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SOUTHERN RAILWAYS

Magazine

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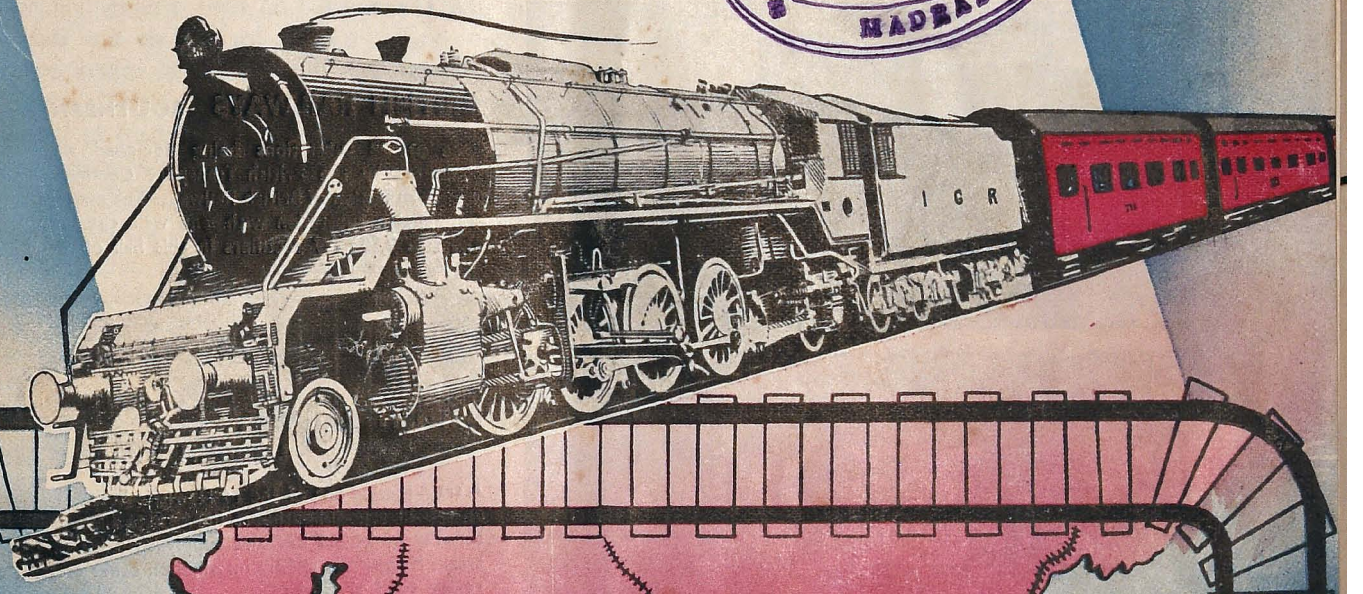

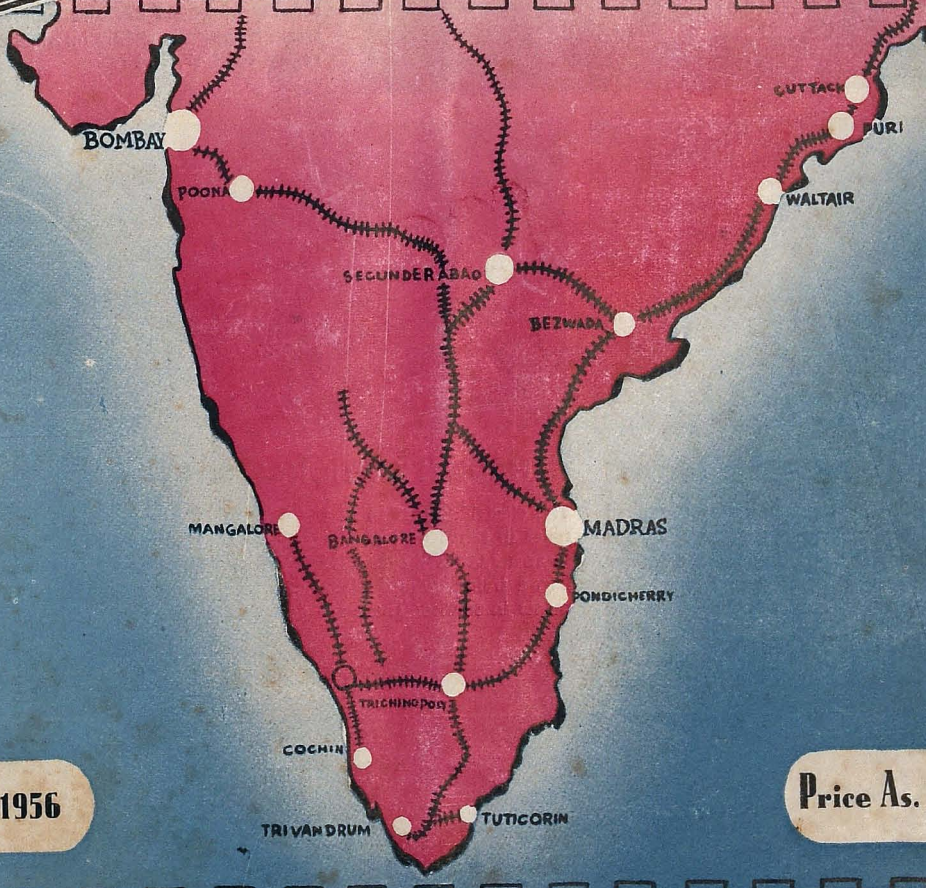

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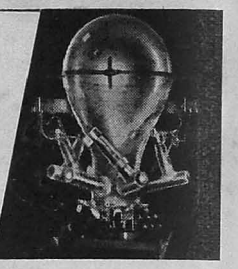
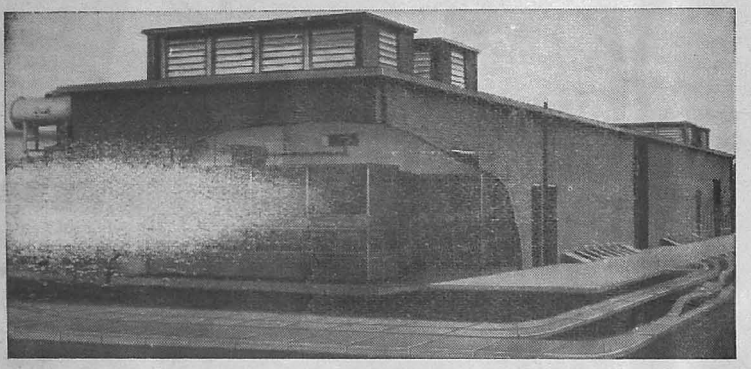
IN TRACTION SERVICE IN 18 COUNTRIES ... Hewittic RECTIFIERS



the converting plant used by the World's principal railways

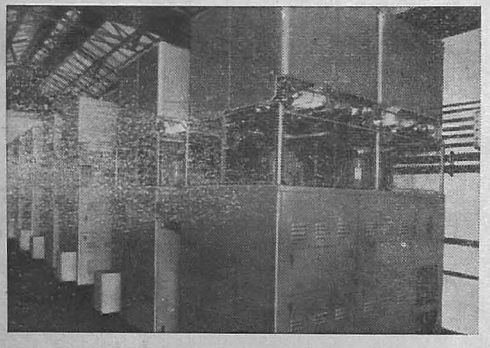


BRITISH RAILWAYS SOUTHERN REGION

One of 28 substations being equipped with Hewittic Rectifiers by the British Transport Commission for the Southern Region of British Railways. The photograph shows Wimbledon substation with one wall cut away to show the two 2,500 kW rectifiers in this half of the building.

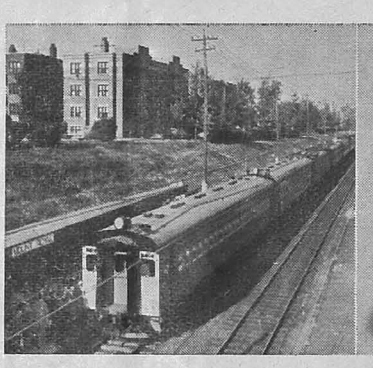
BRITISH RAILWAYS LONDON MIDLAND REGION

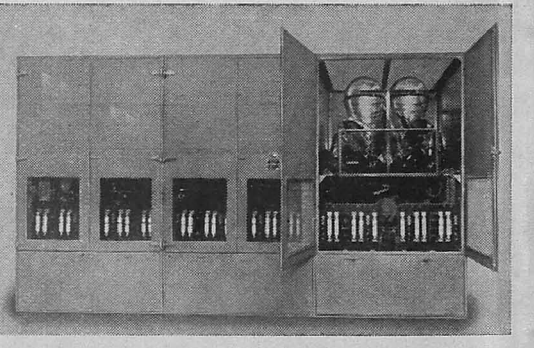
A train passing one of the 14 Hewittic Rectifier substations on the Liverpool-Southport line. These have an aggregate capacity of 24,260 kW and supply 93 miles of electrified track. Hewittic Rectifiers installed on other sections of this region total 47,300 kW



LONDON TRANSPORT RAILWAYS

The 4,000 kW Bond Street substation, equipped exclusively with Hewittic Rectifiers. The plant comprises four 1,000 kW combined rectifier and enclosed air-cooled transformer units. This company is also responsible for the supply and installation of all A.C. and D.C. control gear. Some 90,000 kW of Hewittic Rectifiers have been supplied to the London Transport Executive.





CANADIAN NATIONAL RAILWAYS

The electrified section of the Canadian National Railways, comprising some 70 track miles in the vicinity of Montreal Terminal, is supplied with D.C. by Hewittic Rectifiers in two 3,000 kW substations at Central Station and Saraguay. The photographs show left, a train leaving Mount Royal Station, and right, one of the four 1,500 kW equipments in service. These are designed for operation at 3,000 volts, D.C.

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New Suburban Electrical Coaches in Service

INDEPENDENCE DAY 1956 was a milestone in the Bombay Suburban electrical services of the Central Railway for, on the evening of that day, the first twelve new coaches out of an order for 149 were put into service.

The first electric train in India started out on its inaugural run on the 3rd February 1925, over the Harbour Branch line of the ex-G. I. P. Railway, bound for Kurla. This electrified service was introduced with a stock of 52 coaches. By stages, the electrified suburban services were extended and by March 1929 electrification of all suburban lines upto Kalyan was completed, whilst the number of electrical multiple unit coaches had increased to 92. Progressive additions, to meet growing traffic requirements, took the number to 206 coaches in 1941 and to 270 in 1951. The 64 new coaches which were put into service in 1951 were of light-weight construction and of an integral type. They represented a marked all-round improvement over the old stock.

Suburban traffic over the past sixteen years has grown rapidly due to the growth of Bombay City and its suburbs, the sharp increase in population and the much greater level of Industrialisation. Against 34 million passengers who travelled in 1939-40, 159 million travelled in 1955-56 over the Bombay Suburban section. Not only did passengers grow in numbers, but the average length of their journeys increased as workers went farther from their work to find a home in outlying suburbs.

The Central Railway however has put all its available coaches to maximum use to minimise the overcrowding caused by so phenomenal an increase in traffic. According to figures compiled and published by the International Railway Conference Association in their October

(Continued on page 21)

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Role of Roller Bearing Axleboxes in Locomotive Manufacture

By W. T. Thompson, A. M. I. Loco. E.

ONE of the most imposing exhibits at the Transport Pavilion of the South Bank Exhibition during the Festival of Britain was the Indian Government Railways broad gauge W. G. Class locomotive which was built by The North British Locomotive Company Ltd., Glasgow.

This freight locomotive of 2-8-2 wheel arrangement is one of many built for India in the United Kingdom. It is significant that the Indian Government Railways, after many years of experience on various railways in India, have adopted a progressive policy of fitting roller bearings to locomotive, carriage and wagon axles.

The W. G. class locomotive is equipped with SKF spherical roller bearings on all carrying axles and on the tender axles, and roller bearings are similarly fitted to broad gauge W. P. class and metre gauge Y. G. and Y. P. classes. This policy has been extended to other, lighter classes of locomotives for 2' 6" gauge, such as the Z. B. Class as built by Hudswell Clarke & Co. of Leeds. Others of the same class are in course of erection by W. G. Bagnall Ltd., Stafford. Many Indian classes of locomotives have been similarly equipped.

Experience has shown the advantages which accure from the use of roller bearings and these may be summarised under the following headings :—

(1) The starting resistance of a roller bearing coach or wagon is reduced by about 85%. With locomotives the resistance of the driving mechanism has to be taken into account, and therefore the percentage reduction in the starting resistance will not be so great, but comparisons with plain bearings will show an appreciable advantage in favour of the roller bearings. Increased effort is therefore obtained at the drawbar, and there is also a reduction of the running resistance, permitting higher speeds and improved time schedules.

(2) Increased availability of motive power. The mileages between major shoppings can be at least doubled when all axles are roller bearing equipped. The increased earning capacity of the locomotive more than justifies the increased capital outlay on the roller bearings.

(3) Wear and tear of the locomotives is reduced. The roller bearings maintain their efficiency throughout their life and their running qualities do not deteriorate because (a) the journals do not wear and (b) radial and lateral play in the bearing remain the same. Play in the guides is also eliminated by the use of wear-resisting steels on the horns and boxes. Pounding effects on the coupled boxes of steam locomotives are therefore minimised and the carrying boxes can be controlled within close limits in the guide.

(4) Reduced wheel skidding at starting resulting in fewer flats on the tyres. There are cases where the wheel tyres have had over 50% longer life and this factor has increased the permissible mileages between shoppings for tyre turnings.

(5) Hot boxes, a very prevalent problem in India with plain bearings, can be completely eliminated. It is an important requisite that the roller bearing must be correctly selected for size and life potentiality, which ensures that under normal working conditions roller bearings will have long trouble-free life and adequate reserve capacity for the abnormal conditions that must be met in service, especially in India where monsoon conditions can cause rail irregularities due to subsidences. Roller bearings need no attention on the line and long distances can be run at increased speeds without risk of hot boxes.

(6) For carriage stock, reliability and smooth running with reduced maintenance costs on tyres, and axles might be cited as the main advantage.

(7) For goods wagons, the roller bearing is proving of immense value. The increase in the permissible pay load per train alone justifies the capital investment. Reliability and freedom from hot boxes are factors which particularly commend the roller bearing for goods wagon work. The roller bearings is proving indispensible for oil wagons and for wagons carrying other inflammable substance where hot boxes can lead to extensive damage due to fire, and for high-speed goods wagons carrying perishable foodstuffs. The very low starting effort of the roller bearing wagon avoids the need for the slack couplers required with plain bearings where it is necessary for the effort at the drawbar progressively to start the wagons from the front to the end of the train. The slack coupler causes heavy wear and tear on the wagons by the frequent impacts between the buffers of the individual wagons

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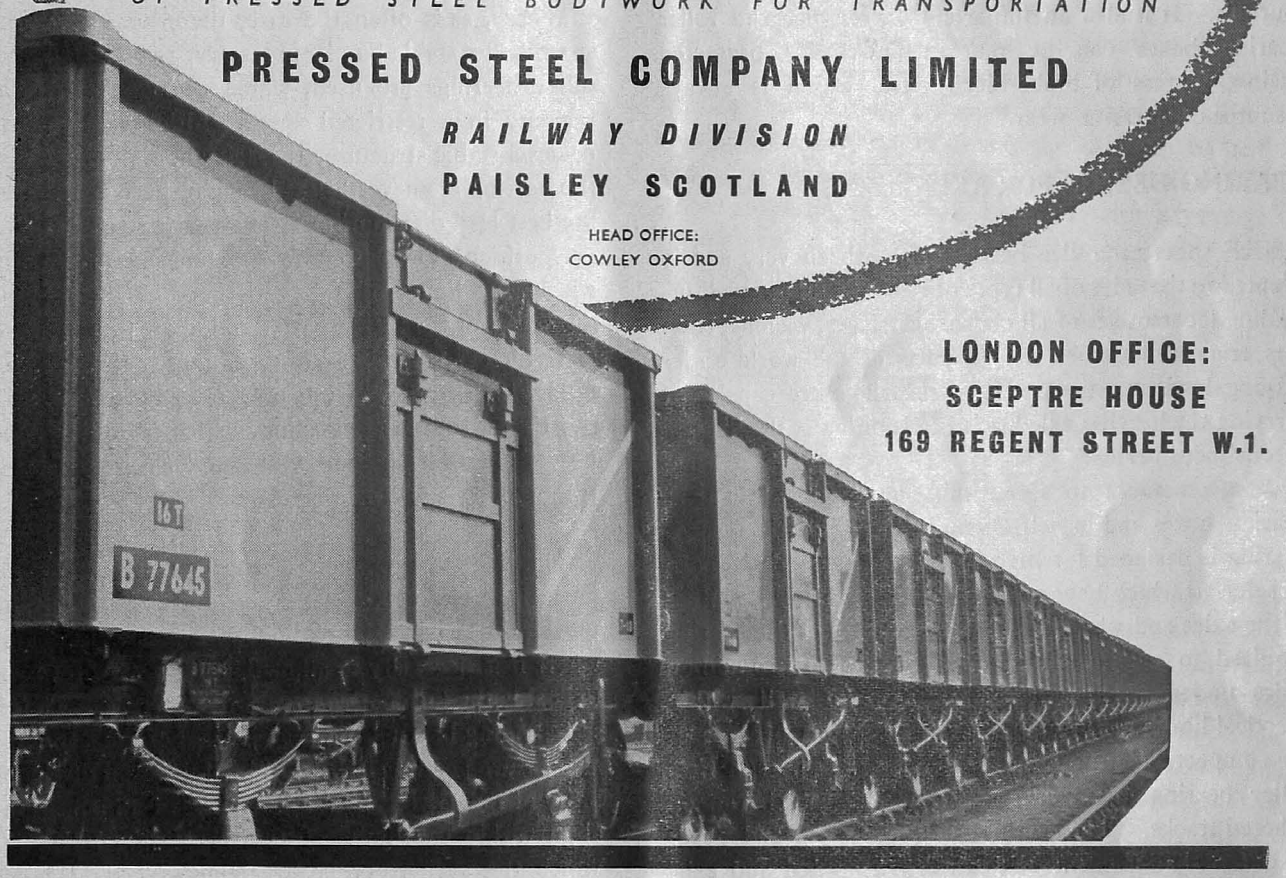

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in the train, which limit the safe speeds at which the trains can be run. Screw-coupled roller bearing wagons that are power-braked permit increased train speeds, and greatly facilitate the transport of goods, permitting a quicker turn-round of wagons and thereby increasing the pay-load per wagon per annum.

(8) The roller bearing axlebox is enclosed to prevent the ingress of grit and water into the bearings. The normal types of seals on plain bearing axleboxes do not offer the necessary protection to the axles and under dusty conditions of operation it is very easy for abrasive matter to get into the boxes and wear the journals. It is also an important factor that the roller bearing boxes can be more satisfactorily protected against ingress of brake-block dust, which is always a source of abrasive wear.

BEARING DESIGN FOR AXLEBOXES

SKF spherical roller bearings have been very widely adapted to the axles of all types of railway rolling stock including locomotives of all classes, carriages, wagons, tram cars and are running in all parts of the world under varying load conditions. These bearings are capable of carrying the heaviest axle loads and running at the highest speeds met in railway practice. Deliveries of these bearings now amount to a few millions, mounted in twin bearing boxes and in self-aligning boxes. This type of bearing is designed for high load capacity, and sizes can be selected which have a life expectation greater than that of the axles and wheels. The proportions of the bearing required to ensure a calculated life up to two million miles under specified axle loadings are well within practical limits for most railway applications because of the compact construction of the bearing. The spherical roller bearing has two rows of rollers which run on sphered tracks. The bearing is self-aligning and needs no external adjustment. It carries both radial and axial loads and is designed to serve as a location unit, enabling it to carry, in addition to the normal journal loads, the thrust loads that are imposed on the axle journals thus obviating the need for a separate thrust bearing. When design circumstances permit it is recommended that this type of bearing be used as a single unit, taking full advantage of its self-aligning properties.

TYPES OF ROLLER BEARING AXLEBOXES

An ideal suspension is the design adopted for the inside crank axle of the British Railways high speed Pacific locomotives " Sir Wm. Stannier F. R. S." and " City of Salford ". Here the load is suspended and full advantage in taken of the self-aligning properties of the bearing, enabling the box to align with the frames. The ability of the box to align about the bearing centre permits a full thrust face on the guides whereas with rigid boxes it is normally necessary to restrict the thrust face areas by bevelling off the guide faces, thus allowing the box to take up an inclined position in relation to the frames. The self-aligning bearing is also mounted singly with top-loaded boxes when the boxes are closely controlled laterally in the guides, and is commonly used on the inside journals of locomotive bogies and coupled axles.

Where, as is often the case, there are restrictions in space and a stable box is necessary, two SKF spherical roller bearings are used, which provide the maximum capacity in a restricted space. Although the box becomes a stable structure, the self-aligning properties of the bearing are nevertheless brought into use to ensure the best load distribution. The bearing outer races take up positions in relation to the housings and journals, within the limits of the variations in the machining tolerances of the fitting parts, and allow the box castings to flex under variable load conditions. In other words the load is spread over the four rows of rollers without any risk of roller edge loading, which can occur with the use of non-self-aligning types under the influence of tilting forces applied externally.

The cannon-type box is often necessary for inside journals in view of the axle end-float which is required on some types of boxes with coupled axles, for instance, where it is necessary to allow float of some of the axles to enable the locomotive to negotiate curves. The SKF self-aligning bearings on each journal of the cannon box also ensure good load distribution by reason of the flexibility of the casting and the ability of the bearings to align within the limits of the machining tolerances to which the various parts are manufactured. Moreover, a fact of some importance, bearings of this type can give under axle flexures, without heavy concentration of loads at the roller edges as with rigid types of roller bearings.

A unique method of increasing the box load capacity while maintaining the same bearing sizes, or of permitting the use of a smaller box for carrying the same load, where a twin bearing box is loaded by means of a saddle, which spreads the load over the maximum number of rollers. When the load is directly applied above the bearing, it is distributed over those rollers directly underneath whereas this design spreads the load over a much larger number of rollers thereby reducing the load per roller and in turn appreciably increasing the load capacity.

The cannon-type box is the type used on Y. P. and Y. G. class locomotives on the leading four-wheel bogies and two-wheel trucks respectively.

A similar design is used on the leading bogies and trucks of W. P. and W. G. class locomotives. The twin bearing box is the type used on the tenders of Y. P. and Y. G. class locomotives and a similar design is used on the hind truck of these locomotives as well as on the hind trucks of the W. G. and W. P. classes.

STEAM LOCOMOTIVE RETURN CRANKS

The SKF spherical roller bearing is used very extensively on the return crank of the Walschært link motion of many classes of locomotives in India and elsewhere. The application of SKF self-aligning ball bearings to this position was first carried out in England in 1916 and has become standard on British locomotives of various classes. Other classes of Indian locomotives are fitted with a similar design but with direct-mounted bearings.

The SKF spherical roller bearing is mounted on the return crank by means of a tapered withdrawal sleeve which facilitates mounting, and the eccentric rod can be conveniently withdrawn with the aid of an extractor nut. The bearing is grease lubricated and requires very little attention in service.

APPLICATIONS TO LOCOMOTIVE SIDE RODS

A number of successful applications have also been carried out to the side rods of locomotives, both in India and elsewhere. The design is a typical illustration of the application of SKF spherical roller bearings to the main driving pins, and here also the sleeve mounting is used to facilitate maintenance, permitting withdrawal of the rods for periodic adjustments and enabling the rods to be remounted whilst maintaining an adequate fit for the bearing races. Here also grease lubrication is used and maintenance attention is reduced to a minimum.

METHODS OF MOUNTING ROLLER BEARINGS

The bearings are shrunk on outside journals and have an interference fit adequate to secure them against movement under the maximum loads imposed. It is therefore not desired that such bearings should be removed during their life, although press equipment can be used to strip the races and to re-fit them if such a course is necessary in order to support the axles in chucks on the tyre turning lathes. However, with direct mountings it is preferable to support the axles on the lathe centres, leaving the bearings suitably protected in position. Alternatively the boxes can with advantage remain in position thus using the box body casting as a protection for the bearings. In this case it is only necessary to remove the inspection covers to gain access to the lathe centres and to provide a front shield to keep swarf from gaining access to the box.

There are several cases where it is not possible to grind the journals within the close limits of 0.001" to 0.0015" necessary for shrunk-on bearings. Furthermore, it is often an essential requirement that the bearings are removed at each tyre turning operation, both for examination of the journals for possible development of fractures, and to permit the axles to be held in chucks in the tyre-turning lathes. The well-known SKF sleeve mounting can then be used with advantage to permit easy withdrawal of the bearings, which can be remounted ensuring the correct fit tonnage for each mounting. The journals can be machined with a tolerance of approximately four times the tolerance necessary for the direct mountings. Standard plain bearing axle blanks and used axles can be conveniently converted to roller bearings using the sleeve mounting, in many cases making use of specially bored sleeves which still permit the use of standard bearings.

The goods wagon box, is a case in point. Sleeve mountings have become very popular and of late years a very large demand for these boxes has arisen in many countries. The solid box is of high tensile iron and can be withdrawn from the bearings for periodic inspections. The sleeve mounting does not call for the same high quality finish of the journals as the direct mounting. All parts are therefore easily renewable. In order to obtain a comparatively low-priced box, goods wagon bearings may be selected for a lower life expectation than is desirable in the case of locomotives and carriage bearings and a small percentage of them may fatigue earlier than 500,000 to 750,000 miles—the calculated minimum life to be expected from SKF spherical roller bearings for goods wagon stock. Ease in making replacement is, therefore, a considerable advantage. These boxes are also designed so that the axles can be entered in the tyre turning lathe without removing the boxes.

The sleeve mounting has a wide field for applications other than goods wagons and when cost justified its use it can be fitted with advantage, greatly facilitating the maintenance of the equipment.

INDIAN GOVERNMENT LIGHT-WEIGHT COACHING STOCK

The Indian Government Railways have adopted the sleeve mounting for their latest light-weight carriage stock, which is being constructed by S. W. S. Zurich (Schweizerische Wagons—und Aufzugefabrik AG, Schlieren, Zurich) and the box type used, is of special interest in that the suspension in conjunction with the SKF self-aligning bearing provides a box which has exceptionally good riding qualities. The helical side springs have good shock-absorbing qualities and the cylindrical guide posts which work as pistons in the oil-field chambers closely register the boxes laterally, eliminating end play of the axle. The vertical movements of the guide posts are cushioned in the oil wells. The guide posts are hollow, thereby forming a cavity for releasing the oil pressures that are induced during the downward movements of the posts. The oil pressure is gradually dispersed by release of oil through the bleed holes in the hollow posts. An air release hole is provided in the top of each posts.

The side spring pockets are situated well below the centre line of the bearing, thereby producing a self-righting effect when the box tends to tilt in relation to the axle under variations in the deflections of the springs. The box can align itself with the spring posts because of the self-aligning properties of the bearing, and therefore harsh riding when tilting forces are imposed will be avoided, particularly when travelling over badly conditioned rails.

The SKF bearing is secured by the tapered withdrawal sleeve previously mentioned, which is finally locked by an axle nut. With this design, maintenance is simplified in that the bearing can be withdrawn and remounted many times with simplicity, the correct fits being ensured each time the sleeve is passed into the bearing. The sealing labyrinth is constructed to allow the required tilt of the axlebox in either direction and efficiently retains the sealing grease, preventing the ingress of foreign matter.

The design is as standardized for carriages on the Swiss Federal Railways and is similar in general construction to that adopted by the Indian Government Railways for light-weight carriage stock. The Indian Government Railways have therefore taken advantage of this design development, which makes full use of the design characteristics of the SKF self-aligning bearing, to obtain the best riding qualities.

LUBRICATION

Roller bearing axleboxes can be designed for oil or grease lubrication. With the former it is unnecessary to top-up the axleboxes fairly frequently whereas with grease lubrication it is possible to run the boxes on one greasing for long periods of service.

In India, where large differences in day and night temperatures lead to internal sweating of the axleboxes, soda base greases can be used to afford full protection to the bearings against rusting in service. Such greases can absorb an appreciable amount of water without losing their protective and lubricating properties.

NEW POST FOR FORMER INDIAN RAILWAYS CHIEF COMMISSIONER

Sir Arthur Griffin, who was Chief Commissioner of Railways in India from 1944 to 1946, has been appointed adviser on economic development to the U. K. High Commissioner for Basutoland, Bechuanaland Protectorate, and Swaziland. This has been announced in London by the Commonwealth Relations Office.

When in the United Kingdom, Sir Arthur will be available for consultations with the Secretary of State for Commonwealth Relations.

Sir Arthur retired from the post of Chairman of the Rhodesian Railways in 1954. He had previously served in Iraq, but most of his career was spent in India, where he held a number of railway appointments. He was Chief Commissioner of Railways from 1944 to 1946.

Additional Trains to be Introduced

MOVE TO EASE OVERCROWDING ON RAILWAYS

(A resume of a speech by Shri Lal Bahadur Shastri, Minister for Railways & Transport at the fifth meeting of the National Railway Users Consultative Council at New Delhi on 20—7—56)

20 Additional trains on the broad gauge and an equal number on the metre gauge would be introduced, and in addition, about 200 trains would be strengthened with additional coaches" said Shri Lal Bahadur Shastri, Minister for Railways and Transport while addressing the fifth meeting of the National Railway Users' Consultative Council at New Delhi The Minister further stated ,that to cope with overcrowding on railways, it was proposed to provide additional transportation capacity of 23% on the metre gauge and 10% on the broad gauge during the second Five Year Plan period.

Referring to the progress made by the Railways in the field of operation during the busy season from November 1955 to April 1956, the Minister revealed that loadings on the broad gauge rose by 7.7 per cent and on the metre gauge by 13.7 per cent. Improvement was also made in regard to the transport of coal generally and its movement through such busy points as Mogulsarai. There had also been steady increase in the transhipment performance at several break of gauge points, Shri Shastri said, as a result of which it had been possible to remove restrictions on the booking of goods traffic via Poona, Manduadih and Viramgam, all of which have in the past been serious bottle-necks. There had further been marked decline in the outstanding registrations for wagons.

However, the Minister warned that inspite of this progress, the Railways would have to face enormous difficulties in respect of transport of goods. Shri Shastri said that we were already faced with increased production in different industries for which the corresponding transport capacity was not available and yet the targets of production were being raised further for coal, cement and foodgrains. Referring to the expected shortfall in goods traffic during the second Plan, he affirmed that the Railways must be enabled to make commitments immediately for rolling stock and line capacity to become available in the fourth and fifth years of the Plan.

Shri Shastri revealed that in the present allotment made to the Railways the Ministry had programmed for the following projects: Doubling of 1,600 miles of track at Rs. 96 crores; other line capacity works at Rs. 70 crores; track renewals at Rs. 100 crores; rolling stock including diesel engines at Rs. 380 crores; electrification at Rs. 80 crores and new lines for steel plants at Rs. 66 crores.

The Minister further stated that while maximum use of rolling stock and track would be made, the efficiency and performance of the Railways would have to be improved. In this connection, he referred to the recommendations of the efficiency Bureau and the introduction of the Divisional System on those railways where the system did not at present operate.

Speaking on passenger transport, the Minister stated that despite the limitations of line capacity and rolling stock which continue to exist, it had been possible to increase the daily average passenger train mileage from 177,909 during 1954–55 to 179,640 during 1955–56 on the broad gauge and from 104,450 to 107, 141 on the metre gauge.

Referring to the suggestion of Prof. Galbraith, an American Economist, to discourage travel on Indian Railways, the Minister affirmed that there was very little luxury travel on our Railways. However, travel in connection with various melas and marriages, he said, could be reduced considerably.

Speaking of passenger amenities, Shri Shastri announced that a fully air-conditioned vestibuled train mainly consisting of third class coaches was likely to be introduced on one of the main trunk routes from October 1st. The fully vestibuled third class train introduced from October 2nd, last year between Delhi and Howrah had proved popular. Similar trains had since been introduced on other main trunk routes, viz., Delhi-Madras, Madras-Howrah and Madras-Bombay.

Referring to departmental catering on Railways, Shri Shastri stated that the Departmental system was on the whole satisfactory and it was proposed to extend it to more stations during the current year.

Referring to the heavy burden of responsibility that would fall on the Railway Board during the implementation of the Five Year Plan, the Minister said that the Railway Board had been strengthened on the highest level by the inclusion of five additional members, who had taken over charge from June 25, 1956.

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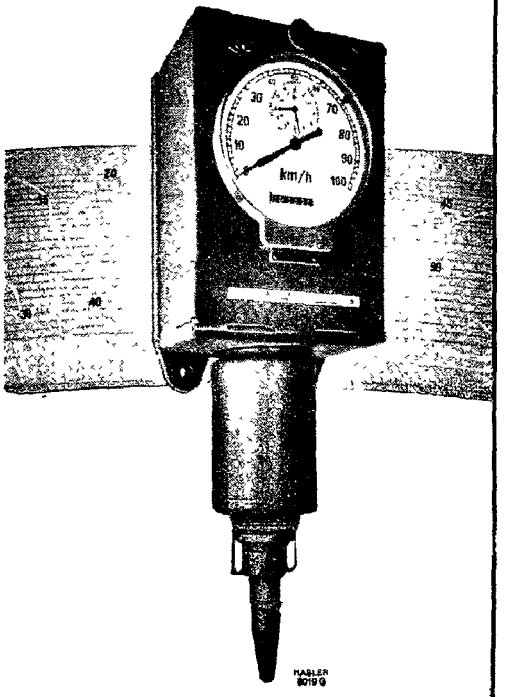

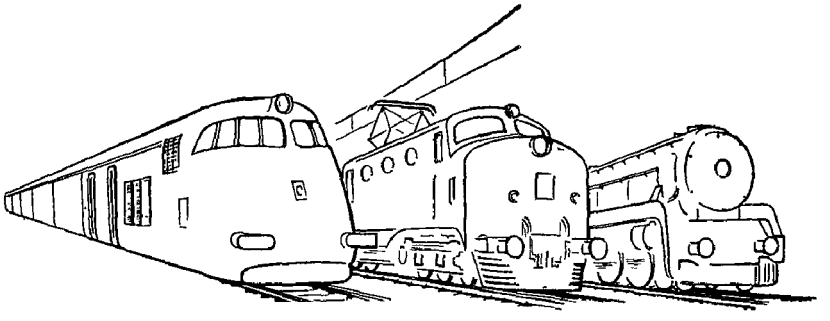

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The Full-Elastic Catenary-Warped Contact Line for Railways

By Mathias Wittgenstein, Grad. Engineer

An exposition of the requirements for constant reception of current without sparking, even at high speeds, followed by a description of the various processes involved when the current receiver slides along contact lines of the vertical catenary or of the catenary-warped type of suspension.

GENERAL ASPECTS

WITH the exception of the Diesel electric locomotive, all electric locomotives depend on being fed electric energy by suitable means. Of the various methods possible (e. g., by contact rail), the electric overhead contact line has proved to be the most efficient and economical. The pantograph of the electric locomotive receives the current from the contact line, which is suspended over the axis of the track from insulated suspension points, and conducts it to the engine. In spite of its being an essential accessory to electric railways, the overhead contact line is a subject considered of little importance and, consequently, sadly neglected by technical research. In the following we shall try to explain the technical significance of the contact line with regard to the electric railway it serves.

The present day engineering skill and knowledge would permit of the construction of electric locomotives and railway systems for speeds of up to 120 miles/h, and even higher on long straight stretches. Were one to go about erecting a contact line system suitable for such speeds according to the art commonly practised in this field, one would, however, encounter enormous difficulties inasmuch as already at speeds of around 80 miles/h the

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vertical type of catenary suspension now generally used is absolutely inadequate as far as current reception and wear and tear on the pull-overs are concerned, and excessive sparking causes waste of current as well as injury to the locomotive engine and to the contact wires.

The constant elasticity of the contact wire in vertical direction along the whole stretch and the position of this wire in relation to the track may be considered two of the most essential factors for the uninterrupted feeding of current without sparking which, in turn, is the main requirement for a good contact between pantograph and wire. A further requirement is that the contact network be cheap, i. e., economical with regard to construction, operation and maintenance.

Nowadays these requirements can be fulfilled to a great extent by the so-called catenary-warped full-elastic contact line which has been developed in the course of many years' exhaustive theoretical research and practical test by the Swiss firm of Kummler & Matter, Ltd., Zurich, and which this firm has been using for some years with highly satisfactory results.

In the following we shall give a general description of the most important technical features leading up to the most modern developments in contact line design, viz., the catenary-warped full-elastic type.

As every passenger has experienced, any train, including the locomotive, is subject to vibrations, shocks and oscillations which increase in intensity when the travelling speed increases and are produced, partly by the track joints, and partly by minute and almost invisible imperfections of the rail surface.

In order to insure continuous contact between current conductor and current receiver, i. e., the copper contact wire and the pantograph, all vibrations and oscillations and besides, the sag of the contact wire must be compensated for. Compared to the work to be performed, the pantograph sliding along the contact wire under a pressure of from 10 to 15.5 lbs. is rather an inert instrument. Where the pantograph is not capable of absorbing all oscillations, the contact line must complete the fulfillment of this requirement, for which purpose it must be elastic and resilient, thereby guaranteeing reception of current without sparking

Fig. 1 shows the catenary curve of a wire (or cable) suspended from points A and B with tensile stress S. In the event of A and B being of equal elevation, the lowest point of the sag is in the middle between these two points. In the resting position of the wire the

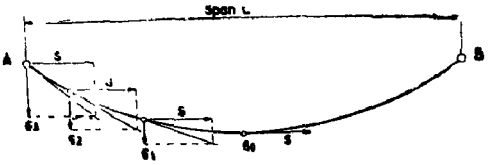


Fig. 1 Catenary curve of a wire in the resting position.

horizontal tensile stress is the same at every point thereof. Corresponding to the curve, of the wire, the weight component acting vertically on the wire is heaviest at the points of suspension and diminishes to zero at the center of the span.

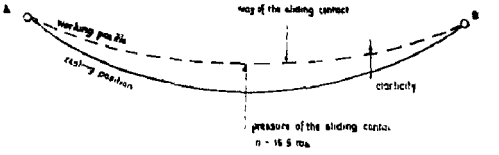


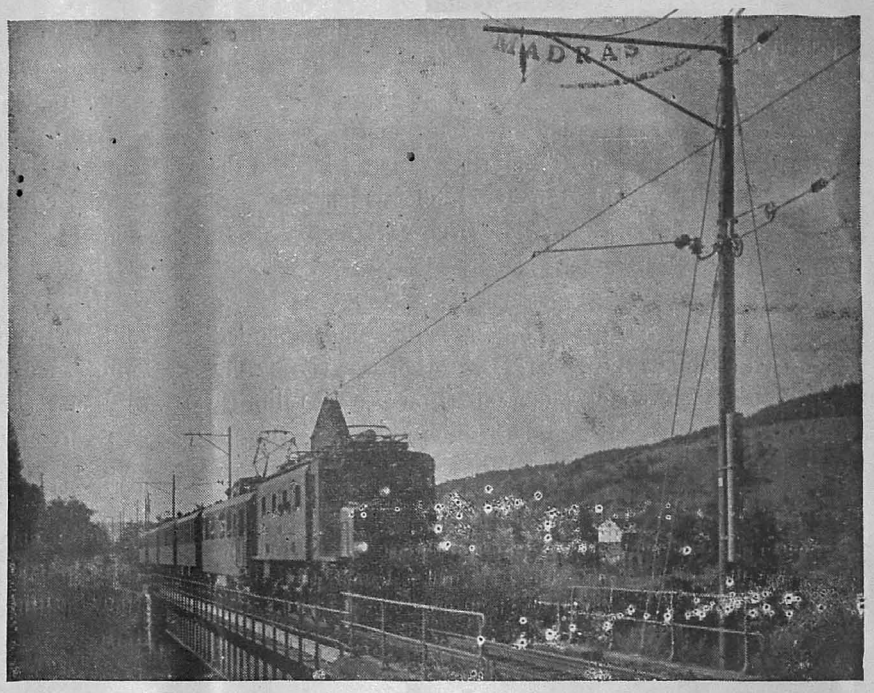
Fig. 2 Catenary curve of the wire while the pantograph is sliding along.

THE VERTICAL CATENARY CONTACT LINE AND SIMILAR SYSTEMS

The initial cost of a contact line depends above all on the number or suspension points (poles or masts) used, for which reason the spans between these points are strung as long as possible, and almost all railway contact lines are of the catenary type. Fig. 3 shows a vertical catenary contact line the contact wire of which is suspended by means of several hangers from the catenary cable. To achieve uniform wear on the contact carbon, the contact wire is strung in a zig-zag line above the axis of the track and supported from the side by insulated pull-overs attached to each mast.

A contact wire suspended vertically from a catenary cable is of an elasticity similar to that of an overhead line as shown in Fig. 2. This fact and, above all, the weight, or rather, the mass inertia of the necessary pull-overs allow the pantograph to raise the wire higher in the middle of the span than it is at the suspension points (cf. Fig. 4) which proves how uneven the elasticity of the vertical catenary type of contact lines is.

The progress of the pantograph along the contact wire of a catenary line is accompanied by a wave, produced by the pressure of the contact and which should have the same amplitude at every point along its path, if current is to be received without sparking and under a constant contact pressure. In other words, the progress of this undulation must not be disturbed or interrupted by uneven elasticity of the wire or by so-called hard points in the line, such as occur at the pull-overs.



right :

Fig. 3 15kv Vertical catenary contact line.

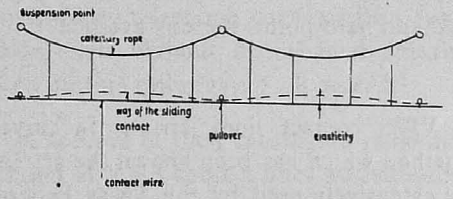


Fig. 4 Vertical catenary contact line-Vertical section.

Thus the problem to be solved was to find a type of contact line having equal elasticity at all points of the contact wire, even at those where it is pulled-over. The pull-overs being a cause of unevenness, a method was sought whereby they could be omitted.

Railway contact lines embodying some elastic qualities had been laid in Germany already in the thirties, but the necessity for using an auxiliary catenary cable at the suspension points so complicated their erection as to make it very difficult and correspondingly expensive. Trials were also made with the so-called crossed-catenary type of contact line shown in Fig. 5 in each span of which contact wire and catenary cable exchanged functions.

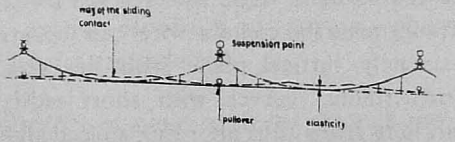


Fig. 5 Vertical crossed-catenary contact line-Vertical section.

This type normally requires rigidly suspended contact wires and catenary cables, however, as the regulation of the weight component, e. g., by swinging outriggers, is connected with great expense. But because this method also requires pull-overs, and, further, because the pantograph has to lift one contact wire at the suspension points and 2 wires at the crossing, points, the path of the pantograph as shown in Fig. 3 is by no means the desired even line, and extensive sparking is produced at higher running speeds. Besides, due to the afore-mentioned hard points, wear and tear become noticeable at certain points of the contact wire after only few years' use. Finally a solution of the problem was offered by the so-called catenary-warped contact line (abbreviated VWS).

THE CATENARY WARPED (VWS) CONTACT LINE STRAIGHT STRETCHES

The erection of VWS contact line is quite simple. The catenary cable is firmly suspended in a sharply pointed zig-zag line above the axis of the track. The contact wire is suspended by the cable by from 4 to 6 hangers per span, and a constant tensile stress is achieved through the use of weights. The weight of the contact wire in combination with its tensile stress results in a slanting position of the hangers and in a horizontally undulating line of the wire (cf. Fig. 6). The nearer

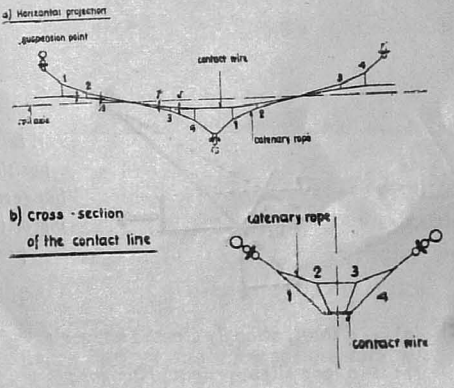


Fig. 6 Catenary-warped contact line in straight line.

(a) Horizontal projection (b) Cross-section, hangers 2 and 3 short, strongly slanted ; hangers 1 and 4 long, slightly slanted ; angles at the point of suspension.

the hangers are to a mast, the longer and the more slanted they are.

Two forces are at play in each hanger, viz., the vertical specific weight G. of the contact wire and the horizontal pull Wz caused by the angle which the wire makes at the point of suspension from each hanger. In Fig. 6 these angles are designated.

When that part of the contact which is suspended from such a slanted hanger is pressed upwards by the pantograph, it becomes apparent-within certain limits, naturally-that, the longer and the more slanting (up to approx. 45° from the vertical) the hanger is, the higher the pantograph can lift the contact wire, the more elastic the contact line becomes (cf. Fig. 8), i. e., the greater the difference in height h between the resting and the working position of the wire becomes.

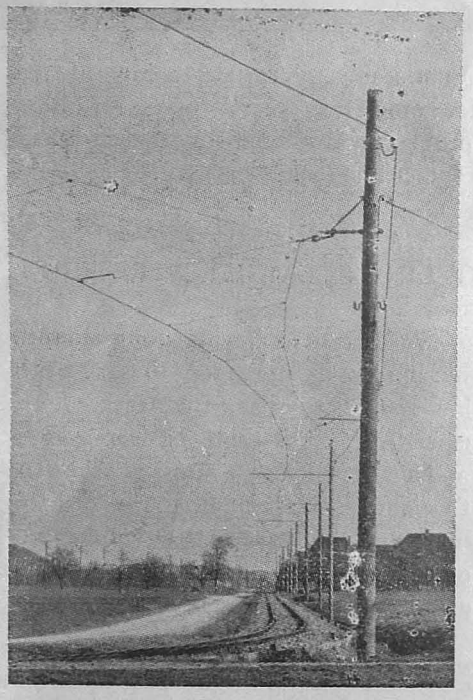


Fig. 7 The catenary warped contact line-Entrance in a curve.

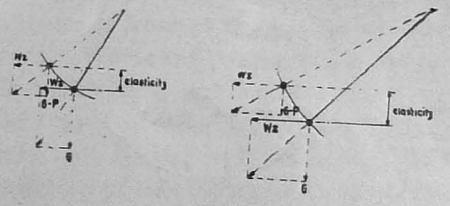


Fig. 8 Working position of the hangers depending on the contact pression.

(a) = a short, strongly slanted hanger ;

(b) = a long slightly slanted hanger ;

G = weighty of the wire ; G — P = vertical weight components in working position ; h = elastic deviation from perpendicular ; Wz = horizontal pull from the contact wire angle ; P = vertical contact pression by the pantograph.

This fact signifies that, according to the catenary-warped type of contact line shown in Fig. 9, the pantograph presses those parts of the contact wire suspended from the longer and more nearly horizontal hangers 1 and 4, which are located near the suspension points, equally as high as those parts suspended from hangers 2 and 3 which, as such, deviated less from the perpendicular, but the lift of which is increased by the elastic deviation of the catenary cable itself. The suitable location and length of the hangers is of utmost importance for attaining the desired constant elasticity all along the contact wire at lowest initial cost. Pull-overs are obviated and hard points thereby avoided.

(b) CURVES

Fig. 9 shows VWS contact lines strune in curves according to a method which has been known the art for sometime and is extensively used by the Swiss Federal Railways.

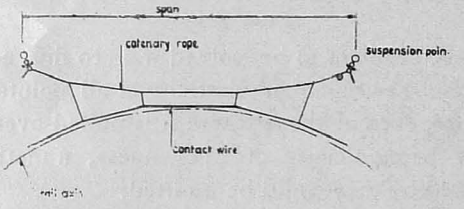
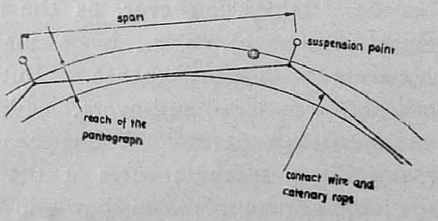


Fig. 9 The catenary-warped contact line in curves, in a pole-economizing kind of construction. Horizontal projection.

The catenary cable is strung overhead outside the curve of the axis of the track, and the contact wire is suspended therefrom by hangers. The weight component of the wire in combination with the horizontal pull determines the position of the contact wire.

The same principle concerning the even lift of the wire by the pantograph holds good for curved stretches as it does for straight stretches of VWS contact lines. By this arrangement the contact wire can be strung on an approximately vertical plane with the axis of the track. Furthermore, curves with short radii can be served with long spans thus affording an economizing of poles. Just the contrary is the case when the catenary vertical type of contact line is used, inasmuch the spans



Horizontal projection

Fig. 10 The catenary vertical contact line in curved stretches ; limited spans.

are then especially short for sharp curves because, as shown in Fig. 10, their contact wires are strung in a straight line between suspension points and must, therefore, be brought within reach of the pantograph by numerous poles.

A certain electric railway with a contact line system of the VWS type has been supplied by the Swiss firm of Hasler Ltd., Berne, with high-frequency installations serving telephone connections between the locomotives and the station over the contact line. Thanks to the perfect current reception conditions due to the VWS contact line, telephone conversations can be carried on during runs without disturbances (maximum travelling speed on this railway = 37.28 miles/h)

On account of their causing no radio disturbances, the erection of VWS contact lines was subsidised in Switzerland by the Federal Postal Authorities.

(4) GENERAL CONCLUSIONS

As a result of many years' practical experience and of measurements taken from the VWS contact lines developed and laid by Messrs. Kummler & Matter Ltd., Zurich, the following conclusions may be drawn regarding this type of contact lines :

(a) Uninterrupted and non-sparking reception of current in combination with even contact pressure at all speeds, due to even elasticity along the whole line. Due to the lack of sparking during current reception on VWS lines, recuperation can be used, for example, without encountering the difficulties hitherto involved.

(b) Economic initial cost, due to pull-overs being superfluous and to the greater length of the spans, especially in curves, whereby less poles are required.

(c) Further economy achieved through the sharply zig-zag course of the catenary cable (cf. Fig. 12), due to its suspension from poles erected alternatingly on opposite sides of the track, for which only very short outriggers or none at all are necessary.

(d) Practically unlimited durability of the elastically suspended contact wire, due to the shock and vibration absorbing effect of the VWS type suspension. After it had been in use for 5 years with an average of 20 pantograph whettings a day, the VWS contact wire of the Yverdon-Ste Croix RR showed a diameter still within the manufacturing tolerance, i. e., revealing no noticeable wear and tear. The contact carbons of the pantographs averaged 150,000 miles. These qualities enable to economize in copper by using copper plated steel contact wire.

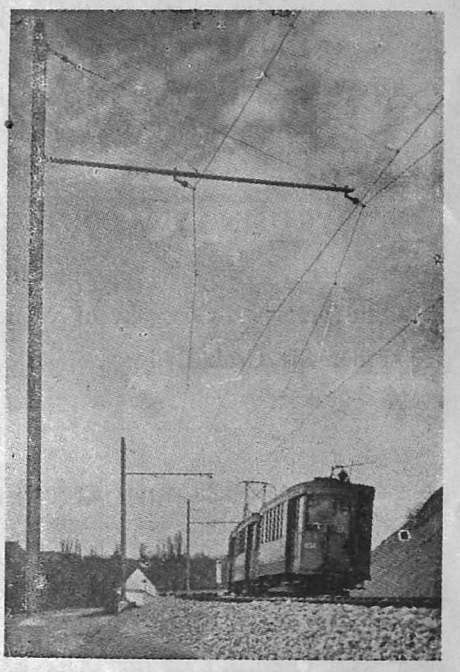


Fig. 11
15000 Volts A. C. 16 2/3 per warped contact line for fast trains.

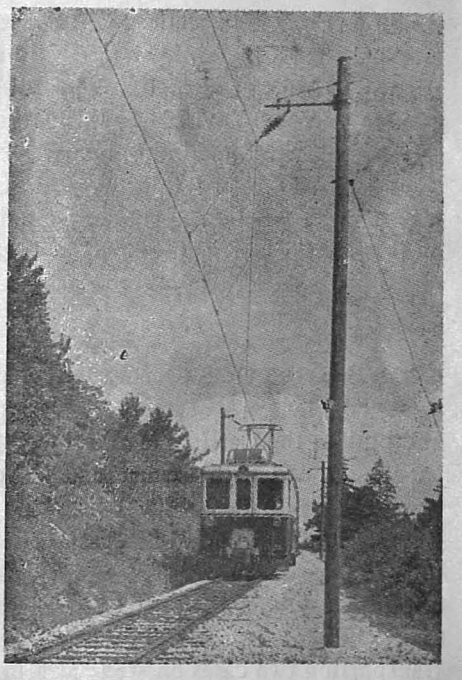


Fig. 12
Catenary warped contact line for double truck erected in pole-saving manner. Patent system Kummler & Matter.

(e) Simple layout and solid construction of the contact line entailing no replacement of hangers because these are constantly under

tension, both in the resting and in the working position.

(f) Insensitive to temperature, i. e., the contact wire remains horizontal[c] in summer and winter.

RAILWAYS USING VWS CONTACT LINES IN SWITZERLAND

Public Transport Company of Winterthur (tramway).

Yverdon-Ste Croix Railway,

Wynen Valley Railway,

Bremgarten-Dietikon Railway,

City Tramways of Shaffhouse (Engehof-Beringen stretch),

Tramways of Schwyz,

Sernf Valley Railway,

PSC Railway (La Chaux-de-Fonds Les Ponts de Martel stretch),

Public Transport Company of Basle (Hoehlebach stretch)

MEDICAL RELIEF AT DOOR-STEP OF RAILWAY STAFF

MOBILE DISPENSARY ON RAILS

A Mobile dispensary on rails for the purpose of rendering medical aid to the staff and their families residing at road-side stations was opened by Shri Mohanlal Sukhadia, Chief Minister, Rajasthan State, on 15th August, 1956, at Kotah. The dispensary car will operate in Kotah Division on this Railway. This dispensary is the first of its kind to be used on the Indian Railways and it is hoped to prove a great boon to the Railway staff. After the experience gained of its functioning on this division, it is proposed to provide such mobile dispensaries on rails in other divisions of this Railway.

The dispensary car has been designed by the Mechanical and Medical Departments of the Western Railway and built at the Carriage Workshops, Lower Parel. The car is equipped with modern medical equipment, drugs, and dressing to deal with day-to-day ailments amongst Railway Staff and their families. The internal arrangements in the car provide for a doctor's consulting room, a waiting room for the patients, a dispensary room and a surgical dressing room. There is also arrangement for transporting two cases on stretchers in case of acute illness or accident to the nearest Divisional hospital of the Railway.

The cost of the Dispensary car with the equipment is approximately Rs. 1½ lakhs.

The mobile dispensary van is provided with one doctor, one dispenser, a dresser and a dispensary peon who are permanently attached to this unit.

The mobile dispensary van will run from station to station on a scheduled programme for six days in a week on the section on which it operates, so that Railway employees and their families residing in road-side stations, where no medical aid of any kind is available, could be attended to on the spot and also can be followed up in the treatment without any hardship to the staff. By bringing medical relief to their door-step, railway authorities hope to increase the over-all efficiency of their staff and also ease pressure on railway hospitals and dispensaries which at present have to serve surrounding stations as well.

*** *** ***

RAILWAY APPOINTMENTS

THREE new senior appointments on the Railways have been announced.

Shri N. Kamalakar Rao, Director, Establishment, in the Railway Board, has been appointed Senior Deputy General Manager of Southern Railway, and his place has been taken by Shri P. H. Sarma who was previously Joint Director, (Transportation), in the Railway Board.

Shri R. W. Wilson, Deputy General Manager, (Personnel) of the Central Railway, has been appointed Director (Civil Engineering) in the Railway Board.

Shri H. D. Awasti, who was a member of the three-man Indian Railway delegation which recently returned from a study tour of China and Japan has been appointed Director, (Planning), in the Railway Board.

Paxman RPH Diesel Engines for Railway Traction

THIS article deals with the RPH Series II range of Traction type Diesel Engines, which includes models in 4-, 6-, 8-, 12- and 16-cylinder vee form. Extensive operational experience has resulted in many improvements in design. These not only give improved efficiency and performance, but also further simplify maintenance by allowing easier access to important parts of the engine.

These features include a large diameter crankshaft, chain drive to camshaft, single-cylinder heads, built-in water pumps and drives, and a double bearing is provided at the drive end of the crankshaft to permit direct coupling.

This latest version of the RPH engine—the RPH Series II—is dealt with in detail in the specification on the following pages.

The advantages of the RPH II engines lie in their compactness and low weight in relation to their wide power range, resulting in power units which are adaptable to all classes of locomotive in this power range, particularly where severe axle load limitations are in

ENGINE RATINGS

MAXIMUM TRACTION RATINGS OF THE RPH SERIES II ENGINE

	Speed	4 RPH		4 RPHX		6 RPH		6 RPHX	
	rpm	bhp	bmep	bhp	bmep	bhp	bmep	bhp	bmep
	1,000	133	88.5	167	110.5	200	88.5	250	110.5
TRACTION	1,250	167	88.5	208	110.5	250	88.5	313	110.5

		8 RPH		8 RPHX		12 RPH		12 RPHX		16 RPHX	
RATING		bhp	bmep	bhp	bmep	bhp	bmep	bhp	bmep	bhp	bmep
	1,000	267	88.5	333	110.5	400	88.5	500	110.5	667	110.5
	1,250	333	88.5	416	110.5	500	88.5	625	110.5	833	110.5

(bmep in lb./sq. in.)

Speeds up to 1,400 rpm may, under certain circumstances, be permissible on reference to the Makers.

The suffix 'X' denotes that the engine is pressure charged.

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

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

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

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

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

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

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

(Inserted in the interests of Travelling Public)

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).

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force. The multi-cylinder design provides a smooth torque, and the small stroke (7¾ in.) results in a moderate piston speed. All working parts are readily handled without mechanical aid, and particular attention has been paid to accessibility.

Full details of dimensions, weights, ratings, and a descriptive section are to be found in this article. It should be noted, however, that the particulars given in this article are not binding, and are provided for guidance only.

The traction rating represents the power which the engine will develop for normal railway operation. This rating is equivalent to the British Standard 12-hour rating as laid down is BSS 649: 1935 including Amendment No. 1: May 1936.

Normal conditions of temperature and altitude are regarded as follows:

(a) Ambient temperature up to 84°F (29°C).

Altitude: Up to 500 feet (150 metres) above sea level.

(b) Ambient temperature up to 78°F (25°C) at sea level.

ALLOWANCES FOR TEMPERATURE AND ALTITUDE

(a) 1 per cent reduction output for each 5°F (2.8°C) rise above 85°F (29°C) and reduction of 4 per cent per 1,000 feet (300 metres) for altitude over 500 feet (150 metres).

(b) The determination of derating allowance in the case of turbo-charged engines will be made by the Makers upon receipt of full information regarding site conditions.

FUEL CONSUMPTION—lb/bhp/hr.

		RPHL	RPHXL
Full load	1,250 rpm	0.42	0.42
	1,000 rpm	0.40	0.40
¾ load	1,250 rpm	0.41	0.41
	1,000 rpm	0.40	0.40
½ load	1,250 rpm	0.44	0.44
	1,000 rpm	0.43	0.43

Above consumptions are based on fuel to BSS 209: 1947 Class A.

Net calorific value: 18,300 BThU/lb (10,714 cals/Kg)

Viscosity: 45 secs (Redwood No. 1)

Sp. gr. : not exceeding 0.88

Fuel consumption figures are guaranteed with a tolerance of 5 per cent.

The Makers should first be consulted if fuel to any other specification is to be used.

LUBRICATING OIL CONSUMPTIONS

The consumption will vary between 0.5 and 0.75 per cent of the fuel consumption, depending upon the duty.

COOLING

Water and oil circulation rates and heat dissipation rates vary in accordance with engine outputs and applications, and therefore reference should be made to the engine makers for these particulars in order that the correct cooling equipment can be designed.

Net dry weights include, for normally aspirated engines: Dry exhaust manifold, air intake filters, lubricating oil filters, lubricating oil strainer, integral oil piping, water pumps, integral water pipes and manifolds, viscous

SCHEDULE OF WEIGHTS

Mark	Net	Dry	Water in Jackets		Oil in Sump		Gross	
	lb	kg	lb	kg	lb	kg	lb	kg
4 RPH	4,800	2,177	80	36	150	68	5,030	2,281
4 RPHX	5,050	2,291	80	36	150	68	5,280	2,995
6 RPH	5,975	2,710	120	54	225	102	6,320	2,866
6 RPHX	6,333	2,873	120	54	225	102	6,678	3,029
8 RPH	6,800	3,084	160	73	300	136	7,260	3,293
8 RPHX	7,190	3,261	160	73	300	136	7,650	3,470
12 RPH	9,875	4,479	240	109	360	163	10,475	4,751
12 RPHX	10,775	4,888	240	109	360	163	11,375	5,160
16 RPHX	12,950	5,874	320	145	585	265	13,855	6,284

damper and fly-wheel where required, duplex fuel oil filter and integral fuel piping.

For Pressure-charged Engines: As above, including turbo-chargers, but excluding intake air filters, which are integral with the turbo-chargers.

ANCILLARY EQUIPMENT

Individual applications may require provision of additional items, the weight of which is not included in the above table. Such items as fly-wheels, lubricating oil priming pumps and motors, couplings, 24-volt electric starting equipment and fabricated steel underbed require separate consideration depending upon the nature of the duty, type of transmission etc. We shall be pleased to submit full particulars upon receipt of enquiry.

DIMENSIONS

Engine Mark	E	F	A	B	C	D	G
4 RPH	48		44½		40		19¼
4 RPHX		56½		42½		39	19¼
6 RPH	57½		44½		40		19¼
6 RPHX		65½		42½		40	19¼
8 RPH	69 1/16		44½		40		19¼
8 RPHX		81 1/16		42½		47	19¼

	A	B	C	D	E	F	G	H
12 RPH		50	32	47	92		62⅝	
12 RPHX	58⅝		32	47	92	102⅞	62⅝	59¾
16 RPHX	59½		32	47	115	125⅞	62⅝	62

All above dimensions in inches.

PAXMAN RPH ENGINES

The engines are designed for direct coupling to traction generators where electrical transmission is employed, the complete power unit being mounted on a fabricated steel underbed.

For mechanical transmission, the engine and gearboxes are amounted independently to the locomotive frames with a suitable coupling for power transmission.

Features of the design include a one-piece cast crankcase which carries an underslung crankshaft in bearings amply proportioned and located in the crankcase by deep-fitting faces.

Hardened and tempered liners are specified to ensure maximum life of liners, rings and pistons.

Pressure-charged models are fitted with exhaust gas turbo-chargers, enabling the output to be increased without raising mechanical stresses.

CRANKCASE

This comprises a single casting of great rigidity carrying the underslung crankshaft in main-bearing housings of ample proportions. In addition to the usual main-bearing cap retaining studs, the caps on the 12- and 16-cylinder engines are further secured by horizontal transverse bolts. These through bolts assist in providing rigidity to the longer 12-and 16-cylinder crankcases. Provision is made in the crankcase for removal of pistons and connecting rods downwards.

CONNECTING RODS AND LARGE END BEARINGS

The connecting rods are heat-treated carbon steel forgings of 'H' section and are accurately matched for weight and balance. They are of fork and blade construction and are fitted with thin wall, prefinished, steel backed, copper-lead lined, lead-flashed bearing shells. The fork rod is attached by four fitted bolts to a high-precision machined large end block. The large end block carries the crankpin bearing and provides a chromium plated outer track for the oscillating blade rod bearing.

CRANKSHAFT AND MAIN BEARINGS

The heat-treated alloy-steel crankshaft is carried in steel backed, copper-lead lined, lead-flashed bearing shells, and has a rigid flange at the driving end for power transmission purposes. In the case of the 4-, 6- and 8-cylinder engines there is a smaller flange at the free end for auxiliary power take-off purposes.

Wide bearings ensure a moderate bearing pressure, and at the drive end, double bearings are arranged to provide adequate support for the larger superimposed weight of any driven unit.

CYLINDER BLOCKS AND LINERS

Cast-iron cylinder blocks carrying the prefinished dry-type cylinder liners are attached to the upper face of the crankcase. These cylinder blocks provide adequate water jacketing, and suitable cleaning facilities are provided. The cylinder blocks are cast in 2, 3- and 4-cylinder units and allow the maximum degree of standardization.

CYLINDER HEADS

The 4-, 6- and 8-cylinder engines are fitted with cylinder heads covering two and three cylinders each. 12- and 16-cylinder engines have single cylinder heads. The combustion chambers in all cases are of the Ricardo Comet, Mark III design.

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)

(Continued from page 1)

1953 bulletin, the annual aggregate mileage of the Central Railway's electrical multiple unit coaches in use was 96,000 whilst that of the British, Danish State, South African and London Underground Railways averaged 70,000 miles, 59,000 miles, 57,135 miles and 55,000 miles respectively. The Central Railway's latest figures of usage are even higher.

Such intensive use results in heavy wear and tear of the mechanical and electrical parts. On a detailed survey of the old 206 electric multiple unit coaches, it was found necessary to replace 106 of them by new coaches. The work of rehabilitation of the others has now been undertaken on a programme basis. The first 16 of the 106 coaches for replacement have already arrived in India, twelve having been put into use on Independence Day 1956 while the remaining four went into service in early September. The next lot of 8 coaches for the Central Railway are already being loaded in Italy and should go into service next month.

The Central Railway will receive in addition to 106 coaches on replacement account 43 new coaches, already on order for the Bombay Suburban Service, which will be on additional account. These 43 coaches will be used exclusively for relieving over-crowding by converting some of the existing 4-coach trains into 8-coach trains and by running additional trains, particularly in the peak period. The entire lot of 149 coaches are expected to be in service in less than 2 years time. Further order for another 33 coaches for the Central Railway, also on additional account, will be placed shortly in the Railway's drive to minimise over-crowding.

These new electric multiple unit coaches were manufactured in Italy by Bredas. Though generally similar in appearance and design to those commissioned in 1951, they incorporate several improvements and detailed refinement introduced for greater passenger comfort. Wider seats have been provided with more leg room for passengers. The new coaches have improved ventilation caused by a large number of fans. The total number of fans per unit in the new coaches is 90 as compared to 42 in the 1951 coaches and 39 in old coaches. A further improvement in ventilation has been achieved on these coaches by the provision of revolving cowls on the roofs.

The coaches are furnished with bright aluminium alloy fittings and seats in the first class coaches are of foam rubber. The interior decor is in pleasing colours of pastel blue and green. Incandescent lights replace the fluorescent lights which were introduced on an experimental basis in the 1951 stock. The level of illumination in this stock is much higher than that of the old stock which it replaces and is almost the same as that attained with fluorescent tubes in the 1951 coaches.

Each unit comprising four coaches is powered by eight traction motors aggregating 1400 horse power. These motors are capable of accelerating the fully loaded unit to a speed of 30 miles per hour in 30 seconds. The stock is designed for running at speeds upto 65 miles per hour. Electropneumatic brakes are provided on these units for rapid deceleration. Automatic air brakes are also provided for further safety.

SUBURBAN USERS' CONSULTATIVE COMMITTEE HOLDS FIRST TIME-TABLE MEETING

The Central Railway's newly constituted Suburban Users' Consultative Committee met in Bombay V. T. on August 28, 1956 under the Chairmanship of Shri D. P. Mathur, Senior Deputy General Manager. The members present were Shri Shantilal Zaveri, a Bombay Municipal Corporator, Shri B. R. Desai of the Thana Municipality, Shri Jaswantray G. Mehta, representative of the Passengers & Traffic Relief Association, Bombay, Shri B. P. Raheria, representative of the Kalyan Camps Passengers' Association and Sarvashri Jayantilal Mehta and Dhirajlal Modi non-official members of the Zonal and Divisional Railway Users' Consultative Committees.

Suggestions pertaining to train timings and allied matters, received from Members of the Committee, Passenger Associations and travelling public, were considered and some minor changes recommended for the time-table to come into force from October 1956.

INJECTION EQUIPMENT

The fuel pumps are of the monobloc type, each with four, six or eight elements, and totally-enclosed camshafts. They are gear-driven from the engine camshaft.

All engines are provided with fuel feed pumps to ensure a positive supply of fuel under pressure to the injection pump gallery. A service tank to provide gravity feed, and its associated independently-driven transfer pump, may be omitted if provision is made for a capacity vessel to be mounted on the engine, and charged by the feed pump.

The injectors are the single-hole pintle type spring loaded; they are readily accessible and may be removed without disturbing cooling water joints.

GOVERNOR

4-, 6- and 8-cylinder engines have integral fuel pump mounted governor. 12- and 16-cylinder engines, a flyweight hydraulic servo governor driven by bevel gearing from the engine camshaft, the main lubricating oil pressure acting as a medium to operate the fuel pump control. By this means a small and compact governor of great sensitivity has been evolved which gives full control throughout a wide speed range. A feature of particular value is the exceptionally light adjustment required which facilitates the setting of remote control. The governor is so arranged that, in the event of the failure of the lubricating oil pressure, the engine is shut down automatically.

LUBRICATION

Forced lubrication is employed throughout, by means of engine-driven pumps. The main pressure pump is of the gear type, driven from the crankshaft and having a large-bore, short, suction pipe. Oil is distributed to the bearings via a control valve, a large capacity filter and a distribution valve. The filter and valves are located externally to facilitate servicing. Supply to the valve gear and camshaft is at a reduced feed.

The sump is of sufficient, capacity to ensure long periods of operation without the addition of extra lubricant. It is fitted with a large-size drain for rapid emptying, and a dip stick for oil level indication. A second oil pump, of the same general design as the main pressure pump, is employed for the cooling circuit, which is therefore completely independent of the main pressure system.

CAMSHAFT AND VALVE OPERATING GEAR

4-, 6- and 8-cylinder engines: A one-piece camshaft of case-hardened steel, ground on all working surfaces, is housed within the crankcase between the cylinder banks. The cams operate the push rods via roller type followers carried in the cylinder banks. The camshaft is gear driven from the free end of the engine.

12- and 16-cylinder engines: The camshaft, of case-hardened steel is in halves, ground on all working surfaces, and carried in a detachable cambox secured to the top of the crankcase in the vee formed between the cylinder blocks. The cams run in an oil bath, and operate swinging tappet levers (with roller followers). The tappet lever and roller bearings are pressure lubricated. The camshaft is chain driven from the drive end of the engine.

PISTONS

The pistons are in aluminium 'Y' alloy and are heat treated. Rings are of high-grade cast iron and are five in number, three pressure and two oil-control. One oil-control ring is housed above the gudgeon pin and the other below.

Gudgeon pins are in a high percentage nickel, case-hardened steel, hollow bored and retained by circlips. Small-end bushes are of silicon bronze.

PRESSURE CHARGERS

Twin exhaust gas turbo-chargers are fitted in the case of the 12- and 16-cylinder engines, and a single exhaust gas turbo-charger for the 4-, 6- and 8-cylinder engines. Operating on the well-known Buchi principle, the pressure chargers are standard and fully tested machines. Exhaust piping connects with two turbine inlet ports of each charger, the outlets being ducted straight up through the roof of the locomotive. The air inlets are fed through viscous-type filters mounted direct on the turbo-chargers, or through remote filters and ducting, if desired.

Air delivery from the compressor volutes is by trunking to the engine inlet manifolds.

STARTING

The engine may be started either by separate electric starter motor, compressed air, or motoring by the main generator in the case of diesel-electric sets. Suitable

automatic starting arrangements can be made to meet individual requirements. Automatic lubricating oil priming can be provided by means of a motor-drived pump, the control of which is interconnected with the engine starting system.

CIRCULATING WATER SYSTEM

Centrifugal pumps, mounted at the free-end and gear driven from the crankshaft, are provided on all models. The design embodies a cast-iron casing which houses a bronze impeller and stainless-steel shaft. The shaft is supported in plain bush bearings pressure lubricated by engine oil.

Inlet manifolds are secured to the lower portion of the cylinder blocks by flanged joints, flexible hose connection being provided in the pump delivery piping. Outlet manifolds are connected to the cylinder heads by short pipes and are located above the vee between the cylinder blanks.

Thermostatically controlled bye-pass valves are recommended for temperature control and are available in a range of standard sizes, each embodying two, three or four of the same bellows-operated valve unit, the number depending on the total water flow.

In applying a Paxman engine to rail traction duty, various aspects of the installation call for close consideration, and the following notes, based upon experience in all classes of service, are offered for guidance.

MAIN DRIVE

Careful consideration is given to every application in order to ensure that the torsional vibration characteristics of the engine in conjunction with the driven unit shall be satisfactory. A fly-wheel is fitted where required and controlled flexibility is secured by choice of well-tried couplings.

Engines may be direct coupled to single-bearing generators, and a viscous-type damper is, if required, mounted on the free end of the crankshaft.

ENGINE CONTROL

Where multiple-unit operation is required, engine speed control may be effected by electro-pneumatic means and we have developed a simple and robust unit for this purpose. Alternatively, where single locomotive driving only is needed, the governor speeder lever may be actuated by mechanical means from the driver's controller. With electric transmission, an accurate reliable torque regulation system is available for incorporation in the standard hydraulic governor.

Protection against failure of the lubrication or water circulation systems may be provided by means of a range of standardised switch units, each of which is wired in circuit with an 'engine run' valve. This valve, which is of the electro-hydraulic type, is located in the lubricating oil supply pipe to the governor and remains energised to permit the engine to run, shutting down the engine when de-energised.

Engine 'stopping' may also be arranged by direct mechanical actuation on the fuel bar, and a centrifugally-operated trip for emergency shut down on overspeed is also available.

A wide range of instruments built to traction standards of robust design is offered either for remote mounting in the driving compartment or for housing in a resiliently-mounted panel on the engine.

ENGINE MOUNTING

Where mechanical transmission is used, the engine may conveniently be bolted direct to bearers which form an integral part of the locomotive main-frames. This is the usual type of layout adopted for shunting and industrial locomotives of the plate-frame type.

For lighter classes of vehicle, such as railcars, we can supply independent mounting of engine and transmission gear by three-point suspended sub-frame, with due allowance for relative movement provided by cardan shaft drive.

Diesel-electric traction power units incorporate a light-weight, yet robust, fabricated steel underbed, which forms the foundation member for engine and generator group. Although a standard pattern is employed, alterations may readily be made to suit the underbed to accommodate any particular foot-mounted generator.

It is, of course, important that the underbed should not be subjected to stresses on account of frame distortion, and that the machinery should be protected as far as possible from rail shocks. For this purpose, the Paxman steel underbed may be adapted to the conventional three-point trunnion and pedestal mounting system or arranged for support on uniformly spaced resilient pads.

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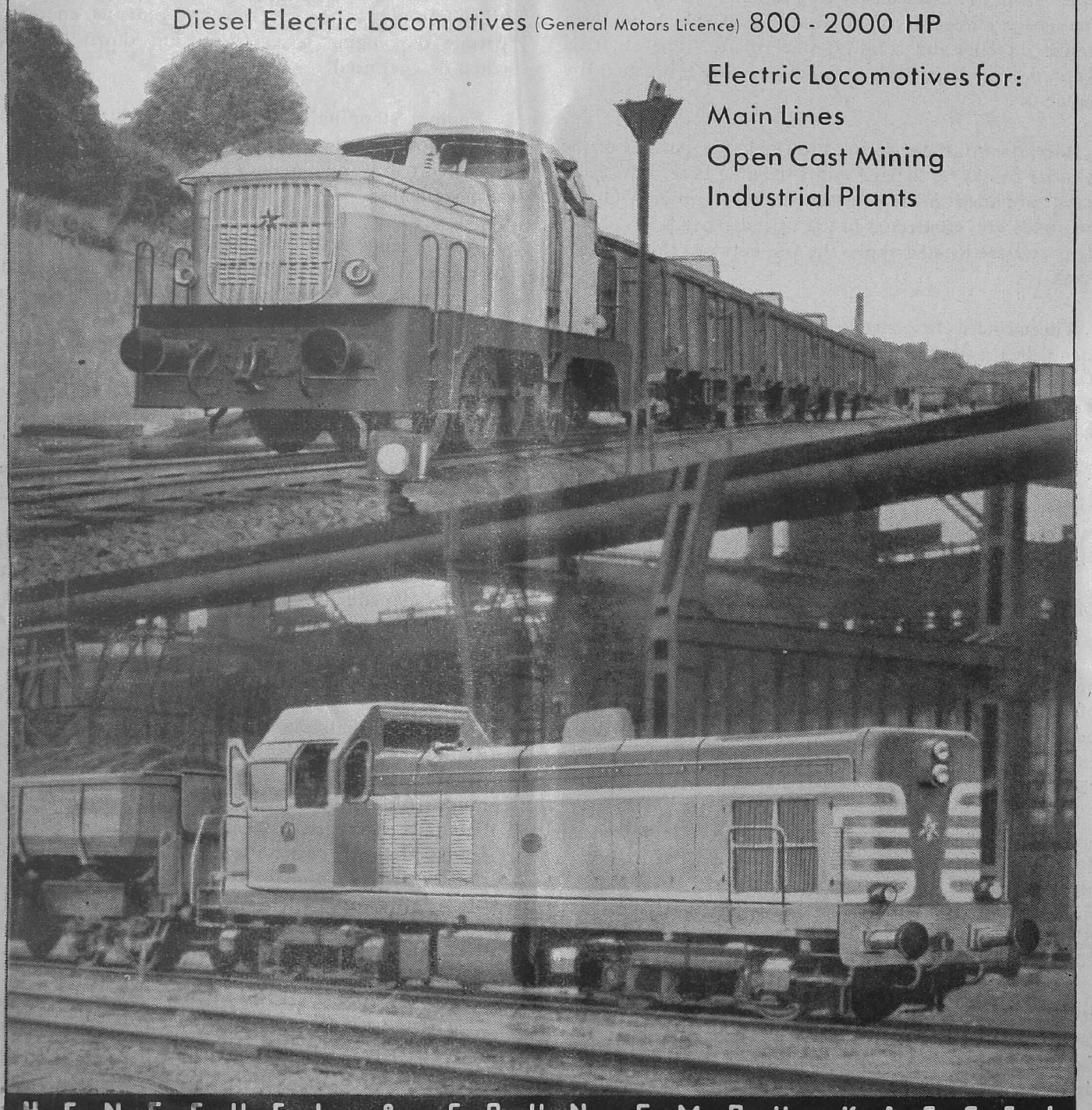

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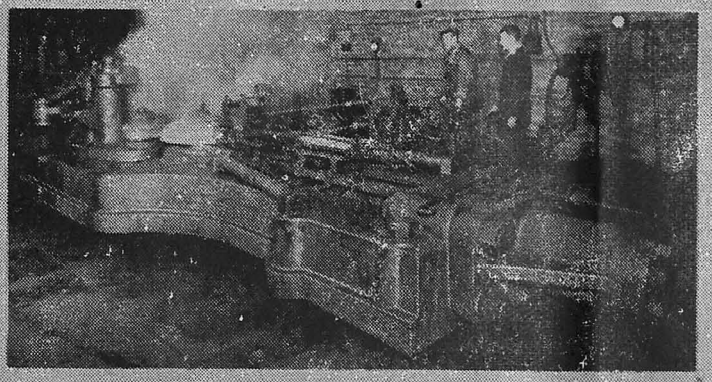

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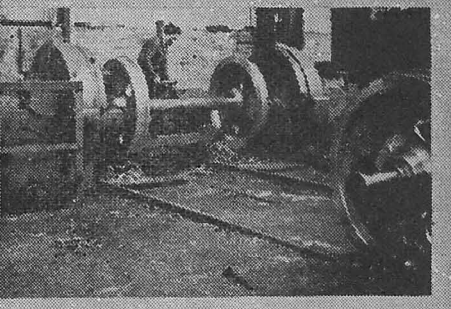

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Cleanliness of the person, of the houses and colonies, reflects discipline in the individual and the community. Discipline is the foundation stone for progress of oneself and the country. Cleanliness is a good habit. It is also cheap.

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

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