecting improvement to about 42 bridges by providing increased waterways and deeper foundation. Guiding of some of the turbulent water courses through the bridges is another important aspect of the programme. The Bridge works involve construction of 24 spans of 150', 31 spans of 100', 34 spans of 60', 54 spans of 40' and 128 spans of 20' and less. Thirty two of these bridges are on well foundation.

IMPROVEMENT IN WAGON MOVEMENT

The strengthening of the Assam Link Route is almost complete except girdering of a few bridges. The frequent interruption and continual trouble to communications on the Link Route would, it is hoped, soon become a thing of the past.

BETTER WAGON MOVEMENT

There has been considerable improvement in movement of traffic East of Siliguri Jn. The daily average movement progressively increased from 132 wagons in 1955 to 257 in 1960.

Rated against 1955 performance as 100, the performance during 1956 to 1960 has been respectively 112 (1956), 133 (1957), 150 (1958) 169 (1959) and 195 (1960). During January and February 1961, the daily average has been 291 wagons or 120.5 per cent of the figure in 1955. The Railway also moved 238 and 126 coaching vehicles respectively by important specials during this period.

BRAHMAPUTRA BRIDGE

At present a passenger and wagon ferry ply between Amingaon and Pandu with a capacity of about 250 wagons a day. During high waters in the rainy season this also becomes difficult. It, therefore, constitutes a bottleneck to speedier movement of wagons and inconvenience to the travelling public. To overcome this, the construction of a combined

rail-road bridge was undertaken in October 1958. The estimated cost of the entire project is Rs. 10.79 crores. The bridge will consist of 10 spans of 403'—4½", centre to centre of piers with a shore span of 108'—11", centre to centre of piers, at each end.

Out of 11 main piers, 8 piers have already been completed and the pier superstructures are ready to receive the girders. The work on the remaining piers is expected to be completed soon. Fabricated materials for the girders have started arriving at the work site.

The project also covers remodelling of Narangi Yard (next station east of Gauhati) which will replace the yards at Amingaon and Pandu and also serve the proposed Oil Refinery at Noonmati (Gauhati) and other ancillary works. The new yard is designed to handle 300 wagons each way for the present and provision has been made for its expansion to cater for 500 wagons or more each way.

The Bridge is likely to be brought into commission by about the middle of 1962.

INCREASING LINE CAPACITY

The single line Main Line section between Katihar and Amingaon is already saturated and will not be able to handle the increased traffic expected during the Third Five Year Plan. In order to break the bottleneck, Master plans for the development of the carrying capacity of this Railway have already been drawn up and are being progressively executed.

A Metre Gauge route of 15.53 miles from Kumedpur to Mukuria (near Barsoi) was opened to goods traffic in July, 1959 and to passenger traffic in December, 1959.

A 20 mile Broad Gauge line from Khajuriaghat to Malda Town with wagon ferry between Farakka and Khajuriaghat was opened to public goods traffic in December, 1960.

Work for provision of 94 mile Broad Gauge line from Barsoi to Siliguri Junction is in progress and is likely to be completed in a short time. Conversion of the Metre Gauge Sections from Katihar to Singhbad linking Malda Town (approximately 69 miles) and from Mukuria near Barsoi to Kumedpur (15.53 miles) into Broad Gauge Line will provide for transshipment

of Broad Gauge to Metre Gauge and Narrow Gauge and vice-versa traffic.

There will thus be a direct Broad Gauge connection between Calcutta and Siliguri with wagon ferry across the Ganga between Farakka and Khejuriaghat. This route will provide for movement of about 100 Broad Gauge wagons per day and will serve North Bengal requirements.

NEW M. G. LINES

Construction of metre gauge from Rangapara North to North Lakhimpur covering about 107 mile, running along the stretch of the country between the Brahmaputra and the Himalayan foothills has been taken in hand. The first stretch of 12 miles including the construction of the Jia Bhareli Bridge consisting of 9 spans of 200 ft. commenced in February 1960. Railway materials have started moving over it since December 1960 upto Jia Bhareli and across the Bridge from February, 1961.

Construction of a new metre gauge line from Kalkalighat to Dharamnagar (10.48 miles), which will link Tripura with Assam has been sanctioned and the project is in progress.

TRACK RENEWALS AND SIGNALLING

Due to worn out rails, trains had to be run at a restricted speed and for this reason complete renewal of track for 262 miles at an estimated cost of Rs. 3 crores has been programmed. Up till now about 190 miles of track have been renewed.

Realignment between Mal and Banarhat, to reduce the gradient, has been undertaken. This and other regrading works now in progress will increase the lead capacity of the locomotives.

To increase safety and to permit higher speeds through station yards all the stations on the main line from Katihar to Tinsukia except Tinsukia, Chaparmukh, Simaluguri Junction and Sripuriagaon have already been included for interlocking in various works programmes. The interlocking work at all the stations on the Katihar-Siliguri Junction section has been completed and that between Tandu and Tinsukia is in hand.

CENTRALISED TRAFFIC CONTROL

The Ministry of Railways has decided to introduce

Centralised Traffic Control system over the 258 mile single line section between Amingaon and Siliguri, the first of its kind on the Indian Railways, at a cost of about Rs. 5 crores.

The work is expected to be completed within about two years. The line capacity will also be increased to 24 trains each way instead of 15.

It is also proposed to dieselise goods train services over the Barauni-Katihar-Amingaon section and on the Lumding-Badarpur section. The first lot of diesels is expected to be put in service about the middle of this year.

HELPING THE INDUSTRIES

The oil Refinery located at Digboi with a capacity of .43 million tons was established there in 1900, about 60 years ago. The Railway has a fleet of 720 tank-wagons for movement of this oil which goes to different parts of the country. The Oil Refinery at Gauhati is likely to go into production by December 1961 with a capacity of .75 million tons. Additional tankwagons of 38.5 tons carrying capacity have been ordered to meet the anticipated demand.

Coal is found in Margherita and Ledo areas in Assam. Coal mining process here is different from what obtains in Bengal and Bihar Coalfields. In the Assam coalfields, the coal seems to be in the shape of hills and the approach to the coal bearing strata is through a horizontal tunnel, or more correctly, one which slopes almost imperceptibly upwards from the pit mouth.

On an average, about 120 coal wagons were loaded every day on this Railway during 1960—61 (upto January) as compared to 80 and 88 wagons in 1958—59 and 1959—60 respectively.

WORKSHOPS & SHEDS

Since the partition left this portion of the Railway without any workshop worth the name, provisions have been made for the setting up of carriage and wagon workshops at Bongaigaon at an estimated cost of about Rs. 5½ crores along with expansion of the capacity of the workshop at Dibrugarh at an estimate of Rs. 10 lakhs (approximately).

Further, a new Diesel Shed at Siliguri Jn. for housing 40 Metre Gauge Locos and another at New Siliguri Jn. for accommodating 25 Narrow Gauge locos

are also proposed to be constructed in the Third Plan. At Narangi a diesel shed for 40 locos has been included in the Brahmaputra Bridge Project.

MOVEMENT OF TRAFFIC

The N. F. Railway's effort to improve, expand and modernise. The system has already borne fruit. From April 1960 to January 1961—Wagon loading has been about 10 per cent more than what was done in the corresponding period of 1958-59. The movement of traffic over the Katiyar-Siliguri-Alipurduar-Amingaon section showed an improvement ranging from 14 per cent to 20 per cent as compared to previous year. Marked improvement has also been noticed on the Lumding-Badarpur section to serve the Cachar district.

Other statistics of performance are as under :—

(PERIOD APRIL TO JANUARY 10 MONTHS)

	1958-59	1959-60	1960-61	Percent- age increase in 1960-61 over 1958-59
1. Daily average No. of wagons loaded	960	985	1047	9.1
2. Tons lifted (in thou- sands)	3423	4324	4105	19.9
3. Net Ton miles (in millions)	788	774	886	12.4
4. Passengers carried (in millions)	27.5	25.5	29.9	8.7
5. Passenger miles (in millions)	1100	1037	1283	16.6

AMENITIES FOR RAILWAY USERS

Since the inception of this Railway, nearly Rs. 52

lakhs have been spent towards passenger amenities which included provision of platform coverings, foot overbridges, refreshment rooms, tea stalls, waiting rooms, waiting halls at 13 stations and bath-rooms cubicles at a number of stations. Besides, 19 stations had been electrified and 6 water coolers provided at 4 stations.

Arrangements for sale of cheap food packets have been made. Departmental catering has also been introduced at Gauhati, Pandu and on the passenger ferry plying between Pandu and Amingaon.

Another important facility introduced since December last is the provision of one 3-tier sleeper coach on the Kamrup Express trains twice a week.

Twenty-one out agencies to afford more booking facilities to the mercantile community, have been opened and public address equipments have been installed at 8 stations to assist the travelling public.

A sum of Rs. 1.03 crores is proposed to be spent during the Third Plan period on passenger amenity works.

SCHOOLS FOR RAILWAYMEN'S CHILDREN

Provision of educational facilities to the children of the Railway staff is receiving close attention and is being made on a programmed basis. The Railway is running: Five English High Schools and 4 more English High Schools will be taken over by the Railway during the Third Plan. Thirty-two single teacher free primary schools have been sanctioned of which 29 are now functioning. The remaining three will be opened shortly. Besides the Railway Schools, capitation grant is given to non-Railway schools situated at some important stations. A vocational training centre has recently been started at Maligaon for imparting technical training to staff and their children.

Super-powerful Open-hearth Furnace

A super-powerful open-hearth furnace has been laid at the giant Magnitogorsk Steel Mill. It will produce 50 per cent more steel than any of the country's biggest furnaces at present. Under the Seven-Year Plan, the Magnitogorsk Mill, built in the thirties under the first Five Year Plan, will almost double its output, increasing it to 12 million tons a year. This increase will be achieved both through enlargement of furnaces and an intensification of the production processes through the use of high-calory fuel natural gas. Scientists are now working on a plan of the comprehensive mechanization and automation of the mill's open-hearth section.

Southern Railway—Its Role in the economy of the South

By H. D. Singh
General Manager, Southern Railway

The author refers, in this article to the significant role the Southern Railway plays in the economy of the five Southern States—Madras, Andhra Pradesh, Kerala, Mysore, and portion of Maharashtra and enumerates the various steps taken by the Railway including the increase in line capacity to tackle ever growing traffic generated by the planned development of the country.

He claims that despite special emphasis laid on the transportation of goods for industrial purposes, the Southern Railway has fared well in providing more amenities to the rail travellers. The Railway has taken a number of measures for the welfare of its 1.63 employees and their families.

THE main problem of the Southern Railway, as on other Railways, has been to cope with the enormous increase in traffic generated since 1950. The Railway's plans had to be tailored to suit the requirements of anticipated expansion in the country and carry on increased traffic generated by the two Five Year Plans.

To meet these commitments and achieve around progress the outlay provided for the Second Five Year Plan was Rs. 134.5 crores as against Rs. 67.6 in the First Plan.

Apart from the general increase in traffic, there are certain aspects in the pattern of movements which are rather peculiar to the Southern Railway. With a total route mileage of 6161 miles and sprawling across the Southern Peninsula, this Railway serves the Southern States of Madras, Andhra, Mysore, Kerala and Maharashtra. Covering the two coast lines, the Railway serves also the two major ports of Madras and Cochin besides many minor ports.

SOUTHERN RAILWAY SERVES AGRICULTURAL REGION

The region served is predominantly agricultural. The food group is mainly cultivated in the delta areas irrigated by the Godavari, the Krishna and the Cauvery river systems.

Large parts of the Southern States are, however, deficit in foodgrains and these are therefore to be moved from the surplus areas by the Railway to the deficit areas.

In broad profile, the deficit areas are the states of Kerala, Mysore and Maharashtra and the western parts of Madras. It has been one of the major concerns of the Railway to move wagons to carry food from surplus to deficit areas.

The main cash crops grown in the area covered by the Southern Railway are tobacco in the coastal districts of Andhra Pradesh, groundnuts almost everywhere except Kerala and coastal Mysore, cotton in the southern and western parts of Madras and sugarcane in select areas in all the States.

Tobacco is cured and exported to countries overseas though substantial quantities are consumed in the cigarette factories in Bombay, Calcutta, Chandisthan, Saharanpur, Hyderabad and Bangalore. Curing is done with coal obtained from the collieries in Bengal and Bihar and Central India.

Groundnut is generally crushed in mills near the growing centres and the oil is moved to Madras for shipment or to the Vanaspati factories. The cake is moved to the Southern parts of Madras for use as cattle feed or manure.

Cotton is ginned locally and the seeds are moved to south Madras or Kerala as cattle fodder. Availability of cotton has largely influenced the growth of the textile industry in many places on the Southern Railway and similar considerations apply to the sugar industry also. There are textile mills located at 18 stations on the Railway and sugar factories at 19 stations.

Sugarcane is grown near about these factories and

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Sugarcane is grown near about these factories and

moved by Railway mainly to the factories. Jaggery is loaded from stations like Kolhapur and Anakapalle to stations in the north.

FEEDING THE INDUSTRIES

The non-availability of coal has to some extent handicapped the progress of industries in the South. South India has unfortunately no collieries and all the coal required for the industries and for the thermal plants have to be got from the collieries in Bengal and Bihar or from the Singareni collieries. The coal movement by the North East line from Bengal and Bihar collieries and from Central India collieries via Vijayawada forms one of the important items of the goods traffic movements. However, where labour has been cheap and other raw materials easily available, some major industries have sprung up. Cement factories are located at Madukarai, Talayuthu, Dalmiapuram, Kottayam, Bhadravati, Bagalkot, Bugganappalle, Vijayawada and Macherla. Raw materials to the cement factories and cement produced from these factories form an important item of traffic. During 1959-60, 1186500 ton of cement was loaded on the Railway.

The other industries include glass factories, paper mills and engineering industries. The Bhadravati Iron and Steel Works depend on coal to be brought from North India. Raw materials are received from nearby areas where they are available and finished products are despatched from these centres.

The Lignite Project in Neyveli on the Railway is a big project and at present large quantities of heavy machinery and iron and steel structural parts are moving to the Factory site. This project will bring in its wake a number of allied industries besides station for generating electricity.

Ceramic and fertiliser factories are being established near Neyveli.

Salt is manufactured in certain packets on the coast line. It is required to be carried to the consuming centres in the interior and some salt even moves upto certain stations in Northern India.

When Lignite mining goes into full swing, large quantities of traffic are expected to and from this area which will have to be carried by this Railway.

RAILWAY'S BUSY SECTIONS

The busiest arterial sections are from Waltair to

Madras, Madras to Jalarpet, Jalarpet to Erode and Raichur to Arkonam. Of these line from Waltair to Madras is the main artery for the movement of traffic from north to south.

The demand for intake of wagons at Waltair has steadily been on the increase and coupled with it the demand for loading in the Krishna and Godavari deltas has also been increasing. The intake from the Central Railway at Vijawada has also increased.

The Second Five Year Plan on the Southern Railway was, therefore, designed primarily to increase the movement capacity to carry the increased traffic from contiguous railways via Waltair, via Vijayawada and via Raichur, and also the traffic generated on account of the increased industrial and agricultural activity in the areas served by the Railway itself.

LINE CAPACITY WORKS

Large scale measures for increasing the line capacity have, been undertaken. Doublings and regradings were necessary on the line from Waltair to Gudur. Other line capacity works like the extension of loops, provision of additional loops, new crossing stations and additional yard facilities were taken up during Plan period. At 24 stations on the Vijayawada-Waltair Section, loops were extended to hold 70 vehicles.

The Gudur-Renigunta metre gauge line was converted to broad gauge early in the Second Plan to a length of 52 miles in 1957.

As a result of this, some of the loads from Gudur to Arkonam are being diverted via Renigunta. This in turn together with the increased intake from Raichur threw a heavy burden on the section from Renigunta to Arkonam for which purpose doubling to the extent of 23 miles between Renigunta and Arkonam was planned in the Second Plan. Doublings and regradings have been undertaken between Arkonam and Jalarpet and between Jalarpet and Erode.

A total of 244 miles had been programmed for doubling during the Second Plan and of this, while 144 miles will be opened for traffic by March 31, this year another 55 miles will be opened by the middle of 1961. The works on the remaining sections are also on hand and in good progress.

BRIDGE BUILDING WORKS

In connection with these doublings, a total of about 1,000 new bridges have to be built, some of which are very major ones and difficult ones with deep well-foundations going upto 50 and 60 feet below bed level.

In view of the scarcity for steel in the early part of the Second Plan particularly in respect of wide plates required for girders, pre-stressed concrete girder construction was adopted on a fairly large scale in the construction and 40, 60 and 64 feet spans have been adopted in pre-stressed concrete. They are all getting completed and the last one is expected to be opened by June 1961.

On this Railway—it has been necessary to run locomotives of heavier axle-loads and to increase the permissible speed over sections. This has necessitated the strengthening of a number of bridges on several sections and this has also received special attention during the Second Plan.

In the Third Five Year Plan, strengthening of Krishna Bridge No. 3 near Vijayawada and strengthening of other major bridges are contemplated.

CONVERSION PROGRAMME

Apart from the conversion of the Renigunta-Gudur section, other important conversions which are in progress are these of Vijayawada-Masulipatam and Gudivada-Bhimavaram sections. Those sections serve the rich rice growing areas in the Krishna delta.

It will also provide an alternative route for a portion on the North-East line between Nidadavolu and Vijayawada. Simultaneously with this conversion, an additional broad gauge line is also being laid between Guntur and Tadepalli so that the heavy passenger traffic between Guntur and Masulipatam can be catered by the broad gauge trains.

It is also expected that Gudivada-Bhimavaram conversion will be completed by the middle of 1961 and the Vijayawada-Masulipatam conversion by the middle of 1962.

The laying of the broad gauge line from Guntur to Tadepalli together with a chord line between Tsundur and Vejendla is also in progress and will be completed early in the Third Plan. It will provide alternative routes for the existing North-East line

between Nidadavolu and Tenali and therefore considerably ease the movement of traffic on these sections.

YARD REMODELLING WORKS

Owing to the increased intake at Waltair and from the Central Railway the work in the Vijayawada Yard had increased considerably. The work relating to remodelling of the Vijayawada yard was completed during Second plan. It includes a Hump Yard for marshalling towards Madras side and a by-pass line connecting Waltair-Vijayawada and Vijayawada-Delhi lines. While in 1956-57 Vijayawada station had been dealing with 29,000 wagons a month on an average, in 1959-60, this Yard dealt with 37,858 wagons per month.

The present m. g. platforms in Vijayawada will be converted into broad gauge platforms to provide increased reception and despatch facilities for passenger trains in the Yard.

It was necessary to remodel some of the other Yards also to augment transport capacity. The work to remodel Jalarpet and Chinglepet Yards is in good progress and a major portion is expected to be completed during the Second Plan period.

OTHER WORKS

Certain lengths on the line between Waltair and Rajamundry have been regraded to remove the steep gradients thereby enabling longer and heavier trains to be worked. This work was completed in December, 1960.

On the Jalarpet-Podanur section, the loops at 15 stations were proposed to be extended and the entire work is expected to be completed during the Second Plan period.

Owing to these special steps taken to improve the transportation capacity, the intake of loads via Waltair, via Vijayawada and via Raichur has been increasing steadily from year to year. An important Project completed during the early years of the Second Plan was the 96½ mile long Quilon-Ernakulam M. G. length.

TRACK RENEWALS

The track renewal programme has also received attention during the Plan period and over 340 miles

of broad gauge and over 490 miles of metre gauge tracks are expected to be completed during the Plan period.

REMODELLING OF MADRAS CENTRAL

To improve the facilities for dealing with passenger traffic at Madras Central Station, its remodelling is provided for in the Plan.

Power signalling and route relay interlocking is also provided for in the remodelling. The work is being taken up in phases. Most of these items are nearing completion.

ORE TRAFFIC

A fillip has been given to the mining of Iron and Manganese Ores because of demand for export overseas. In fact, almost all the ports on the Bay of Bengal and on the Arabian Sea are availed of to ship the ore traffic.

The mines of South India lie around Hospet, Chitradurg, Banasandra, and Dandeli in the Mysore State and Jaggaipet near Vijayawada in Andhra Pradesh. The ore is exported mainly from Madras Port, Vizagapatam, Cocanada, Masulipatam, Karwar and Cuddalore.

To enable the movement of increasing quantities of Ore from Hospet-Guntakal section to Madras and other various ports, line capacity Works at 44 stations in the Guntakal Division have been undertaken. These are in very good progress and most of the works are expected to be completed during the Second Plan period.

The following figures of originating traffic in Iron ore will show the increase in this traffic :

IRON ORE		
	Tons	Index
1951—1952	116700	100
1955—1956	571200	489
1959—1960	1245800	1068

SIGNALLING AND TELE-COMMUNICATIONS

During the Second Plan 72 non-interlocked stations have been interlocked and the standards of signalling have been raised at 32 stations on this Railway. Eleven non-control sections have been provided with section control.

Seven new teleprinter circuits have been brought into use to facilitate quick clearance of Railway messages. A major signalling and tele-communication workshop has been set up at Podanur with an annual out-turn of equipment worth Rs. 25 lakhs, making the Railway self-sufficient in regard to its repair and overhaul programme of signalling and tele-communication apparatus. A training school has also been opened as an annexe to the workshop and its further expansion is proposed during the Third Plan. It is expected that the workshop will be able to manufacture certain essential components of power signalling.

Improvements are thus being made to the Mechanical Workshops at Perambur and Hubli, the engineering workshops at Arkonam, the car-shed at Tambaram, the new diesel-car-shed at Tiruchirappalli and the local sheds at Jalarpet, Shoranur, Gooty, Guntakal, Yeswantpur, Arkonam, Mysore and Nandalur.

TRANSPORT FACILITIES

The Railway has the problem of break of gauge transshipment. The existing facilities have been enlarged at the important tranship sheds of Arkonam, Guntakal, Bangalore and Tadepalli. A 22 per cent increase in the transshipment out-put in 1959-60 over 1955-56 has been achieved at these points.

PROVISION OF BETTER RAIL SERVICES

The system of guaranteed Quick Transit Service was introduced on this Railway on 1-4-1956. The Railway is now operating 111 such services.

To reduce the incidence of handling damages and chances of misdespatch of 'smalls' consignments, a Container Service has been introduced for parcels traffic as an experimental measure.

During 1960, two refrigerator vans have been put on a weekly service between Calicut and Madras for carrying fish traffic from West Coast to Madras and these are well patronised.

Collection and delivery services which give a door-to-door service to the public have also been extended to a number of stations.

ENORMOUS SPURT IN TRAFFIC

The various works carried out during the Five Year

Plan have enabled the Railway to carry over increasing traffic from year to year. Given below are particulars of goods traffic carried during 1955-56, the last year of the First Five Year Plan and 1959-60, the fourth year of the Second Five Year Plan :—

	Tons		Ten miles	
	—Index		—Index	
	Millions		Millions	
1955—56	15.84	100	3942	100
1959—60	20.91	132	5081	130

The Railways carried in 1959-60, 32 per cent more of goods traffic than that carried at the end of the First Five Year Plan.

THIRD PLAN

During the Third Five Year Plan, the Railways will have to carry even more traffic and this would also mean taking over even large number of wagons at the interchange points at Waltair, Vijayawada and Raichur.

The target proposed for the Third Plan period is 600 wagons per day intake at Waltair and 500 wagons per day at Vijayawada. For this purpose, the remaining patches between Tenali and Gudur are being doubled as well as the patches between Arkonam and Jalarpet.

On the West Coast line too, certain difficult portions are being doubled in order to eliminate bottlenecks. The conversion of the Bhimavaram-Cudivada section into broad gauge, laying of the broad gauge line from Tadepalli to Guntur together with a chord line between Tsundur and Vejjenda and increasing the capacity of the Krishna and Godavari Bridges are some of the more important items which will be completed in the Third Five Year Plan.

SUBURBAN TRAFFIC

The suburban traffic in the Madras area is ever on the increase. The number of passengers carried on the electrified suburban section increased from 29.2 millions in 1955-56 to 44.6 millions in 1959-60. The plan provided for increasing the facilities to deal with the suburban traffic also. Six 4-coach electric multiple units have been added to the fleet of suburban coaches during the Second Plan period. Proposals have been made to procure 19 additional four coach EM Units to meet the suburban traffic on electrified section during the Third Plan.

It is also proposed to extend electrification from Tambaram to Villupuram on 25 K. V. AC Single phase 50 cycles system of traction. This work is expected to be completed during the Third Plan period.

AMENITIES TO PASSENGERS

During the Second Plan, daily Janata train services were introduced between Delhi and Madras and the frequency of the Janata Express between Madras and Bombay has been increased to three times a week. Tri-weekly air-conditioned express trains were also introduced between Madras and Delhi.

Sleeping accommodation now offered without any extra surcharge is provided on two pairs of trains and this facility will further be extended. It is proposed to reduce substantially the overall running time of the Grand Trunk Express between Madras and Delhi and other trains like the Calcutta Mail, Bombay Express, the Cochin Express, Malabar Express etc.

STAFF AMENITIES

The Southern Railway has on its pay rolls nearly 1.63 lakh employees. Several works have been carried out for providing amenities to the staff. 4,386 quarters are expected to be completed during the Second Plan period. Major hospitals have been constructed or are in good progress at Divisional headquarters at Hubli, Mysore, Olavakkot, and Guntakal. Besides, the hospital at Perambur has also been provided with additional 118 beds. Several dispensaries and Health Units have been opened at various stations. Chest Clinics, Maternity and Child Welfare Centres and Dental Clinics were opened at all Divisional Headquarters. Provision has also been made for reserving 207 beds for Railway employees and their families at various Tuberculosis Sanatoria in addition to 67 beds in Railway Hospitals.

Three Holiday Homes have been established at Courtalam, Mysore and Yercaud and a convalescent home at Coonoor. Handicraft centres have been opened at 17 stations. During the year 1959-60, 359 scholarships for technical education of children of the staff inclusive of renewals amounting to over Rs. 1.2 lakhs were awarded.

Railway transport has a vital role to play in the economic development of the Southern States and the necessary planning is being done so that the Southern Railway may play its part worthily.

DRAGONAIR OIL FIRED AIR HEATING

FIVE models, with outputs ranging from 100,000 B.T.U. / Hr. to 1,000,000 B.T.U. / Hr., make up the recently introduced series of Dragonair Heaters.

Claimed to be the most efficient and economical method of heating by providing heat where and when it is required at an efficiency of 85%, the Dragonair method of heating is by Direct-to-Air heat exchange with the warm air supply distributed through a system of ducting. Air flow rates range from 600 c.f.m. with the smallest model to 8,000 c.f.m. with the largest model. Each Dragonair heating system is scientifically designed and tailor-made to heat individual premises for minimum fuel cost and yet it can be done at a very moderate capital cost.

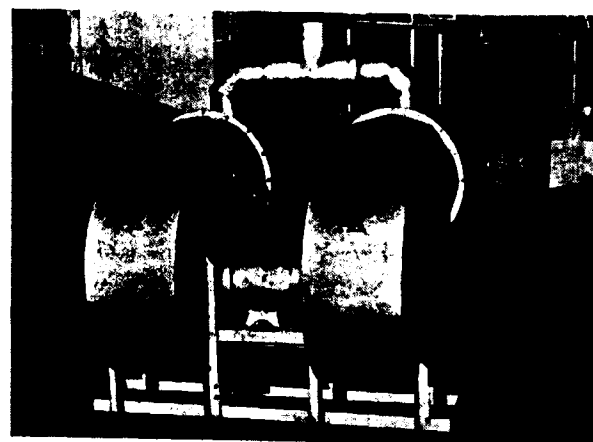
A pressure atomising burner, of the Company's own design, with flame failure and overheat safety devices, together with welded stainless steel heat exchanger, is contained in a steel casing to form the heater unit.



DVLA. 500 (Heat output 500,000 BTUs/hr.)

The multi-vane impeller is mounted direct onto the motor shaft from which a two-stage gear pump is belt-driven. Fuel is fed to the burner, strained and filtered; its pressure is measured and the supply is controlled by an electro-magnetic valve. The control box is mounted on a panel which may, if necessary, be remote from the heater. This box has a 'heat-off-ventilate' switch that provides the means of summer ventilation without heat by isolating the burner.

The air supply can be variable from 100% recirculation of the air inside the premises concerned to 100% fresh air supply to give either maximum economy or maximum ventilation to remove odours etc. Thermostatic control ensures that fuel is only consumed when



DVLA. 1000 (Heat output 1,000,000 BTUs/hr.)

heat is actually required. Time-switching can be provided for initial start-up and shut-down of the plant each day, and Night Anti-Frost control is available if required.

The outputs of these heaters have been so designed that almost any combination can be supplied by harnessing two or more models to operate as one.

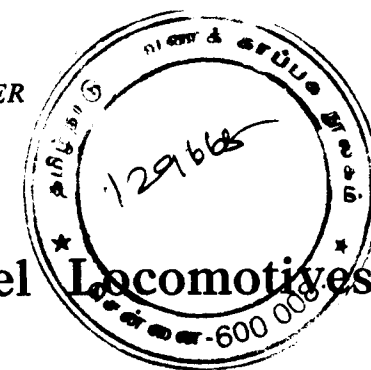
The Company also manufactures Mobile Dragonair heaters, the DVLB. 100 being a standard unit of 100,000 B.T.U./Hr. This is basically a DVLA. 100 heater mounted on a 2-wheeled frame incorporating its own fuel tank. The other mobile unit is a self-contained 250,000 B.T.U./Hr. heater powered by a Diesel engine. It is primarily designed for aerodrome use and is built to order.

Other products include the Dragonfly airborne heater for aircraft and helicopter heating and the DVLA. 80 Railcar Heater as supplied to British Railways. Equipment has also been designed and supplied for specific uses such as tea withering in Assam.

Air Filtration as Applied to Diesel Locomotives

By D. Bennel

Chief Engineer, Air and Liquid Filtration
Division of Locker Industries Ltd.



THE filtration of air as required by the modern diesel electric locomotive can be classified into two groups, viz. Air required by the traction motors and auxiliaries and air required by the diesel engine.

The choice of filtration equipment varies with individual designers and conditions under which the locomotive may have to work, but, basically, the following are the types of filters which can be reasonably applied.

- (1) Dry Type Panel filters.
- (2) Viscous Type Panel filters.
- (3) Oil Bath Air filters.
- (4) Panel Bath Air filters.
- (5) Cyclone Type filters.
- (6) Combination of 5 with oil bath filter.

Locker Industries Ltd. manufacture "AIR-MAZE" filters of all types, but for reasons of economics and maintenance, advise types Nos. 2, 3 and 4 for locomotives.

Type No. 2, Fig. 1, is commercially known as the PSR and is of the herringbone or chevron construction.

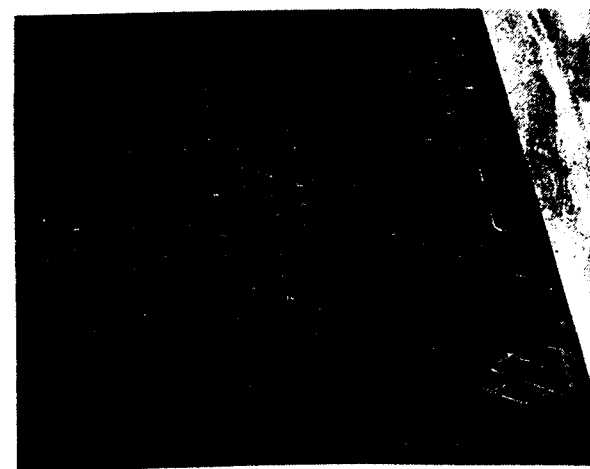


Fig. 1 Herringbone or Chevron Construction air filter panel.

Technically a high velocity range between 500—600 f.p.m. for optimum efficiency. It can be manufactured in both 2" and 4" thickness. It is so designed that in the event of poor or indifferent servicing it will unload its collected dirt through the filter. This is based on the assumption that dirty air to the auxiliaries is better than no air. Scheduled maintenance, however, makes this type of filter the ideal unit for the traction motors, etc., as apart from its unloading characteristics it has many desirable features.

Fig. 2 shows a cross crimp, progressive density filter panel. This panel has a somewhat higher initial pressure drop but has the advantage of holding its high efficiency over a wide range of air flows. It will not unload and therefore requires a frequent and fixed cleaning schedule.

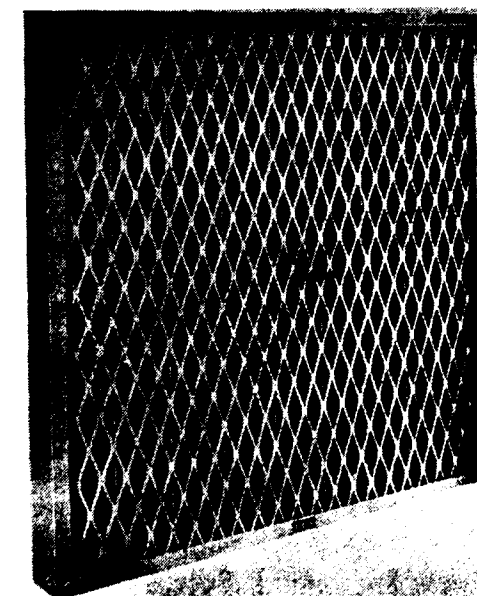


Fig. 2 Cross Crimp progressive density panel.

Fig. 3 shows a conventional oil bath air filter. This type of filter has been used, with considerable success, for many years on stationary engines

JL
D51-m 2, NS3RW
N 61.8.4

and air compressors. Recently, an adaptation of this filter has been designed solely for incorporating in the diesel locomotive, see Fig. 4. Whilst both the conventional and modified filter work in the same manner, it will be seen that there is a physical difference in so much as the locomotive oil bath has no hood and an exceptionally short body length. The reason for this is that, due to the streamlining of the



Fig. 3. Conventional oil bath without hood.

modern locomotive, very little space is available inside the body shell for mounting the filter units which, depending on the horse power of the main line express, may require as much as 6,000 to 8,000 C.F.M. air. This oil bath has also a new design of filter element which enables us to still further reduce the overall size of the oil bath without impairing dirt holding capacity. The oil bath filter is without doubt the most efficient permanent type filter that can be applied to the air intake of the diesel engine. One reason for this high efficiency is that the highly efficient screen of woven wire filter media is continuously receiving an adequate supply of oil to wet the dirt, and the dirt intercepted by the filter media is constantly removed by the oil washing action and retained in the oil sump. A further advantage being that the changing air velocities do not effect the efficiency to any marked degree, the oil washing action being effective from 10% capacity to full capacity. Furthermore, the oil bath is inherently a silencing unit and thus saves, in many cases, the additional cost of a separate air intake silencer.

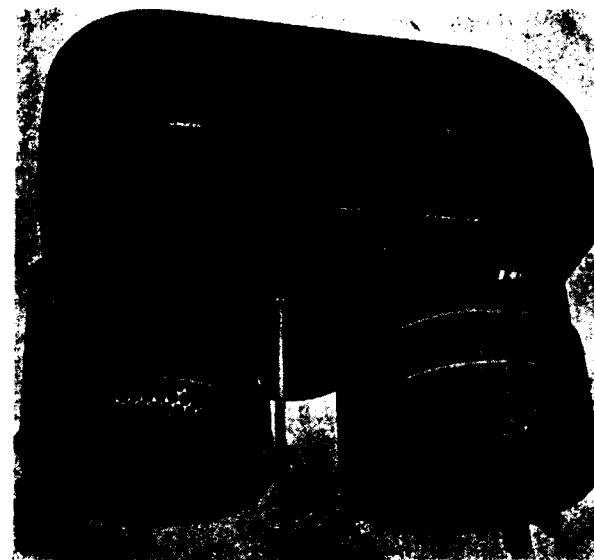


Fig. 4. Showing twin assembly locomotive oil bath 2000 C.F.M.

Fig. 5 is known as the "Panel bath" air filter. This unit is a hybrid or cross between a panel filter and an oil bath filter. This type of filter was designed to meet the ever-increasing demand for smaller units with higher air flows. Whilst it is not as efficient as the oil bath filter it has a higher efficiency than the static panel type, and is capable of handling a remarkable range of air flows which neither the static panel nor the oil bath can achieve. Technical details of the "Panel bath" which is manufactured in one size only, are as follows:

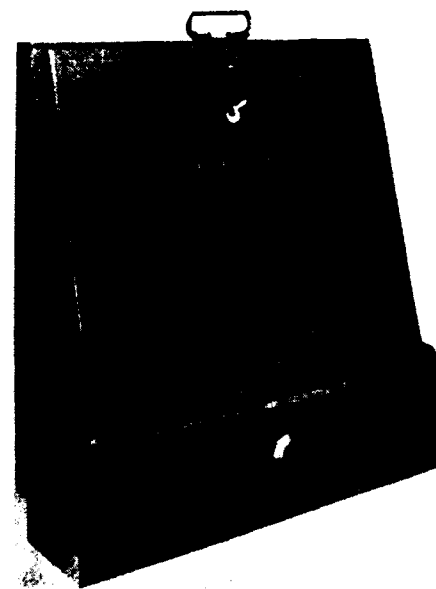


Fig. 5. Panel bath filter.

Operating Range	400 to 1750 C.F.M.
Pressure drop	4.6" w.g.
Efficiency	90%.
Lump oil capacity	1.25 imp. galls.

The operation of the panel bath is quite simple and there is only one moving part, the baffle. As to operation, air is drawn through the front grill where the air stream divides into two parts, one part going directly to the filter panel surface, which has previously been oil wetted, and the second part to the oil control trough where the oil is picked up and carried to the panel filter media. The baffle automatically controls the air flow to the oil control trough; at engine idling speeds the baffle is closed, thus directing all the air to

the oil trough. At higher air flows the baffle opens and directs a greater part of the air to the filter Panel, thus providing effective oil wetting at all engine speeds.

From the foregoing it will be obvious that the choice of air filters will be determined by engine location. It is therefore an economic study on a particular railway to determine on a long range basis, taking into account initial cost, maintenance, expense of each type, protection to the engine and typical air-borne dirt conditions which is the better filter for a particular locomotive in its operating district.

No one filter will give the complete answer to all working conditions.

'HUNSLET' again supplies Sudan with locomotives

Against strong foreign competition the Hunslet Engine Co. Ltd., has received a further order from The Sudan Gezira Board, (Consulting Engineers, Messrs. Livesey & Henderson, 1-2, Finsbury Square, London, E.C.2) for eighteen 135 h. p. 0-8-0 type diesel-mechanical locomotives required for the Managil extension.

This is the sixth repeat order received from The Sudan Gezira Board, for 'Hunslet' locomotives specially designed for their cotton plantation narrow gauge railway system.

The 'Hunslet' 17½ ton 8-wheel locomotives are powered by Gardner diesel engines. Transmission is through a 'Hunslet' multiplate friction clutch and a

flexible coupling to a 'Hunslet' constant mesh gearbox giving four speeds of 5, 8½, 14½ and 20 m.p.h. in either direction of travel. Maximum tractive effort at site is 8620 lbs.

The first diesel locomotives were supplied over thirty years ago and still continue to give good service.

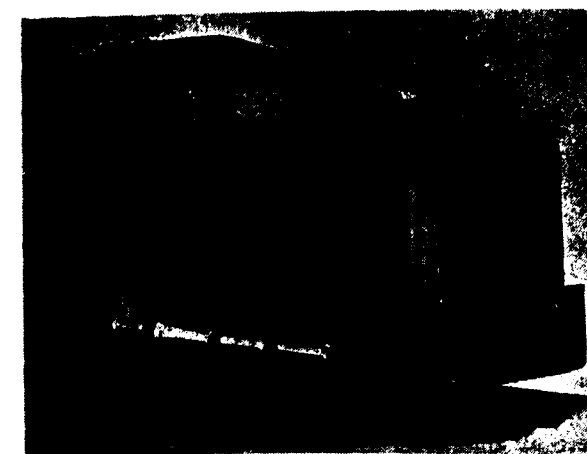
During the last ten years, a complete locomotive fleet has been developed comprising fast main line 0-8-0 locomotives and smaller 0-6-0 units for local lines and shunting operations.

The photograph shows the class of 0-8-0 locomotive to be supplied against the current order.

* * * * *

HOUSEHOLD SEWING MACHINES

The Indian Standards Institution has published IS: 1610-1960 General Requirements for Sewing Machines (Household Model) which covers requirements for two types of household model sewing machines of cam-take-up and link-take-up classes, with round bobbin, oscillating sewing mechanism, and designed for operation by hand, foot or motor. The two types are designated as type A with speed of 1000 stitches per minute and type B with speed of 800 stitches per minute. This standard has been prepared at the instance of the Development Commissioner for Small Scale Industries, Government of India, and also on the recommendation of the Tariff Commission.



'HUNSLET' 0-8-0 Type Diesel Locomotive 18 of which are now on order for the Sudan Gezira Board

(Continued from page 4)

goods wagons, has been expanded. Additions have been made to the fleet of locomotives and wagons.

With ever-increasing demands on the Railway's resources, it was essential to make the most of existing assets. At a time when the increase in traffic was outstripping the expansion in capacity, additional calls for transport could only be met by conserving available resources.

The percentage of average locomotives (i. e. older than the scheduled life of 40 years) which five years ago was 40, is still as high as 35 today.

FAST TRAINS

All possible expedients were adopted to step up the tempo of traffic so as to utilise to the best advantage existing line capacity, rolling stock and manpower. One of the most interesting and heartening innovations has been the introduction of fast goods trains running to fixed schedules like passenger trains.

There are now more than 100 crack goods trains on this Railway. They have contributed to the greater fluidity of operation and also to an improvement in goods train operation on certain congested sections. The speeds of through goods trains have risen on Northern Railway from an average of 10 miles per hour to 12 miles per hour.

The average load of a goods train has increased by 5 wagons, and each broad gauge wagon on this Railway is doing 65 per cent more work than it was doing seven years ago. A similar analysis of locomotive utilisation gives a 26 per cent improvement on the broad gauge and 45 per cent on the metre gauge. These statistics are an index of increased efficiency which enabled this Railway during these years of economic growth to meet the increasing calls made on it.

The provision of an adequate, speedy and diversified transport in an expanding economy is a difficult though exciting venture. Though a high priority in such an economy has necessarily to be given to goods operation, the needs of passenger traffic have also been kept in view.

As many as 110 new passenger services, including diesel rail cars, have been introduced on the Northern

Railway during the Second Plan period, and another 50 existing trains have been extended to cover new areas. And this had to be done in the context of the continued high proportion of overage coaches and locomotives.

FACILITIES FOR RAIL USERS

For the convenience of passengers and the trade, city booking agencies and out agencies have been opened at several places; their number has risen to 62 on this Railway which represents a 30 per cent increase during the last five years. Street collection and delivery services are also being opened in the major cities served by this Railway to bring the service to the door of the user.

There is thus a steady stress on providing more amenities. More railway stations are being built, and, at stations, more waiting halls, retiring rooms, drinking fountains, booking and parcels windows, overbridges, etc. Some 5176 fans were fitted in Third Class compartments on this Railway during the last five years of the Plan.

Three-tier coaches have been introduced on a number of trains, making it possible for a third class passenger to have sleeping accommodation reserved for himself.

NEW SAFETY MEASURES

New safety measures are being tested on a few selected trains: these include the provision of alarm bell-pushes in the ladies' compartments, which, when pressed, give a red light indication in the Guard's compartment, and also ring an alarm bell there; at the same time an electric siren sounds in the adjacent general compartment, and amber-coloured lights are displayed on the affected ladies' compartment.

PUNCTUALITY PERFORMANCE

In passenger operation Northern Railway's twin objective is reduction in journey time and improvement in the level of punctuality. In recent months, a number of trains have been speeded up. Punctuality has been generally maintained at a level ranging between 80 and 90 per cent both on the broad and metre gauges.

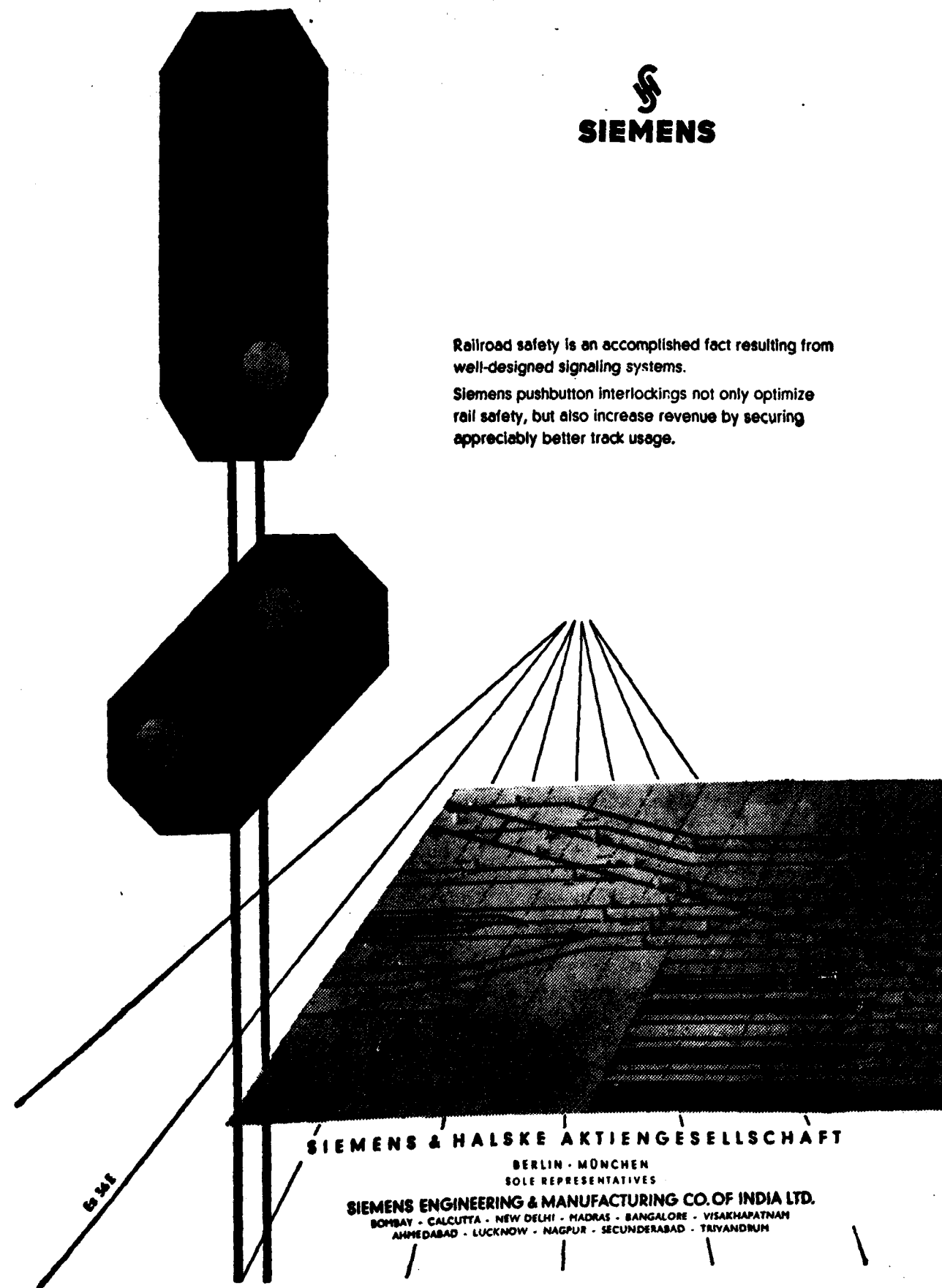
It may have been possible to achieve better results



SIEMENS

Railroad safety is an accomplished fact resulting from well-designed signaling systems.

Siemens pushbutton interlockings not only optimize rail safety, but also increase revenue by securing appreciably better track usage.



in this respect if a large number of works on various points on the Railway for expanding carrying capacity were not in progress; these works have necessarily had to be done while the tempo of the traffic was maintained or even growing.

The re-girding of a bridge, the remodelling of a yard or the replacement of signalling gear have had to proceed without a visible effect on the flow of traffic. All this has called for a considerable amount of ingenuity and vigilance on the part of those entrusted with planning and executing movements from day to day.

With the current dynamism in the country's economy, transport and particularly railway transport has to continually expand and adjust itself to the changing pattern of the national economy. Trends of traffic both on this Railway and from and to other Railways continually undergo changes in response to the growth and changes in the economic structure.

FUTURE COMMITMENTS

Large scale development projects are planned and are in progress in the regions served by this Railway. There will be new cement works, aluminium and synthetic rubber plants, antibiotic units, soda ash and sodium sulphate factories, fertiliser factories and woollen spinning and weaving mills.

A number of small industrial units will be set up; the existing plants will be enlarged. The Rajasthan Canal Project will call for a heavy movement of construction material and, when completed, will yield something like a million tons of foodgrains, the major portion of which may be expected to move by rail.

As the tempo of industrialisation increases, the movement of coal and other traffic on the main east-to-west trunk route of this Railway from Mughal Sarai to stations in Northern and Western India, is expected to almost double itself from the present level of about 2,300 to 4,500 wagons per day.

TRAFFIC PATTERN DURING THIRD PLAN

The new pattern of traffic anticipated in the Third

Five Year Plan will gradually unfold itself. Meanwhile the Northern Railway is gearing itself to meet it; the gaps in available sectional capacity, rolling stock, locomotives, workshop capacity and signalling equipment have been underscored; the major works of the first year of the Third Five Year Plan are already under way.

New types of wagons are under manufacture to enable the Railway to carry much heavier loads, in bulk, by each goods train, thus releasing line capacity for other trains. A new bridge is being built over the river Yamuna near Delhi; schemes are under way to cope with the traffic that pours increasingly into the capital of the Indian Union every day.

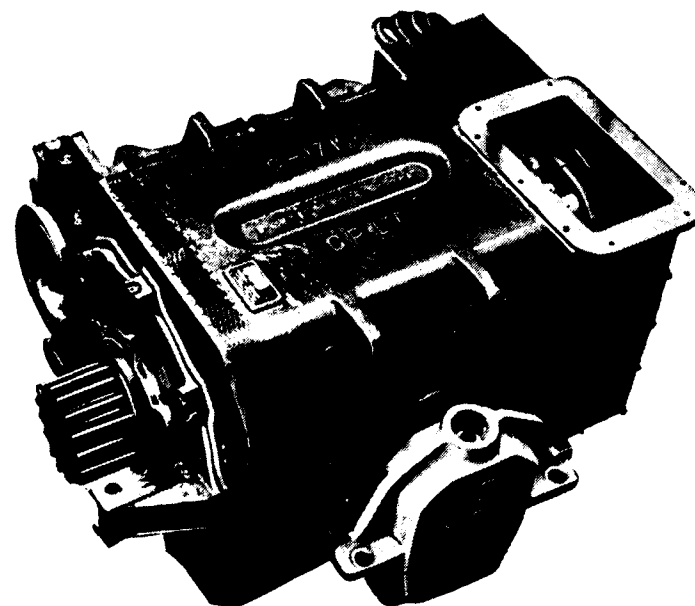
GARHWA—ROBERTSGANJ LINE

A new 101-mile railway line to link Garhwa Road and Robertsganj is being laid at an approximate cost of Rs. 17 crores. When ready, by about January, 1963, this will provide an alternative east-to-west route, releasing additional capacity via Mughal Sarai and opening up new mineral-rich areas for development.

It is expected that double lines will carry the main streams of traffic right from Mughal Sarai to Ghaziabad and Delhi, and on the major portion of the run from Lucknow to Amritsar. Diesel and electric traction and the use of automatic signalling will speed up traffic further on a number of sections.

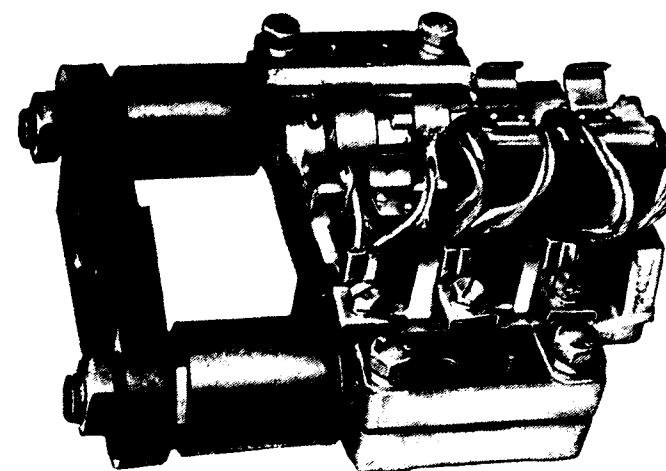
In a progressive and planned economy such as ours with its continually rising targets of production, a gap between the demand for and availability of transport is likely to remain, particularly during a transitional phase of development. The responsibility for bridging this gap lies with hundreds of thousands of railwaymen at all levels; their vigilance, ingenuity and enthusiasm is a *sine qua non* of efficient operation.

There is no doubt that the Northern Railway will continue to achieve its dual objective of utilising existing resources to the maximum and of expanding its capacity to meet the growing demands of regions served by it.



Engineers use the word performance in two senses, a limited one which refers to parameters that can be specified and checked; and a wider, vaguer, but essentially more realistic sense which covers freedom from trouble, ease of servicing, adaptability and many other things. Performance in the first sense is reproducible by any competent manufacturer; it depends on designing to well established principles. Performance in the second sense is the basis of choice between manufacturers. It comes from countless small differences in design that are based on know-how or experience.

This thing called know-how



Look at this brush-box from a traction motor; an ordinary enough piece of equipment but nevertheless embodying a great deal of experience. Note for example the very heavy insulators made from an unshatterable, non-tracking synthetic material vastly superior to porcelain. Note how the spring can be disengaged so that the brushes are easily slipped out for inspection and that the pressure on each brush can be adjusted separately. Where, owing to the design of the locomotive, there is no access to the top of the motor, the brushgear is mounted on a ring, normally clamped and dowelled in position but, when released, capable of being racked round by a gear engaging teeth in its periphery to bring each set of brushes in turn to the position from which they can be most easily reached. It is on details of this kind that performance in service depends.

Crompton Parkinson

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G-E universal locomotives are the result of skilled manufacturing and superior product design

① DIESEL ENGINE of modern 4-stroke turbosupercharged design is built for long life and fuel economy. Exclusive cylinder design provides better cooling, longer engine life, and easier "upper end" maintenance with maximum interchangeability. Articulated connecting rod doubles effective rod bearing area.

② GENERATOR is mounted directly on the engine. This permits single-bearing construction which eliminates mis-alignment. Flashover tendency is designed out. Simple flexible electric cables are the only transmission connection to the trucks. Ample capacity is available for steep grades, heavy trains and high speeds.

③ CONTROLS are the essence of simplicity. Responsiveness and reliability have been assured by keeping the number of moving parts to a minimum and by using factory-set adjustments.

④ HIGH-SPEED TRUCKS complete with powerful traction motors mounted on each axle have a worldwide reputation for reliability, long life, and high efficiency.

Single spur gear of motors drives each axle directly.

MECHANICAL DESIGN is simple, rugged, efficient. Dynamic braking **⑤** can be easily added to facilitate train handling, reduce brake shoe wear. A single, direct-driven variable speed fan **⑥** gives increased air cooling efficiency. Interchangeability and standardization throughout the universal line reduce parts inventory.

IN ADDITION to these product features, the engineering skill of General Electric is utilized for motive power recommendations based on surveys by experienced technicians; research and development to constantly improve components and concepts, testing complete locomotives on a private multi-gage test track.

Throughout the world General Electric locomotives have established enviable records of performance by producing high gross ton mileages at low cost. To learn how these universal diesel-electric locomotives can benefit your railway, contact your International General Electric representative.

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