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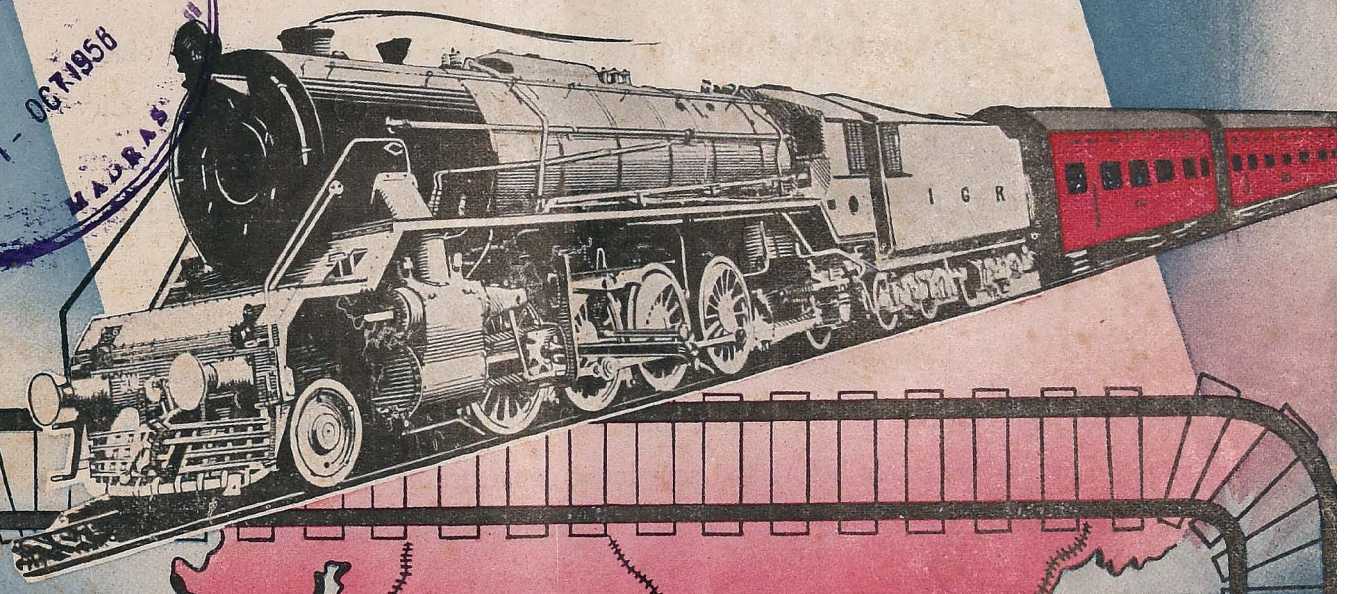
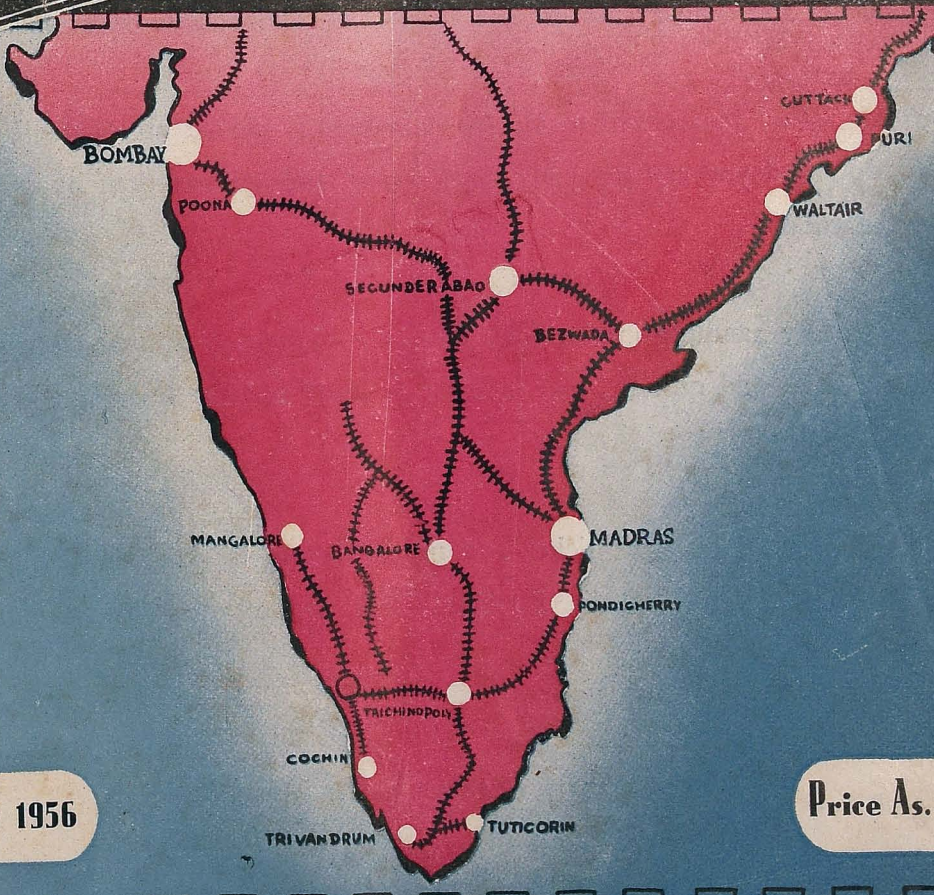
Magazine





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(Inserted in the interests of Travelling Public)

Front and Trailing Trucks—their Influence on the behaviour of a Locomotive

By M. S. Surma

IN response to the demand of increasing traffic, the power and consequently the size of locomotives is being increased considerably, and the limitations imposed by the moving dimensions, force this increase in the longitudinal direction only. If the locomotives were to move only on the straight tracks, the increase in their length would be beneficial as,

(i) A longer wheel base results in a reduction of angularity in track.

(ii) Full weight of loco can be utilised as adhesive weight and thus slipping of wheels while pulling heavier loads can be avoided.

(iii) The problem of axle load limitations is solved.

But their running on curves and turn-outs brings in the problem of wheel rail infringement which can only be solved, either by the provision of enormous lateral clearances at the intermediate wheels or by dividing the whole locomotive in a number of trucks.

When both of these alternatives are studied, it would be found that it is advisable to divide a locomotive in a number of trucks than to provide sufficient lateral clearances at the inter wheels. In this way not only the required flexibility on curves and turn-outs is provided, a control mechanism can also be located suitably for efficient guidance. Apart from the consideration of running in curves and turn-outs, the use of low grade coals is another factor which necessitates a trailing truck and more preferably a single axle truck.

While dividing a locomotive into different trucks, the following vital points are to be kept in veiw :—

(i) All the axles grouped together under a common chassis should be parallel to each other.

(ii) All the wheels forming a truck should preferably have equal diameters.

(iii) The trucks should be able to swivel and if one of them is unable to swivel, the other should not only be able to swivel but should be capable of lateral movement as well.

In a locomotive the main truck consists of the one formed by the coupled wheels, and the others trucks, if any, are called the auxiliary trucks. The main truck is unable to swivel but is provided with little transverse play, but the auxiliary trucks have provision for lateral movement and swivelling. On Indian Railways they are found in the following combinations :—

(a) Pony at front end.

(b) Pony at front and at rear.

(c) Bogie at front only.

(d) Bogie at front and at rear.

(e) Pony at front and bogie at rear.

(f) Bogie at front and pony at rear.

From the above combinations it will be seen that though the system of providing auxiliary trucks is found in so many combinations, the kinds of trucks are only two namely four wheeled bogies (The bogies, in use in India have four wheels only, though six wheeled bogies are in use abroad) and two wheeled ponies.

The three important points, by which the influence of a bogie or a pony truck on the behaviour of a locomotive can be determined are :—

(i) The location of contact between flange and rail. This contact have three locations. (a) Ahead of the vertical through axle centre. (b) At a point on the vertical through axle centre. (c) And behind the vertical through axle centre. It can be proved by the resolution of forces acting at the point of flange rail contact, that the magnitude of the lateral force which an axle can withstand before it derails is pretty high in the case of trailing contact (when the wheel is said to have an inward running tendency) than in the case of a leading contact (when wheel is said to have outward running tendency).

(ii) The guiding force which a truck can supply through its control mechanism, the optimum value of which should be sufficient to guide a locomotive around a curve or a turn-out with the least possible flange impacts. For the considerations of safety the value of the optimum guiding force has to be kept under a specified value.

(iii) The amount of lateral swing provided for the truck for smooth running around curves and turn-outs. The maximum desirable value of this swing can be determined by plotting the locomotive on the sharpest curve or turn-out it has to negotiate. The swing should be sufficient to avoid any flange rail infringement. Mathematically the swing for a single axle truck, as given in "Steam Locomotive" by R. P. Johnson can be determined by the following formula.

$$S_p = \frac{d.y^2 + y.c.R}{y^2 \ddagger R^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For a double axle truck,

$$S_b = \sqrt{R^2 + B^2 + A\,B} - R \quad \ldots\ldots\ldots (2)$$

Where,

S_p is swing of pony.

S_b is swing of bogie.

A is length of rigid wheel base.

B is distance between the leading coupled wheel and truck pivot pin.

C is distance between the rigid wheel base centre to pony pin.

d is Radius of curve minus lateral clearance at inter wheel.

R is radius of curve.

Y is length or radius bar.

In the light of the above considerations, an attempt has been made in this note, to discuss in a brief and a simple way, the behaviour of different combinations of the auxiliary trucks i. e. bogies and ponies.

PONY TRUCKS

A pony is a single axle truck used in front as well as rear of certain locomotives. While traversing curves it always adopts constrained curving, because of one of its flange being guided by outer rail and of its attachment to the engine through radius bar, which allows it to run radial to the curve, giving it a natural inward running

tendency. The optimum length of the radius bar can be calculated by the well known Baldry formula,

$$Y = \tfrac{1}{2}(T - F^2/T) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

or from the formula given in "Steam Locomotive" by Mr. Ralph. P. Johnson,

$$Y = \frac{(A + B)B}{A + 2B} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

F is $\frac{1}{2}$ the rigid wheel base.

T is distance between the centres of rigid wheel base and pony truck

PONY AS A GUIDING TRUCK

For a given speed, there is a minimum guiding force which must be supplied by the control mechanism located on a pony, to guide a locomotive around a curve. At the same time the value of this guiding force, for consideration of safety, should not exceed certain percentage of the axle load of pony truck. As stated before that the remarkable characteristic of a pony truck is its tendency to run inwardly, thus the flange rail contact being behind the vertical through axle centre and the centre of friction ahead of the axle. If this behaviour of the pony trucks can be guaranteed, they will really be very efficient guiding agents for locomotives but unfortunately a higher value of control force —sufficient to guide a modern high speed locomotive round a curve—forces it to adopt an 'outward' running thereby placing a definite limit on control force which can be tolerated in the case of a pony truck.

It may be mentioned that hardly, in India we come across a pony truck having more than 12 tons axle load, and if control force is limited to 40% of its axle load — a fair figure for the safety consideration—then it may be concluded that the figure will be ridiculously small to guide a heavy and high speed locomotive. It proves that a pony truck in the case of a high speed locomotive cannot be considered as an efficient guiding agent.

PONY AS A TRAILING TRUCK

A locomotive while running in a curve requires a minimum possible control force at its rear end as it opposes the locomotive to adopt itself in curve. Though this anticurving force at the rear of a locomotive is undesirable yet a minimum value of it, just capable of making the rear truck self-centring while running out of curves, has to be provided. The value of this force is pretty small as compared with the guiding force at front. Therefore a pony truck which 'misbehaves' under the influence of a heavy control is most suited as rear truck. As it runs radial to the curve it negotiates it does not produce rearing action on the rear of locomotive.

BOGIE AS GUIDING TRUCK

A bogie with two axles is more suitable as a guiding truck as it can supply double the amount of control force than a pony truck. While running on the curves it may run either with its leading outer wheel or with both leading and trailing wheels against outer rail. The latter is advantageous as the reaction of the control is shared by both the flanges and thus the leading wheel of the bogie is relieved of some of the flange force. If the contact with the rail is made by the outer leading wheel only it is sure to have an outward running tendency so that the wheel cannot take up sufficiently heavy lateral loads and its tendency always will be to mount the rail. If both the leading and the trailing flanges make contact with the outer rail the bogie becomes inward running and the wheel in this case will be able to withstand heavier lateral loads without any danger of derailment. The inward running tendency for the bogies can be gained by providing the swivelling arrangements about the pivot and the control mechanism within the wheel base of the bogie.

BOGIE AS TRAILING TRUCK

When the bogie is trailing it helps the engine to turn itself and adjust in the track while running on the curves, but is unable of turning itself. This induces a rearing action. It is bound to run 'outward' and its leading wheel will always be binding on the outer rail making contact with the rail ahead of the vertical drawn through the axle centre. It also produces some anticurving effect on the engine as it is well known that any

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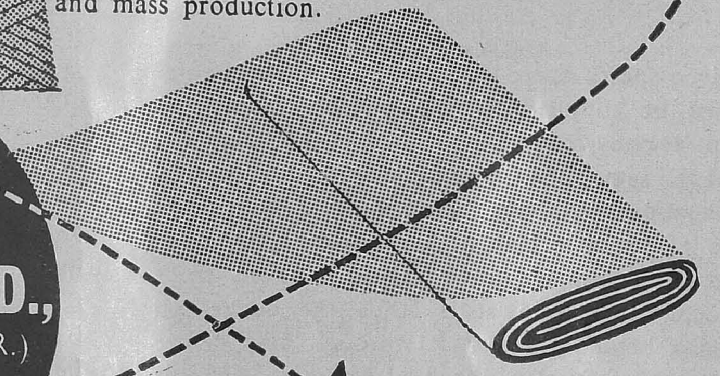

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appreciable control force in the rear will resist the efforts of a locomotive to screw round the curves.

BOGIE AT THE FRONT AND AT REAR

In this case if the locomotive is to run only in one direction, the action of the leading bogie is to guide the loco round the curve smoothly, if provided with adequate control, but as stated above the presence of the trailing bogie will produce rearing action. If the locomotive is to run in both the directions, the problem becomes of a different nature.

As is well known that leading bogie with adequate control helps in guiding the locomotive on curves and a trailing bogie gives an anti-curving force, therefore the amount of control at the rear should be as little as possible, say, only to overcome the friction between the slides of the trailing truck, so that the engine is forced back to its central position after curving out. Even if this control is slightly less than the friction between the slides, it will bring the engine back to the central position, as the frictional resistance between the slides is always changing on account of the vertical oscillations at the cab end.

If the locomotive is to run in the backward direction, this bogie which has a very little amount of control will be leading, and it will be impossible for it to guide the locomotive round the curve without the danger of derailment and excessive lateral forces on coupled wheels. In this case the maximum guiding will be done by the leading coupled wheels. But at this wheel has a smaller lever arm about the centre of friction, it will be subjected to comparatively greater lateral forces. At the same time the trailing bogie with a heavier control will hardly allow the locomotive to screw itself round the curves. The danger of derailment, therefore, in this case is far greater.

If the locomotives fitted with trailing bogies are to run in one direction only, the control provided should, be as stated before, very little. The locomotive while running on a curve does not run as a chord to the curve but facing outward so that the centre of friction always is somewhere between the trailing coupled of wheel and the trailing truck, and the value of the control will not go so high as to be very detrimental.

To provide adequate guiding for the high speed locomotives, the best combinations, therefore, seem to be a bogie at the front and a pony at the rear.

END CONTROL

Controls, if adequate at the front at the rear of a locomotive, will not only keep the whole locomotive in a single rigid wheel base on a straight track, thus making it run 'hunting free', but will make it run smoothly round curves without giving rise to excessive flange forces. If the curve around which a locomotive has to pass is without any irregularity, then with adequate control force, the whole guiding will be performed by the front truck, without the locomotive encroaching upon its lateral clearances on coupled wheels. But as the irregularities in the track cannot be avoided the function of the controls remains to reduce the value of flange impacts to minimum possible.

Controls may be divided into two classes, viz.

(i) Gravity control and
(ii) Spring control

GRAVITY CONTROL

Gravity controls are provided by the introduction of either slanting slides, for example Cartaxi slides, or swing links. In the case of slanting slides, the locomotive after getting shifted from the central position, will try to come back to the original position under the action of gravity. The presence of the slanting slides affects the weight distribution, which is undesirable and therefore they have almost been eliminated as control agents. In the case of swing links if the locomotive drifts from the central position, the vertical component of the link tension and the compression on the spring, force it to come back to the central position. The wear on the pins in the case of a swing link cannot be avoided and consequently the value of the control is affected. On our new locomotives the swing link control has been replaced by more efficient one i. e. spring control in conjunction with slides.

SPRING CONTROL

Two types of springs—laminate or helical—are used in this system. The laminated springs when used afford damping on account of the friction between the plates. This friction has a detrimental effect of reducing the force by which the locomotive has to be forced back to the central position after moving out of a curve, because some work has to be done to overcome the friction between the slides. Sometimes on account of this friction the instantaneous force of the laminated spring becomes less than the frictional resistance between the slides and the truck, even after leaving the curve, goes on running towards one side till such time due to vibrations the frictional resistance between slides reduces to an extent that the spring force is able to move the slide laterally to the central position. Therefore, if the laminated springs are used as control springs, there initial crack off will have to be kept sufficiently high to cope up

with the above mentioned phenomenon. As the total initial crack off has to set at a specified limit, laminated springs can only be used where metal slides with efficient lubrication are used.

A difficulty, in the case where metal slides with lubrication are used, is generally experienced to attain efficient lubrication. Experience has shown that it is impossible to avoid dirt finding its way thus causing the friction to attain a very abnormal value which may sometime cause a derailment.

In view of the above argument, it may be concluded that laminated springs and lubricated metal slides cannot efficiently perform the function of control device and therefore, they are not very suitable.

It may be mentioned that the two XP locomotives, when first came to India, were fitted with the laminated spring controls. The location of the control at the front end was as usual, but for the rear end it was at the front tender bogie instead of at hind truck. The location of the rear control was however, again brought to the hind truck and the laminated springs control were replaced by helical spring controls, and lubricated metal slides were replaced by fabric friction material slides.

HELICAL SPRING CONTROL

The helical springs do not offer any damping effect and unlike laminated springs do not loose any force while attaining there original position. When these springs are used in conjunction with the friction material slides with a low coefficient of friction say 0.15 or even lower just to offer sufficient damping, give really very good results. The friction slides are meant to run dry, therefore there is no trouble of maintaining the lubrication. They are supposed to have a constant coefficient of friction throughout the service, if given a good smooth surface before fitting in position. Care should be taken that these slides are not lubricated and that the engines fitted with these slides are not allowed to stay idle for a considerable period otherwise there is a danger of these slides getting jammed.

Research on the Indian Railways is in progress to find out a suitable material to match with these slides which will give the lowest and a constant coefficient of friction. Trials by the Research directorate have also been conducted, to determine the behaviour of guiding tracks, when these slides have a reduced bearing area. Some interesting results will come out when the reports of these trials which are under preparation are published.

ANTI-SWIVEL CONTROL AT THE BOGIE TABLE

Moderate friction at the bogie table is desirable to oppose any independent nosing of bogie trucks under a locomotive. At the same time friction should not attain a value so as to augment flange loads at the leading bogie wheel. Mr. da Costa in his paper " Riding of Pacific Locos " has worked out an example which gives the limit for the moment of this frictional couple for a bogie with a particular wheel base and vertical loads on its axles.

EFFECT OF THE AMOUNT OF CONTROL

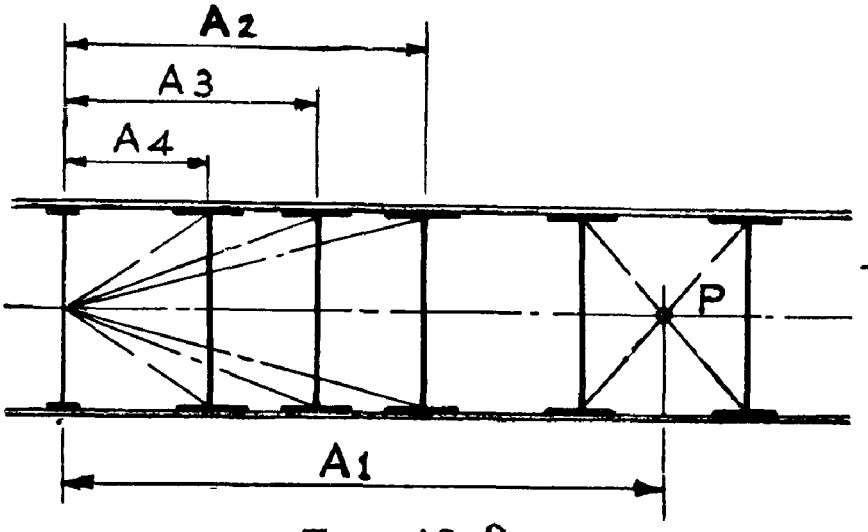
If the control on the front end of an engine is increased it relieves the leading coupled wheel of the flange force but brings an increase on the truck wheel flange force. This has an advantage, because if the wear on leading coupled wheels on account of excessive flange force is greater, and if the leading coupled wheels are to be turned down to the correct profile, all the coupled wheels, irrespective of the amount of wear on them, will have to be turned so as to have equal diameters. A comparatively greater amount of work, time and money will be involved. But if by the provision of a heavier control, the wear on the leading truck wheels, is greater, necessitating the turning of these wheels, it will be comparatively an easier process.

A very heavy control at the front end makes the leading truck to bear the brunt of the guiding force. On its being at the extreme end, if on account of excessive lateral force it derails, the total guiding will then have to be performed by the leading coupled wheel—only a relatively small share being taken by the other wheels—which are nearer to the centre of gravity of the locomotive. Leading coupled having relatively smaller leverage than that of the front truck may not be able to guide the locomotive effectively and under the influence of heavy lateral forces may follow the leading truck with disastrous consequences. If perchance the wheel, in the case of weaker front control, derails, the leading truck because of its greater leverage can still guide the locomotive and there is a possibility of the leading coupled again getting on to the rails as in fact has been once noticed at Weaver Junction in England.

THE AMOUNT OF CONTROL FOR EFFICIENT GUIDING

The amount of controls at the ends of a locomotive is so determined that the locomotive may remain in a single rigid wheel base while running on straights and may pass the curves with the slightest possible

flange loads. At the front end its value is fixed by taking moments about the imaginary centre of friction at the wheel treads of all the coupled wheels and then by balancing the sum of these moments by another moment about the same centre of friction at the front truck. For example consider a locomotive as in fig. No. 2. The centre of friction is assumed to be at the hind truck. Then the moments will be,



P= SPRING CRACK OFF+FRICTION BETWEEN BOGIE SLIDES.

FIG. NO. 2

$$2UW\sqrt{A_2^2+G^2} + 2UW\sqrt{A_3^2+G^2} + 2UW\sqrt{A_4^2+G^2} \quad ..(5)$$

Consider this equal to K

This moment should be balanced by the moment of the coupled A, P ....(6)

From which,

$$P = K/A_1 \quad ....(7)$$

where,

W = Wheel load,

= Coefficient of friction between wheel and rail,

G = ½ the track gauge at the tread contact points and

A_1 A_2 A_3 A_4 as given in Fig. No. 2.

The value of P thus arrived at is equal to initial spring crack off plus frictional resistance between the truck slides. The distribution of the load P between the spring crack off and the slide friction is proportioned in such a way as to keep the initial spring crack off a little higher than the frictional resistance between the slides. The maximum value of P may be limited to 40% of the load under the truck.

After a considerable research, the Indian Railway authorities have set out the optimum values of controls at both ends of locomotives. The initial control at the front end may be 16% of the truck weight on the rails with the control spring deflection of approximately one inch for every 20% of the truck weight on rails. To this will be added the frictional resistance of the slides. The amount of control at the rear end may be set at 20% of the truck weight on rails but with a sufficiently greater deflection of the spring per ton load.

RAILWAY DELEGATION TO CHINA AND JAPAN

A three-member Railway delegation left New Delhi on Saturday 9th June, 1956 for a month's study tour of the Railway Systems of China and Japan. The members of the delegation are Shri J. Dayal, Financial Commissioner for Railways, Shri K.B. Mathur, Member (Transportation) Railway Board and Shri H. D. Awasty, Joint Director (Planning), Railway Board. The delegation is expected to tour important Railway sections in these two countries and, in particular, make a detailed study of the working of important marshalling yards and control offices; regulation of movement of traffic; the working of the centralised traffic control system; the capacity of single line sections by diesel and by electric traction; operation of heavy mineral traffic like coal, iron ore etc., and compilation of statistics. The delegation will stay in each country for about a fortnight.

Atoms May Revolutionize Food Industry

(By A Special Technical Correspondent)

THE future of atomic food preservation looks so promising that a new plant to process 1000 tons of food per month will be built in the United States. In this plant, which will start operations in 1958, scientists expect to perfect this extraordinary development, considered the most beneficial use of atomic energy ever discovered. If successful, the results will be preservation of food without refrigeration, an advance that will revolutionize food storage and distribution throughout the world.

Progress toward a practical, effective method of "cold sterilizing" food through exposure to atomic radiation has been rapid during the last five years. At the beginning, scientific knowledge was limited almost entirely to two facts: spoilage bacteria in food is killed by atomic radiation, and food so treated does not retain any of the atomic radiation. They did not know how much radiation was needed, how long the preserved food could be stored without refrigeration, what changes would occur in taste, odor and nutrient value of the food. Most important of all, no one knew whether the atomic-processed food would be harmful to human beings.

Through painstaking costly research, most of these uncertainties have been eliminated. The effort has been nationwide in scope, with research conducted by more than 60 universities, industries, foundations and government agencies. Because of the excessively high cost of such research, the United States Army, which also is interested in the benefits of atomic food preservation, assumed responsibility for the financing and co-ordination of this program. Today, thousands of scientists across the nation are co-operating in this tremendous research effort.

The results to date are remarkable. Atomic energy has been found extremely useful in many different ways. Radiation can be used to completely sterilize food so that it can be stored for weeks, months and even years without refrigeration. It can be used to pasteurize, or partially sterilize food, which increases storage life, so necessary in marketing perishables. The sterilizing power of atomic radiation also can be used to permanently destroy food parasites; insects in dry foods, such as wheat, peas and beans, or to prevent sprouting of tubers, such as potatoes and onions.

Several different types of atomic equipment using the waste products from atomic reactors, atomic rays produced by high-voltage machines, and radioisotopes have proved highly effective.

Through eating tests, atomic-processed foods have been found as nutritious as untreated foods and completely safe for consumption by animals or humans.

Though five years of research have brought rapid progress, there still are problems to be solved before atomic food preservation becomes commercially practical. One problem is the bad odor and poor flavor of some atomic-processed foods, which makes them unacceptable. Many "cold sterilized" foods, both cooked and uncooked, taste exactly the same as unprocessed food, such as chicken, pork, beef, fish, bread, asparagus, carrots, sweet potatoes and a great variety of fruits. Poorest results are achieved with dairy products—milk, butter and eggs. Processing must be improved to make these foods palatable.

When this processing problem is solved, other obstacles in the path of large-scale atomic food preservation must be overcome. Effective, convenient methods must be devised for packaging, handling, storage and shipment of atomic-preserved foods. Also the cost of atomic sterilization must be reduced before it can compete with other food processes, such as canning, freezing and chemical treatment. Operation of the new processing plant is expected to solve these problems.

Although the successful development of atomic food preservation will cost many millions of dollars, the expenditure is warranted by the benefits that will be shared by everyone in the world. Important will be reduction of diseases caused by parasites, by bacteria-contaminated food and by the lack of fresh vegetables, fruits and other nourishing foods in many areas. The greatest benefits, of course, will be increased quantities of food and reduction in the need for refrigeration to preserve supplies during shipment and storage.

The vital need for atomic food preservation is pointed up by the results of United Nations surveys, which show that many areas of the world cannot meet the minimum nutritional requirements of their people and that the world population is increasing by 100,000 persons per day.

Locopulsor Shunting Machine

By A Special Correspondent

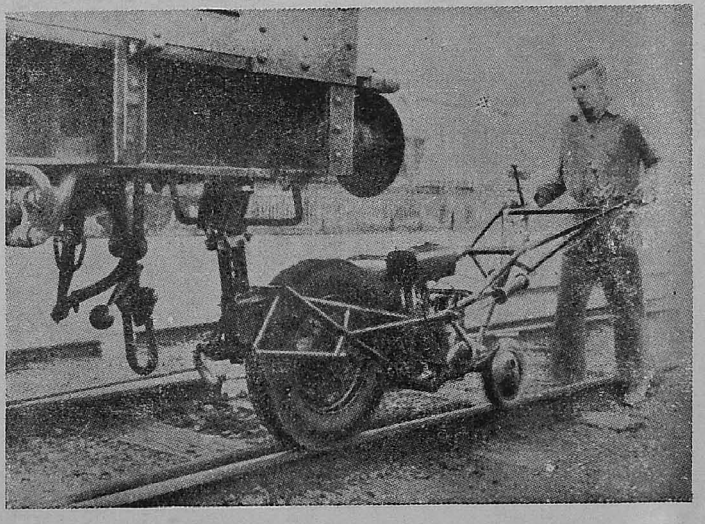
ALL Industrial firms possessing their own Sidings have at one time or another been faced with the problem of how to move and shunt the wagons on these Sidings into position for loading and unloading.

If the Sidings are very extensive or very small the problem generally solves itself, for if the length of the Sidings is great it will probably be necessary to employ a Locomotive, either steam or diesel, whereas if the Sidings are very small, probably the Railway Company will be able to place the wagons in position once per day.

With the intermediate size of Siding installation, however, the problem is by no means simple, and many Engineers will feel that whereas the extent of their Railway sidings does not justify the heavy costs, both in maintenance and capital expenditure, of a full sized Locomotive; neither is it satisfactory to work the Sidings without some suitable mechanical means of shunting the wagons from one siding to another.

Accordingly, over the years a number of methods of shunting wagons without using Locomotives have been adapted, and these vary from the simple device of using a horse full scale installation of electric capstans, etc.

One of the most recent developments in connection with shunting problems has been the design of the Locopulsor Shunting Machine, which has been specially constructed to meet the needs of Industrial Engineers who wish a compact and simple, yet powerful method of shunting Railway Wagons in their own Sidings.

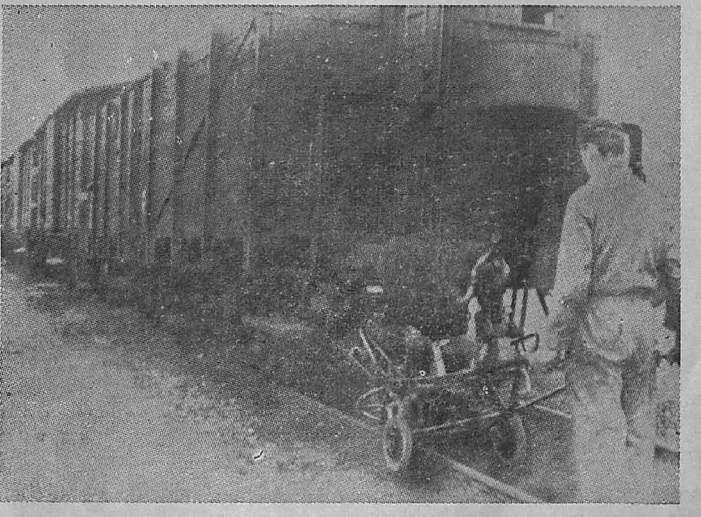


The photographs give a good general idea of the lay-out of the machine and the method of use. Briefly the details of the machine are as follows.

The Locopulsor has a driving wheel fitted with pneumatic tyres. This tyre is grooved and corrugated to afford the maximum adhesion to the rail, and this wheel is driven through a gear box and a special speed reducing device. There are auxiliary wheels for transporting the machine from one place to another, but in actual shunting operations these are not used and the machine is operated by running the driving wheel on the rail.

The power units is a 600 c.c. J. A. P. petrol engine.

The general principle of the machine is rather ingenious as it utilises the forward torque of the driving



wheel to give a forward and upward thrust through a pushing jack which sits below the headstock of the wagon, thereby employing the weight of the wagon to give adhesion to the rail and not depending on the weight of the machine itself to give the necessary frictional adhesion. This frictional force would be small as the machine weighs only 3.1/2 cwts. for easy handling.

The chassis of the machine is welded throughout from high tensile tubular steel, and specially annealed steel castings are employed in the pushing jack. The whole design of the machine incorporates lightness and strength and wherever possible high tensile aluminium alloy is used in any part where the necessary strength can be obtained in this metal.

The operation of the machine is very simple as the Operator sits the machine on the rail a yard or so from the wagon and raises the pushing jack to the requisite height by means of a hand lever. He then places the jack under the headstock of the wagon and after that it is merely necessary to engage first gear, let in the clutch and simply guide the machine gently on the rail. There is no difficulty in negotiating points or crossings.

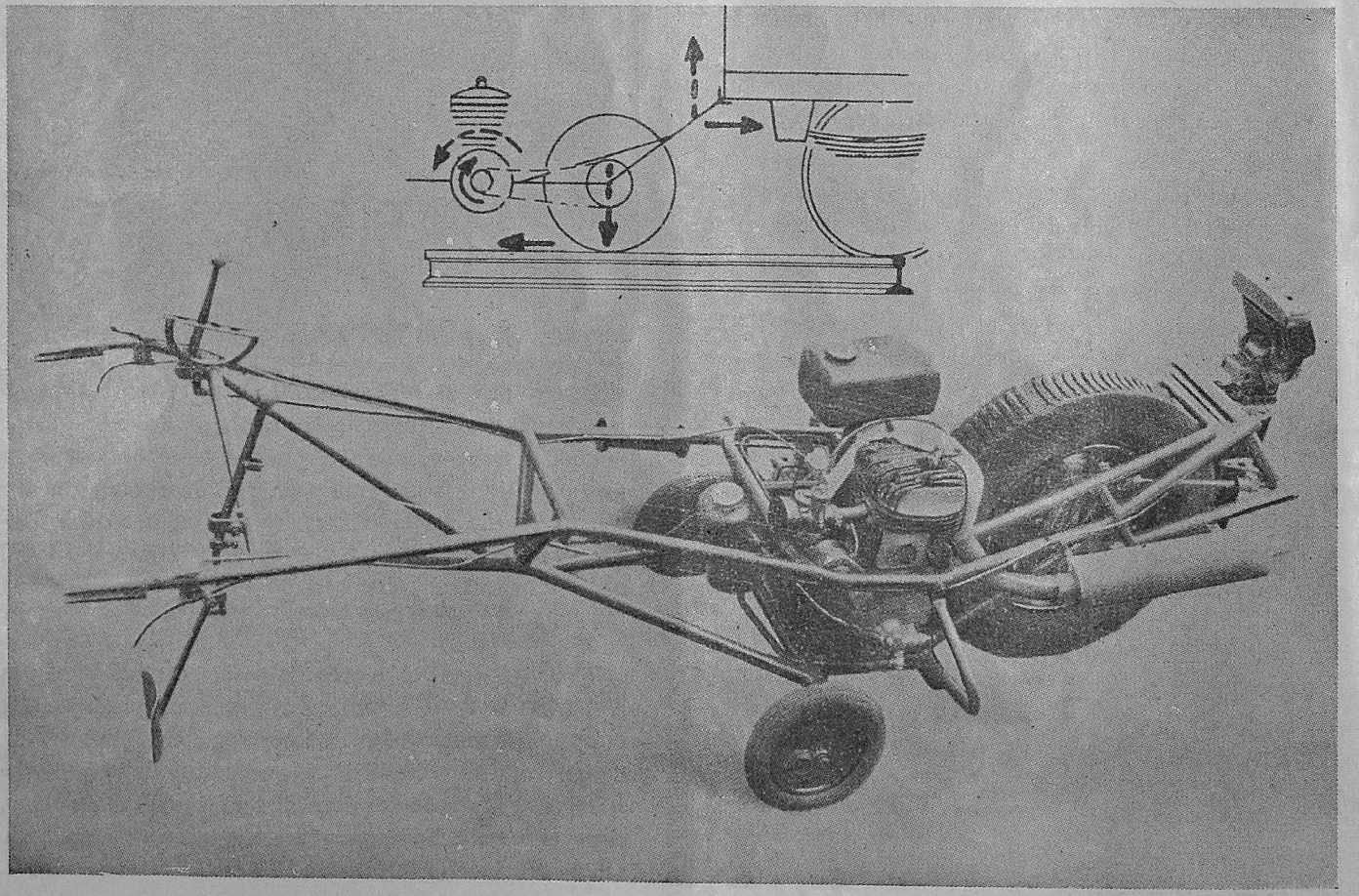
Several features of the design are ingenious. There is for example, a pre-selective gear box. This enable the Operator to have at all times the free use of at least one hand on the handlebars. Once a particular gear has been engaged the gear selector quadrant can be moved to any other position. No change will result until the clutch is let out and in when the desired gear position will then be automatically selected.

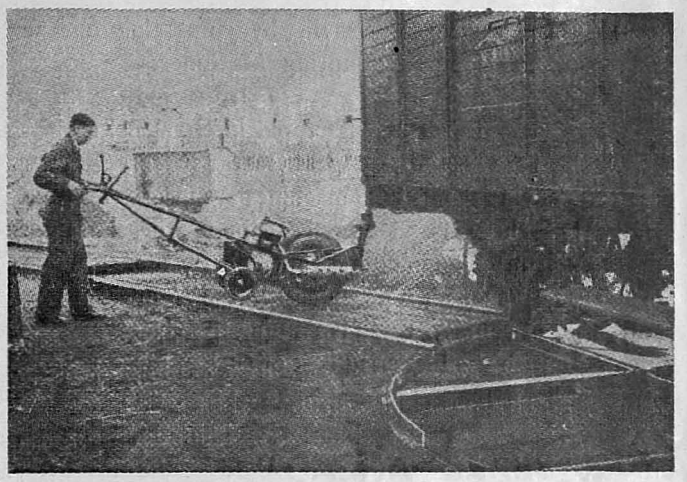
In the speed reducing unit there is an ingenious yet simply maintained arrangement of epicyclic gearing; also the clutch is heavily reinforced for heavy starting duties and the gear box has a wide range of ratios which allow for heavy starting and also for high speeds when the shunting is well under way, or when taking the machine from one part of the works to another.

It might be thought that with such an apparently lightly built machine that it would not stand up to heavy duty over a period of years, but the opposite is found, in fact, to be the case. There have been some machines operating in the south of England for almost ten years and the maintenance of them has been exceedingly low. In fact, the bulk of the attention which they require is the renewal of worn control cables from time to time. The specially designed pneumatic tyre is also very resistant to wear and with normal attention the tyre should last for two or three years without renewal.

It is, of course, important in designing a machine of this nature to consider the number of wagons which will be shunted, and it has been found in practice that loads of up to 150 tons or more can be shunted with ease on a well laid level track, with, of course correspondingly smaller loads on inlines. The writer has seen the Locopulsor Shunting Machine shunt over 200 tons, although this probably would not be recommended for every day use, but does demonstrate the fact that 150 tons is well within the working capacity of the machine.

Accessories which can be supplied are a standing gear which can supply a trickle of sand to the rail if the rails are likely to be wet or greasy. Also a special low head





can be supplied for use with very low wagons, for example, those of the type used in quarries, etc. If inflammable material is used in the works the machine can be completely flameproofed.

The safety aspect of the design of the machine has been well considered, in particular the question of a runaway down an incline which might carry the machine away out of control, has been successfully dealt with. First of all there is an immediate release apparatus to the pushing jack which allows it to drop from contact with the wagon headstock immediately on the full of a hand lever. There is, in addition, a free wheel device on the machine which would operate in the unlikely event of the release machanism failing.

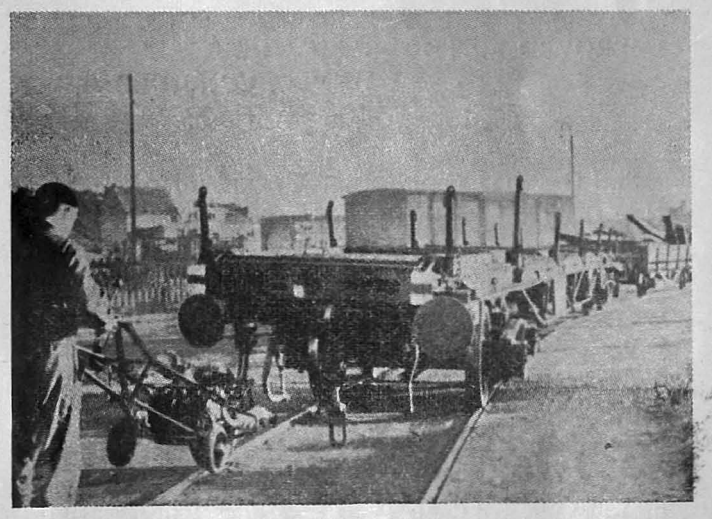
Over a thousand of these machines are now in use throughout the world and it has been found that the machine stands up to heavy use with very little wear and maintenance being required.

One of the facts which might not be considered at first, is that even large works which use Locomotives, often have parts of the works where it is not economical to employ an additional locomotive. Or again, it might be that on week end working it is not an economical method of working to keep a Locomotive under steam, apart altogether from the question of a day requiring to be set aside for boiler cleaning etc. For these reasons a number of very large firms, employing several locomotives, have found that the Locopulsor is extremely useful as an auxiliary, or as a standby in the event of a break down, especially in view of the fact that the capital cost of the Locopulsor is only a very small fraction of that of a Locomotive, and the maintenance and running costs are correspondingly very small.

The following table may be of interest in considering the question of operating costs. The figures are based on the assumption of an eight hour shift with a running time of five hours per shift for the machine.

	Fuel	Lubricating Oil	Wages	Total
Locopulsor	8/-d.	1/-d.	24/-d.	33/-d.
Steam Locomotive	49/-d.	1/-d.	61/-d.	111/-d.

The marked difference of the operating costs is obvious and the fuel costs of the Locopulsor is based on its petrol consumption of 3/8 gallon of petrol per hour. The comparison between the Locopulsor and the steam Locomotive becomes even more pronounced when annual standing charges are compared. On the following table the following assumptions have been made.



"Depreciation" has been calculated on the life of the machine over the period shown with the machine or Locomotive thereafter assuming a nil scrap value.

"Interest" on the purchase cost has been taken at 4%.

"Maintenance" accounts for the general care of the machine together with recommended oil changes and servicing.

"Replacements" allows for tyres and engine wear.

	Locopulsor	Steam Locomotive
Life	10 years	50 years
Capital cost	£475	£10,500
Depreciation	£35	£69
Interest at 4%	18	420
Maintenance	78	715
Replacements	20	–
Total Annual charges	£151	£1204

The above figures are from a calculation given by J. G. Lee, Esq., in "The Engineer", April 30th, 1954, in the comparison of various methods of wagon shunting.

It will be seen, therefore, that the Locopulsor has an annual running cost of less than 1/8 that of a Locomotive and yet for many purposes the services of a Locopulsor are sufficient to replace those of a Locomotive.

The conclusion is obvious that many Industrial Firms which are at present shunting by steam Locomotives could effect a very large saving by employing one or more of the Locopulsor Shunting Machines.

The Locopulsor is manufactured in Great Britain by E. G. Steel & Co. Ltd., 93 West George Street, Glasgow and already a few of these machines are in operation in India, but there is undoubtedly scope for the increased use of this machine in many works where the shunting of Railway Wagons is a heavy cost in the Annual Budget, and one, of course, which is tending to become heavier each year with the increased cost of coal and labour.

"RAILWAYS MUST PLAN 20 YEARS AHEAD"

IMPROVED METHODS OF WORK UNDER CONSIDERATION

Shri G. Pande, Chairman, Railway Board, declared in New Delhi last month that it was not enough for the Indian Railways to plan only for the next five-year period. "We must look ahead and plan from now on for heavier responsibilities during the next 15 or 20 years", he said.

Shri Pande, who was speaking at a three-day conference of the General Managers of the various Railways broadly indicated the lines on which the Railwayshad to work in order to achieve even higher efficiency standards than in the past.

The Railway Board was in this connection, he said, examining certain technical points which had a bearing on improved methods of work in the future. The Board was also thinking in terms of heavier trains, better track standards, more intensive operation through dieselisation and electrification on selected sections etc. The question of reorganising on modern lines the Central Standards Office for the Railways and the Railway Research Directorate was also receiving attention.

The Financial Commissioner for the Railways, Shri J. Dayal, said that while the Railways had made considerable progress during recent years, the search for securing further improvement in the efficiency of performance should be continued. Experience of certain foreign countries which he had recently visited showed that with greater attention to certain matters of technical detail, organisation and planning, it might be possible to achieve a better utilisation of the existing stock of locomotives, wagons, etc., and thereby to improve the railways' carrying capacity, so vital to the successful implementation of the second Five Year Plan.

The conference also heard from Shri P. C. Mukerjee, Member (Engineering), Railway Board, an account of his experience during his recent tour of Western and Eastern Europe, where he inspected a number of factories manufacturing railway equipment, and met various railway authorities.

SEPARATE TARGETS FOR EACH RAILWAY

Sri K.B.Mathur, Member (Transportation) also suggested certain practical means of improved utilisation of rolling stock. The General Managers gave the conference details with regard to performance and maintenance of rolling stock. The view was accepted that, in future, separate efficiency targets should be laid down for each Railway, and for sections within each Railway.

The conference expressed itself strongly in favour of strengthening the personnel organisations of the Railways and felt that greater initiative should be placed in the hands of personnel officers so that the legitimate demands and grievances of the staff could be dealt with more satisfactorily and with greater expedition.

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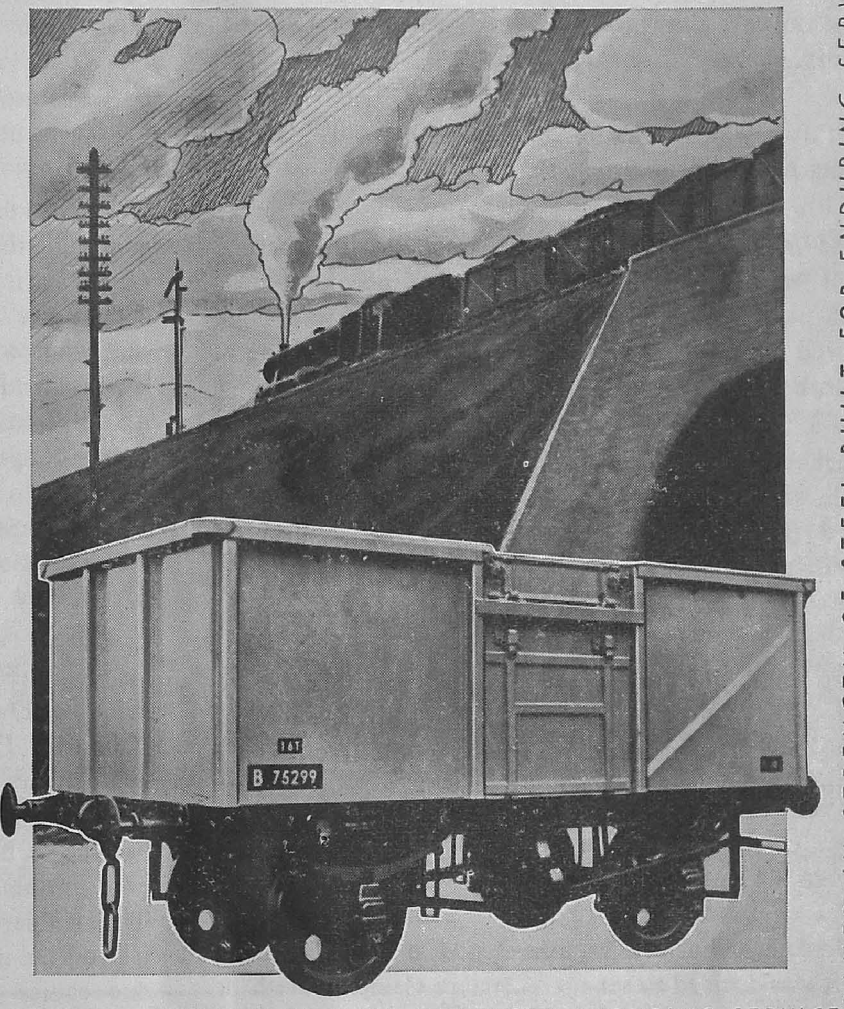

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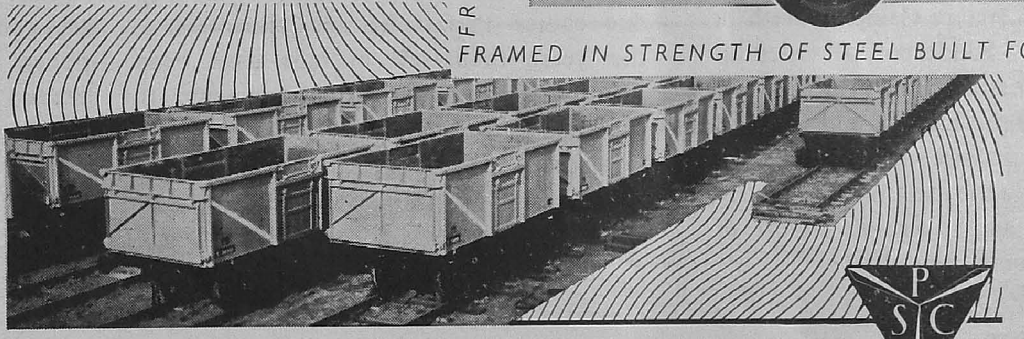

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Bearing Metals and Alloys for Railways

WITH a progressive workshop in Calcutta The Eyre Smelting Ltd., have been associated for a long period with the Indian Railways and can claim an unbroken connexion going back over 45 years. It is interesting to note that the first consignment of bearing metals destined for the Indian Railways was shipped from the parent company in 1910 since when the organisation has been supplying material to the railways either from England or from its Calcutta foundry.

Let us now make a rapid review of the world's largest bearing metal organisation.

The first Indian Railway to be supplied with bearing metals was the Bengal Nagpur Railway, now known as South-Eastern Railway and this business was soon followed by orders from the M. & S. M. and South Indian Railways (now Southern Railway).

Such excellent results were obtained with the bearing metals supplied by this firm that its products quickly gained favour and its reputation was further enhanced by outstanding performances on the Bikaner State Railway.

The engineers of this great organisation paid regular visits to the various workshops of the Indian Railways and gained first-hand knowledge of running conditions in India.

BIRTH OF KIDDERPORE WORKS

By 1930 the business had developed to such an extent that it was decided to set up an Indian Company with a well equipped Works at Kidderpore, Calcutta. Technical personnel from the main foundry in London were sent to India to supervise production and to train Indians in this work. Within a short space of time the Indian counterpart was capable of meeting the entire demands of the Indian market and as a result import of bearing metal from abroad virtually ceased.

RESEARCH & LABORATORY

The Kidderpore foundry has a large well equipped laboratory staffed by qualified chemists and metallurgists and with full support of the parent company in London it engages in research and investigates any special problems that may arise in connexion with bearings and bearing metals.

The establishment of the foundry in India has enabled the Company to develop the business on broader lines than was previously possible and in addition to railway bearing metals, it has been producing bearing alloys for every type of bearing application and has a wide connexion with general engineering industry. The brand names "Tandem" and "Eyre" are so well known that needs no introduction.

The Company also manufactures solders and tinning and soldering fluxes and having exceptionally wide experience in the application of bearing metals it has been able to give valuable advice on a number of occasions in connexion with the whitemetalling of bearings and the lay-out and equipment of whitemetalling shops. An illustration occurred as early as 1938 when the Company gave advice and technical assistance to the East Indian Railway in connexion with the lay-out and re-equipment of their Carriage and Wagon Whitemetalling shop at Lilooah.

Another aspect of the Company's activity is the manufacture of printing metals for supply to the Printing Trade throughout India. Messrs. Fry's Metal Foundries Ltd., London (an associated firm) have for many years been the main contractors for printing metals to the industry in England, in fact "Fry's" has become a household name in the trade and each and every printer recognises it as the hallmark of quality. The Kidderpore foundry was therefore in a position to take on the manufacture of Fry's Printing Metals and in due course import became unnecessary. Throughout the years thousands of tons have been supplied to Printing Presses throughout India and the demand is expanding considerably with the growth of literacy throughout the country.

Throughout the 45 years that the Company has been supplying its alloys to the Indian market Heatly & Gresham Ltd, have acted as selling agents for all Railway and Printing metal business. With offices in Calcutta, Bombay, Madras and New Delhi they are well placed to cater for demands from all parts of the country. At all times close co-operation has been maintained between the two Companies.

Role of Limpet in Locomotive Building

"LIMPET" is the registered Trade Mark in India of the products of Messrs. J. W. Roberts Limited, Armley, Leeds, England, who specialise in the insulation of Railway rolling stock and they are also the sole lessors of the process known as Sprayed "Limpet" Asbestos.

SPRAYED "LIMPET" ASBESTOS is fully patented throughout the world and is a unique form of insulation. Asbestos fibre is passed through a machine controlling the output of fibre which is blown by a fan through a large bore hose and nozzle on to the surface to be insulated. Atomised jets of water mingle with the fibre steam at the point of discharge and form a covering of asbestos of any desired thickness and density under the control of the Operator.

Special grades of pure asbestos fibre are used for thermal insulation, anti-condensation work in Mills, etc, and the acoustic improvement of halls, theatres and offices. Railway Engineers are mainly interested in thermal insulation and the "K" value of Sprayed "Limpet" Asbestos may be taken as being from 0.30 to 0.35 according to density and quality of the fibre used. It should be remembered that as an unbroken coating of insulation is built up this "K" value is obtained in practice, whereas in the case of most alternative forms of insulation their nominal "K" value is not achieved in practice because of gaps and joints between adjacent sheets. A notable instance of the use of Sprayed Asbestos is on the air-conditioned broad gauge coaches built in India, which, up to the present, have been insulated by means of Sprayed "Limpet" Asbestos, the first of these having been constructed in 1937.

A further use for Sprayed "Limpet" Asbestos by Railway Engineers, is the application of asbestos fibre, usually one inch thick, to the underside of locomotive clothing sheets, so that when the sheets are removed for repair or inspection, the insulation is removed at the same time. One great advantage of this system, on the back ends in particular, is that no provision has to be made for hand holes or boiler stays and the maximum insulation efficiency is obtained. In case of damage to the insulation, it can very easily be made good by spraying on additional fibre.

The insulation of steam cylinders and piping is another outlet for "Spray" and in fact it will serve many other useful purposes in a railway workshop. The use of pure "Limpet" Asbestos ensures that no chemical reaction will take place.

"LIMPET" SHEET is one of the products of J. W. Roberts Limited, widely appreciated by Railway Engineers in India. This sheet or board was designed many years ago to meet the peculiar conditions of heat and humidity prevailing in India and it has proved to be very successful. "Limpet" Sheet, being flexible, is particularly suitable for the interior lining of the ceilings of passenger coaches; it is non-inflammable and is unaffected by climatic conditions. Being composed mainly of asbestos, it is immune to attack by any sort of vermin and is non-hygroscopic. The minimum quantity of paint is required for decoration. A convenient feature is that it is supplied in sheets ten or twenty feet long by four or five feet wide, so that the ceiling of a broad gauge coach can be spanned with the minimum of wastage in cutting. The standard thickness is two millimeters but it can be supplied three millimeters

A CORRECTION

The article entitled "NARROW-GAUGE LOCOMOTIVES FOR INDIA" published in our July Annual Number cum Engineering Supplement is a reprint from the "DIESEL RAILWAY TRACTION". We regret for the above omission.

EDITOR

thick where exceptional strength is required. "Limpet" Sheet is now being made in India by Asbestos, Magnesia & Friction Materials Ltd. by arrangement with J. W. Roberts Limited, Leeds.

"LIMPET" ASBESTOS MATTRESSES for locomotive boiler lagging are another popular of Messrs. J. W. Roberts Limited. These are made of chemically pure woven asbestos cloth free from vegetable or organic matter and with a filling of pure asbestos and, if handled with reasonable care, they will last the life of a boiler. The ease with which they can be removed and refitted is an advantage not possessed by any other form of boiler lagging. "Limpet" Mattresses have a world wide reputation for efficiency and durability and though the tendency in India in past years has been to neglect the complete insulation of locomotive boilers, possibly due to the low cost of fuel in former years, it has been proved that a very appreciable saving in fuel costs can be obtained by efficient lagging and this is not confined to cold weather conditions. Tests carried out with a model boiler in a wind tunnel prove that the total heat loss with clothing sheets only, is about four times as great as when the boiler is lagged with "Limpet" Asbestos Mattresses one inch in thickness, in addition to clothing sheets.

"DECOLITE" COMPOSITION FLOORING

The name "Decolite" is now generally accepted in India for composition flooring for Railway rolling stock but "Decolite" is a Trade Mark of Messrs. J. W. Roberts Limited, and it should not really be applied to composition flooring of indigenous manufacture. This product is too well known to carriage and wagon builders to require a detailed description, but it is as well to remember that genuine "Decolite" flooring is supplied only by Messrs. J. W. Roberts Limited or their accredited Vendors. The Sole Vendors in India for the products of Messrs. J.W. Roberts Limited, and the Sole Licensees for the "Sprayed LIMPET Asbestos" process, are Messrs. Asbestos, Magnesia & Friction Materials Ltd., Bombay, Calcutta and Madras.

ELECTRIFICATION OF RAILWAYS

FRENCH REPORT PRESENTED

A report on certain aspects of railway electrification in India prepared by a team of French Experts was presented to the Railway Board.

The report was presented by M. F. Nouvion, Chief Engineer, French National Railways, and leader of the team of experts, to Mr. G. Pande, Chairman of the Railway Board.

Among those present at the ceremony were M. Christian Belle, Minister-Councillor and M. Guy Chaumet, Councillor for Economic Affairs at the French Embassy, M. J. Boulgne, Project Engineer, French Railways and Members of the Railway Board.

Mr. Pande said that the report prepared after very hard work would be most valuable in helping the Government of India in taking final decisions in regard to electrification of railways.

In the report the team is reported to have expressed the opinion that A.C.-50 cycles traction system would be more appropriate for Indian conditions and substantially cheaper than the D.C. system.

The services of the team were placed at the disposal of the Government of India by the Government of France, which offered to meet all the expenses connected with their travel and stay in India. The experts visited sections of the Indian Railways where electrification is planned and prepared the report on return to France.

*** *** ***

MACHINERY FOR PERAMBUR COACH FACTORY—ORDERS PLACED FOR 40 LAKHS

Railway Machine Tool manufacturers in eight European countries have secured orders aggregating about Rs. 40 lakhs for the second instalment of machinery and plant for the Perambur Integral Coach Factory.

The factory, when equipped with this machinery is expected to complete its annual target production of 350 coaches one year ahead of the original schedule in four years instead of five.

Firms in West Germany and the U. K. together have secured more than 50 per cent of the total value of the orders, which cover 189 machines of various types. Smaller but sizable orders have gone to manufacturers in Switzerland, Italy, Czechoslovakia, Poland, Austria and Sweden.

Two senior Railway Officers were recently deputed to Europe to negotiate and finalise the contracts on the spot after inspecting the machines where necessary. Global tenders were invited and nearly 170 firms in 15 different countries submitted tenders which formed the basis of the negotiations.

Modern Static Load Testing of Railway Coach Body Frames

WHEN new coaches are built according to a long standing design, it is not customary to carry out any special testing on them before their leaving the factory. Their faults have already been remedied from the experience gained in years of running of similar type coaches.

This is no longer true when a coach is constructed to a completely new design. A case in point is that of the two prototype light-weight steel coaches recently arrived in this country from Switzerland. Previously no all-welded coaches was running on the Indian railway system and these coaches had to be designed to meet Indian conditions and requirements.

The design of the body shell is the first step towards production. A completely welded body frame may be considered as a large steel tube the wall thickness of which varies and is punctured by door openings, windows etc. On account of these facts the exact calculation of stresses in the steel is impossible and approximations have to be made to simplify the work. The stresses in any part of the shell may be fairly accurately foretold, but it is necessary to check the calculation by measuring the actual stresses occurring in the body shell after its assembly by means of a load test.

Such a test was carried out on the Schlieren prototype coaches for the Indian Railways.

The coach body frame is mounted over two special bogies, being supported at the centre pivots of the body bolsters only. Two tests are then carried out: vertical loading test on coach floor and horizontal compression

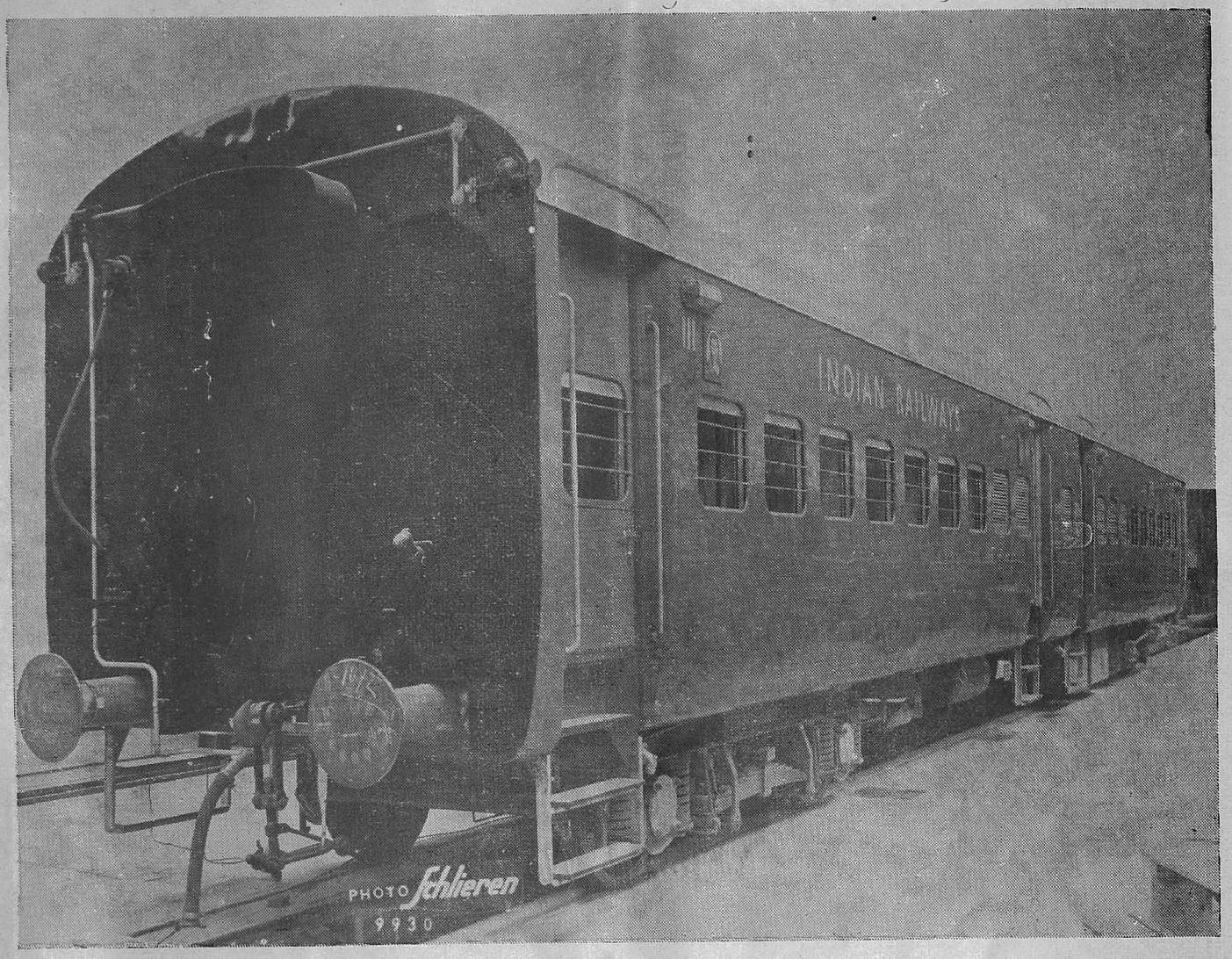
Editorial Notice

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

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

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

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

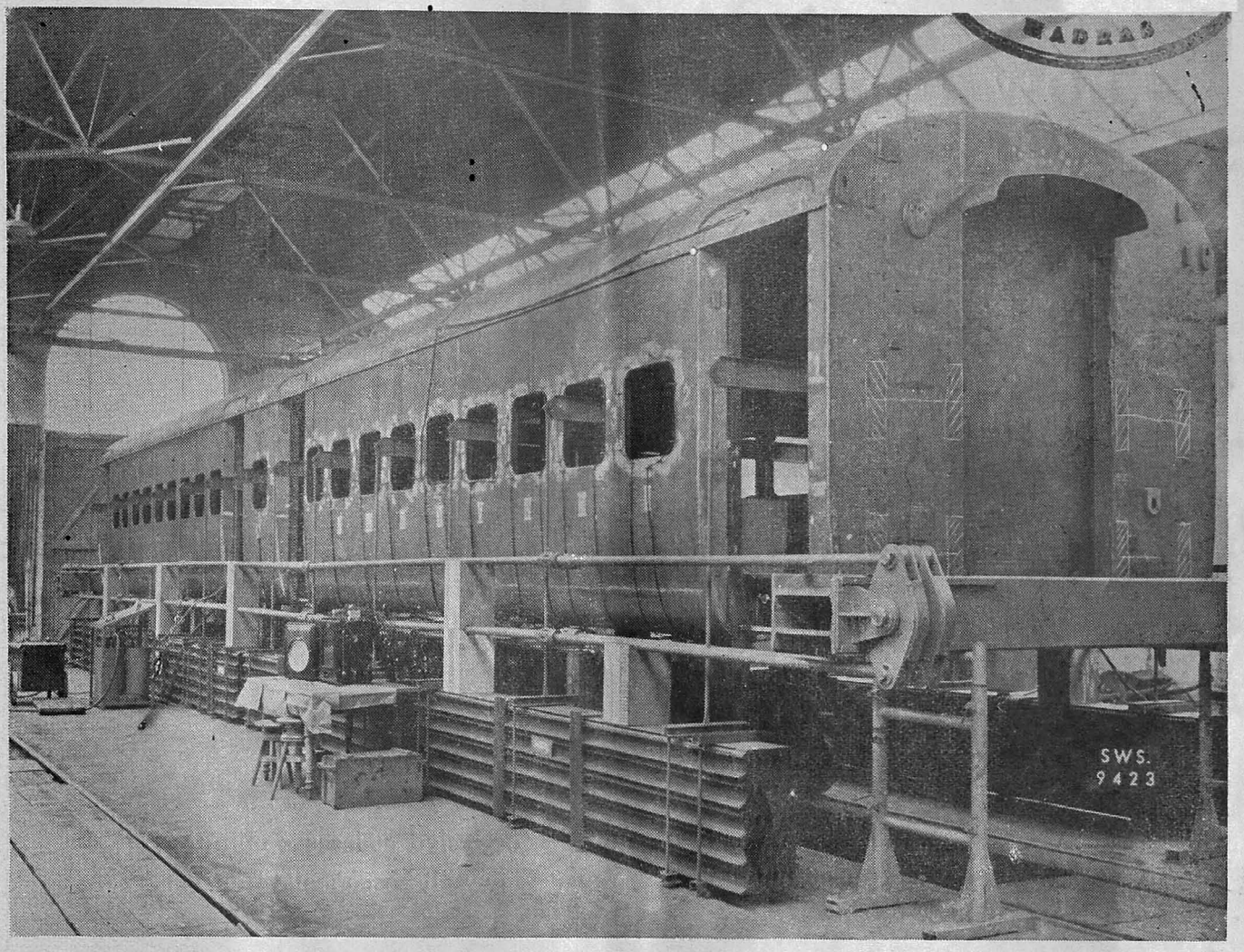


test in the longitudinal direction. About 26 cylinders and pistons actuated by compressed air rest on timber planks laid on the floor. The pistons are anchored rigidly by being connected to beams crossing the coach and anchored outside the coach to heavy *steel masses* resting on the floor of the building. The vertical pressure on the floor can be varied as required by adjusting the pressure of the compressed air supply to the pressure cylinders.

The horizontal load is applied by two hydraulic presses acting at each end of the body shell. The compressive load is varied by means of a hand pump.

"Extensometers" or electrical "Strain gauges" are used to measure the stresses occurring in the steel. Essentially an extensometer is a length of very fine wire mounted in cellophane or paper about the size of a postage stamp. This is stuck on to the place to be tested and electric wires run from it to a recorder. In the case of the new light-weight coaches, 178 of these extensometers were fixed on the roof, side-walls and underframe, i. e. on all points of the coach which wanted testing. When the coach is loaded up, the coach steel work is deformed, thereby causing the wires in the extensometers to contract or extend and thus to change their electrical resistance. By passing small electric currents through these extensometers, the stresses in the coach body-work are recorded on a specially calibrated scale. This method of stress measurement is a comparatively new one and is extensively used in the testing of aircraft.

Another measurement which is carried out is the deflection of the coach under load. This is carried out with an exact clock gauge. The deflection must be less than 1/500th of the distance between centre pivots.



These Coaches are built by Messrs. Swiss Car & Elevator Manufacturing Corporation Ltd., Schlieren for the Indian Government Railways. Now these coaches are being built at Integral Coach Factory, Perambur in collaboration with this firm.

The results of the tests are then carefully examined and in case any parts of the shell should not show a sufficient margin of safety, these would have to be stiffened up. Conversely the results also indicate where members were oversized and where the weight of the bodywork might be reduced in later coaches.

Thus accurate load testing of the coaches points the way towards the most economical use of materials and leads to greater safety for the passenger. Furthermore experience is gained for the design of later coaches since each test is a further step, towards the "Ideal Coaches".

£ 300,000 INDIAN CONTRACT FOR BRITISH CRANES

AFTER a 16-day trip to India, Mr. W. H. Sharp, director of a British firm manufacturing cranes and excavators, is back in Yorkshire with a £ 300,000 contract.

The contract, gained in the face of keen competition from Japanese, Italian, German, Belgian, and French manufacturers, is for 27 cranes for use on Indian Railways, where they will assist in maintenance work. To be delivered over the next two years, they comprise 18 ten-ton steam travelling cranes and nine five-tonners.

The British firm recently completed a previous contract worth £ 250,000 for supplying 24 cranes.

HOW TO RESERVE ACCOMMODATION

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

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

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

Tickets will be used only if accommodation is available.

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

Reservation fee is not refundable.

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

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

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

(Inserted in the interests of Travelling Public)

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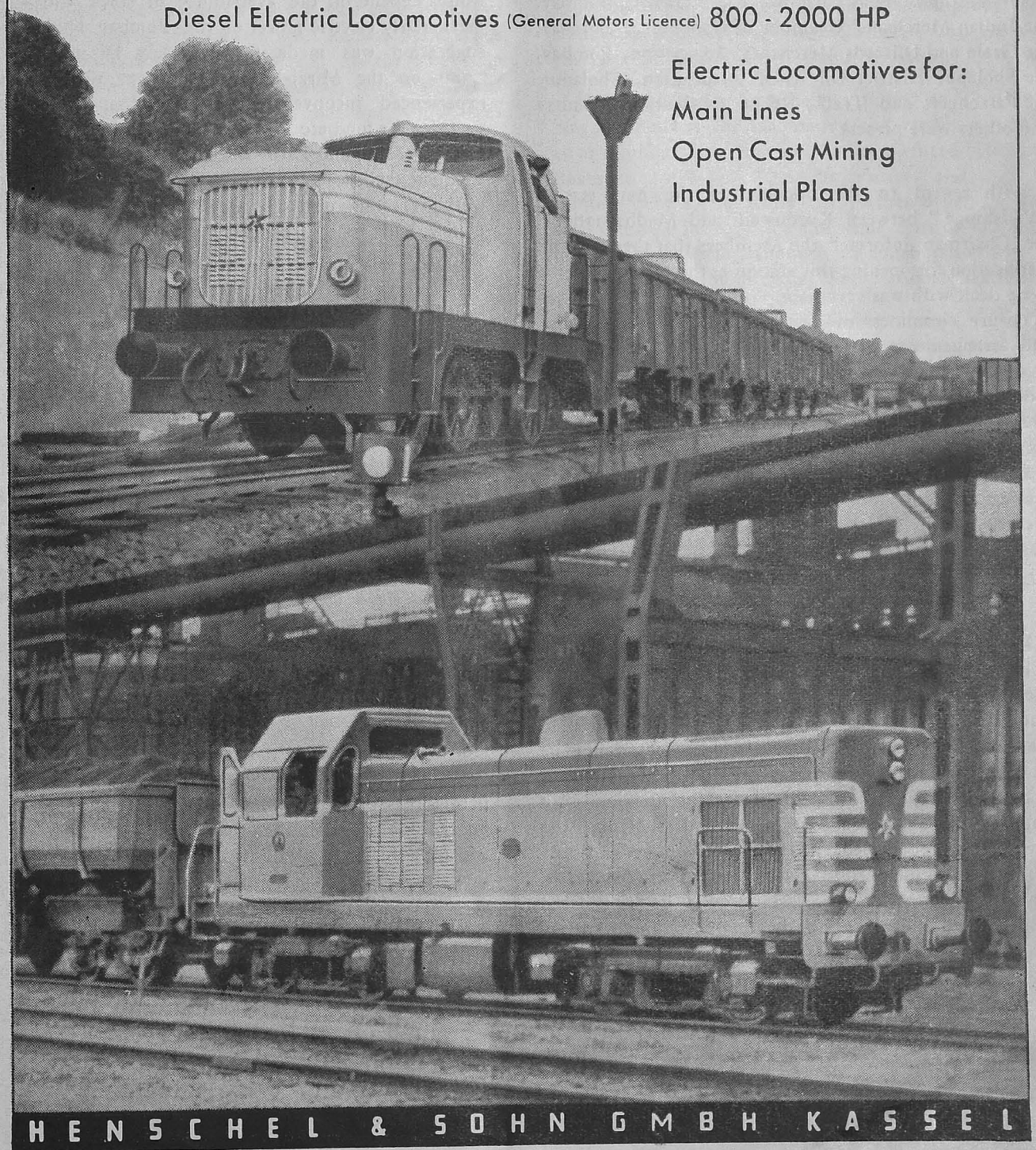

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BOMBAY DIVISIONAL RAILWAY USERS' CONSULTATIVE COMMITTEE MEETS

THE Bombay Divisional Railway Users' Consultative Committee held its 15th Meeting at Bhusaval on June 30, 1956 presided over by the Divisional Superintendent, Bombay. Representatives of the Hindustani Merchants and Commission Agents Association Ltd., Bombay, the Bombay Chamber of Commerce, Bombay, the Indian Merchants' Chamber of Commerce, Bombay, the Grain and Oilseeds Merchants' Association, Bombay, the Sholapur District Oil Mills' Association, Sholapur, the Passengers and Traffic Relief Association, Bombay and others were present.

With regard to the opening of the new station "Vadshinge" between Kurduwadi and Madha stations, the Chairman informed the Members that there was no justification for opening this station as the traffic expected to be dealt with was very poor. Action was being taken to ensure cleanliness of carriages on Suburban trains, and arrangements were being made to put up notice boards in the office of the Assistant Station Master indicating the availability of staff for cleaning compartments. As regards inconvenience caused to passengers for want of lights, it was pointed out that the absence of lights was due to thefts of electrical parts and fittings. A system of protecting these fittings against pilferage had been devised by which it was hoped that such thefts would be minimised. Steps were also being taken to brighten lights.

It was represented that an Enquiry Office with a public telephone should be opened at Sholapur station. Members were advised that for Sholapur an independent Enquiry Office had been provided in the structural plan that had been prepared and that arrangements would be made to ensure that enquiries were promptly attended to by the staff there. The need for introduction of a Shuttle Service between Kurduwadi and Sholapur, the Members were advised, had been recognised and this item had been included in the Second Five-Year Plan. The introduction of this train would be considered subject to additional stock and power becoming available.

With regard to the suggestion for introduction of a Janata Express train between Bombay and Bezwada, it was stated that this suggestion had already been borne on the programme of additional trains to be introduced during the Second Five-Year Plan period and that much would depend on the availability of stock and power, particularly electric power on the Bombay Division. A suggestion was made for providing Dining Cars on trains on the Miraj-Latur Section as the passengers experienced inconvenience in the absence of proper facilities for food etc. It was explained that the distance between Miraj and Latur was only 203 miles and that adequate facilities exist at present for meeting the needs of the travelling public by way of tea and light refreshments and food. Further, as it was proposed to convert the Miraj-Kurduwadi line to Broad Gauge line in the Second Five-Year Plan, the provision of Dining Cars on this Section was not considered necessary for the present. In regard to the inconvenience caused to passengers due to shortage of water at Bombay V. T. the Members were advised that it had been decided to provide an additional underground reservoir of one lakh gallon capacity. This would meet the requirements of passengers.

Amongst other subjects discussed were effective measures to be taken to deal with the nuisance of unsocial elements in railway premises, introduction of II Class accommodation on Deccan Queen, punctual running of 328 Up Raichur-Poona Passenger and 330 Up Bezwada-Poona passenger trains, standardisation of the period of availability of the concession return tickets issued during Diwali Holidays, provision of a direct coach on Calcutta Mail via Allahabad between Bombay and Patna at least twice a week and construction of a foot-overbridge joining the Central Railway Station and the Southern Railway Station at Sholapur. The proposals regarding safety measures to be adopted cautioning the public crossing the Seena Bridge between Pakhni and Mohol stations, withdrawal of II class accommodation from Branch line trains, pilferage of coal from wagons standing in Sholapur Yard and opening of a City Booking Office at Pandharpur were also discussed.

HOFFMANN AXLEBOXES

COMMENCING manufacture in 1898 the Hoffmann Manufacturing Co. Ltd., has expanded until today it is the oldest and largest works manufacturing antifriction bearings in Great Britain and the British Commonwealth. The need for antifriction bearings became acute as transport and engineering science developed in the early 1900's and one by one, commencing with the ball thrust and the compound bearing, the various well known basic types of Hoffmann Bearings were evolved. In the year 1910 the Hoffmann parallel roller bearing, with cylindrical rollers having their length and diameter equal, was introduced. This bearing forms the basis of many modern Hoffmann Axleboxes, although an increase in the ratio of roller length to diameter is sometimes made to obtain greater load carrying capacity. Hoffmann Axleboxes were first supplied for tramcars about 1920. These boxes were fitted with two roller bearings for carrying the journal load and a ball location bearing to deal with end thrust. The bearings were mounted on a sleeve which was machined to suit a taper seating on the end of the axle. Similar boxes were later supplied in large numbers for use in Bombay, Calcutta and Karachi.

This early type of box proved highly successful and after carrying out a number of similar applications to light railcars in Great Britain and Ireland, the first Hoffmann axleboxes fitted to a locomotive and tender were put into service on the Great Southern Railways of Ireland in 1936. About the same time 5 sets of these boxes were fitted to trailing axles of "Princess" Class locomotives of the old L. M. S. R.—now the Midland Region of British Railways. All the sets have run over 1,000,000 miles and are still giving, good service. The first roller bearing application in India was some 54 years' ago when two four wheeled coaches on the old Eastern Bengal Line were fitted with cylindrical rollers 9" long and $1\frac{3}{4}$" diameter made in their own workshops. These ran 160,000 miles but large scale manufacture was prevented by metallurgical limitations. However the fruits of these early experiments are seen in the recent standardisation in India of roller bearings for all types of tank-vehicles, air-conditioned coaches, explosive vans and well wagons and dining cars, following the earlier standardisation for locomotives, railcars, new main-line passenger stock and electric suburban stock.

Hoffmann Boxes have been supplied to The Bengal Nagpur Railway for locomotive and tender use and in 1950 Indian Government Railways, fitted Hoffmann Boxes to 10 W. G. Class locomotives and these are running very satisfactorily. A further order for boxes was received in 1953 for the same class of locomotive and these are being supplied in collaboration with our associated company in India, The National Bearing Co. Ltd., Jaipur.

Experience in countries all over the world including Great Britain, Ireland, France, Africa, Ceylon and Australia has shown that mileages well in excess of 1,000,000 and 20 years' service are being achieved on Hoffmann Boxes and the ultimate length of life has yet to be proved. Moreover, wear on the rollers, tracks and pad faces even after such prolonged running periods, is hardly measurable.

The famous London Underground has been using Hoffmann Boxes since 1935 and many thousands are in use today on this vast system. All new stock is being fitted with axleboxes of the Hoffmann design. The little known and unique underground Post Office railway, which is driverless and entirely automatic is another system relying on Hoffmann roller bearings. It

ANNOUNCEMENT

We have pleasure in announcing to all Advertisers and Subscribers that we are issuing a special Supplement for Christmas along with our December 1956 issue.

Editor

is noteworthy that these bearings are fitted to the axles of the latest turbo diesel locomotive and to the Metro-Vick Gas Turbine Electric locomotive which is reputed to be the most powerful in its class in the World.

We will now describe two or three types of axlebox which we are putting forward today for railway work. The journal load is carried on two rows of caged rollers each with its own outer race but running on a common inner race. End location of the axle and thrust load, are taken care of independently of the roller journal bearings by a phosphor bronze thrust pad operating against the axle end. The axle end must have a good smooth and unbroken surface. With other types of boxes it is common practice to stamp certain information on the ends of the axles but with the pad box this stamping must be done on the small stepped portion of the outside diameter extending beyond the inner race.

A felt pad is let into the face of the phosphor bronze pad and is kept in contact with the axle end by a spring to promote continuous lubrication between the thrust faces. Axleboxes of this type are in use with both oil and grease lubrication but the box is designed for grease which has of course a number of advantage over oil. Oil tends to drain away from the bearings on standing whereas grease, on account of its coating properties affords protection to the bearing at all times. It also provides some protection against the ingress of foreign matter into the boxes. A further point of considerable importance to Railway Engineers is that grease lubricated boxes require very little attention over extended periods whereas with oil lubrication the oil level must be checked regularly and the boxes topped up periodically.

An outstanding advantage of this type of box is the turning, the bogie frame must be lifted, after which the ease and rapidity with which it can be mounted and removed from the axle. Should it be necessary to remove the boxes for inspection purposes or tyre boxes, complete with outer races, cages and rollers can be slipped off, leaving the inner races and throwers in position on the axle. There is no need to remove the components from the axles for tyre turning.

These axleboxes, complete with their outer races, cages and rollers are interchangeable with one another and any box can be slipped on to any inner race. This is a big advantage from the Maintenance Engineer's point of view as there is no need to mark boxes and inner races so that they are assembled in the same way as they were previously used. It will be noted that no screw threads are required on the axles and no inner race taper clamping sleeves are employed nor is there any need to provide adjustment for the bearings. The absence of such features does much to ensure the simplicity and ease with which maintenance can be carried out.

It is occasionally necessary to leave the end of the axle clear, and often to fit boxes between the wheels, and in both cases the phosphor bronze pad design cannot be used. In such cases a ball bearing may be used to locate the axle and take the side thrust. Here again the main load is carried on two roller journal bearings and in this particular design each has its own inner and outer races. The ball bearing also has its own races and it should be noted that it is left clear radially in the axlebox so that it cannot carry journal load, leaving its full capacity for dealing with thrust load. A very simple form of mounting is thus obtained and again no adjustment of the bearings is necessary. All the races are clamped firmly endways. The bearings may be inspected after lifting the bogie frame from the axleboxes. In order to carry out inspection it is necessary to remove the thrower which is clamped to the axle and free the detachable end cover after which the axlebox may be drawn to one side leaving the bearings in position. As the distance piece between the outer races is in halves it can be removed, permitting the outer races of the roller bearing to be slipped to one side exposing the outer tracks and the rollers for inspection.

Another type of box known as the cannon box and this type has definite advantages with some frame arrangements and has been found particularly useful for two-wheeled leading and trailing trucks. It is also becoming popular for the axles of the main driving wheels of locomotives. The cannon box is suitable only for cases where the wheels are fitted on the end of the axles, and the bearing arrangement consists of a roller journal bearing at each end of a long cast housing extending between the wheels. A ball location bearing clear on its outside diameter is fitted at one end for locating the axle endways and dealing with thrust. No adjustment of the bearings is required and all the races are held endways. In some cases the cannon box is split along its longitudinal axis or alternatively, loose caps may be provided at the bearing positions only.

Other types of axlebox can of course be supplied and we are always pleased to assist the Railway Engineer and submit recommendations, if full details are put before us.

LITTLE KNOWN FACT

These hearty, Alpine peasants linger to drink from a highly polished steer's horn, as they enjoy a holiday from work. Gasteiner Valley, high in the Austrian Alps, is noted for its health-giving mineral springs, its lakes and magnificent scenery.

WELL-KNOWN BRAND

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Enriched with 700 international units of vitamin 'A' per ounce and also with vitamin 'D'.
Tushar is a well known brand of Vanaspati. Its hygienic process of manufacture and its health-giving properties have made Tushar an ideal cooking medium.

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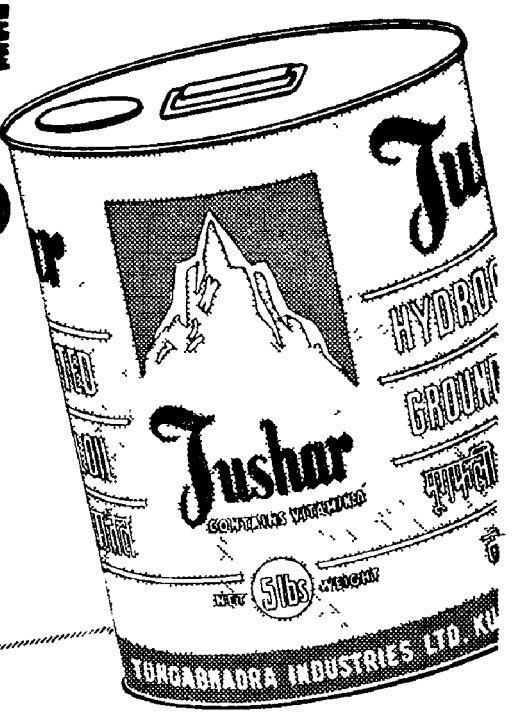

CLEANLINESS LEADS TO HEALTH AND HAPPINESS

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

Cleanliness prevents disease; medicine only attempts to cure.

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

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

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