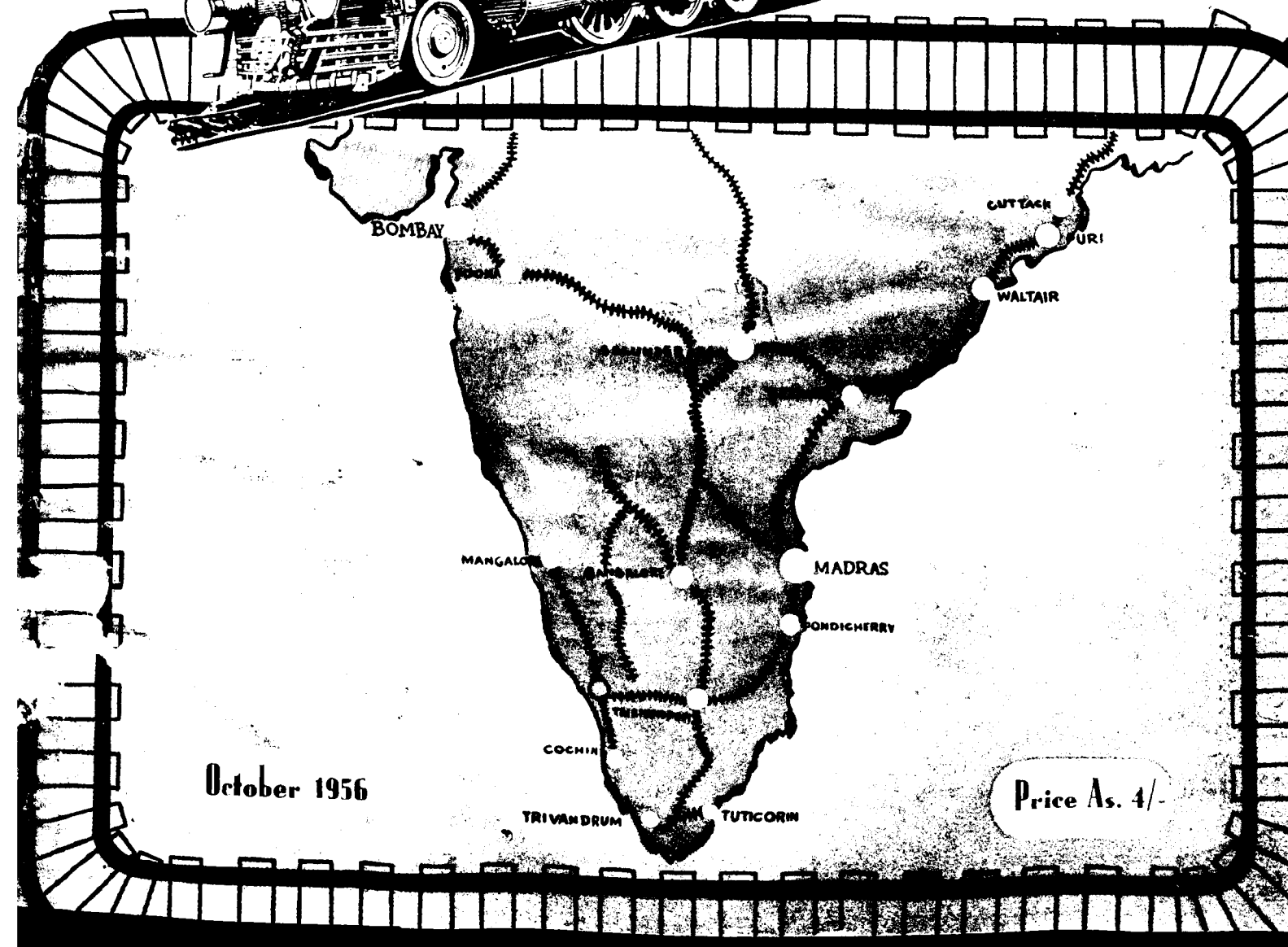
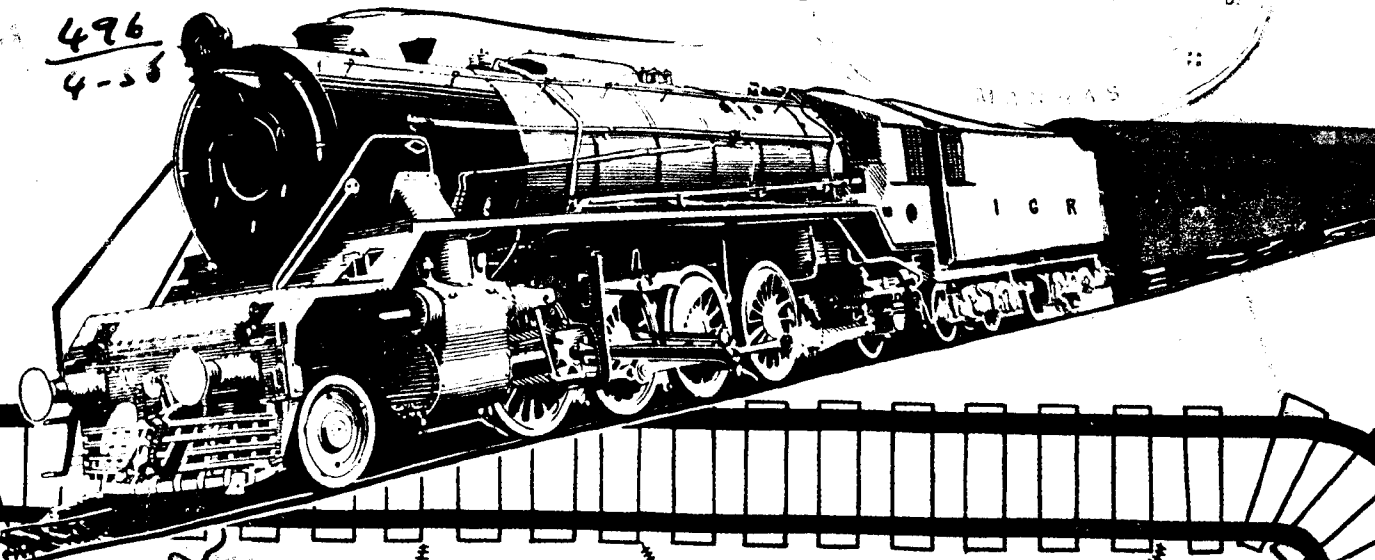


496

SOUTHERN RAILWAYS

Magazine

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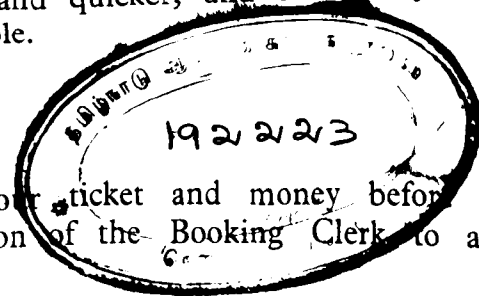
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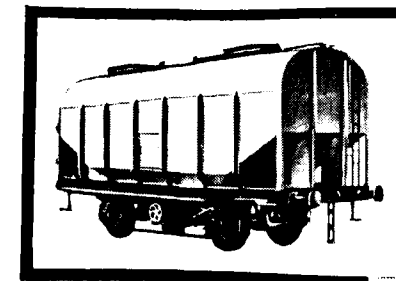


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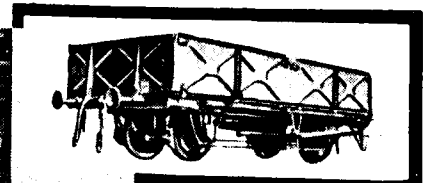
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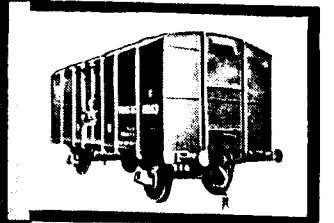
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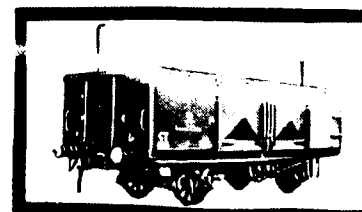
20-ton capacity Bulk Grain Van to the order of British Railways.



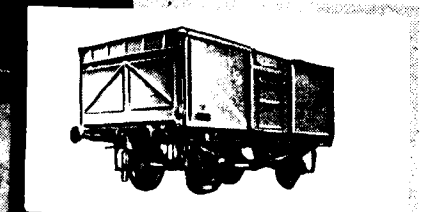
F.J.S. Low-sided Open type Wagon as used by Queensland Government Railways, Australia.



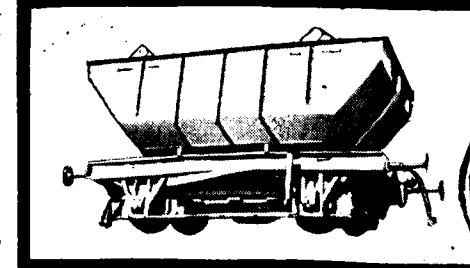
Broad gauge covered Wagon type C.R. as used by Indian Railways.



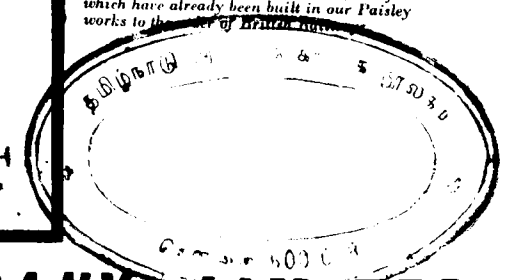
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Forty Years of Sulzer Diesel Traction

FORTY years ago, in September of 1912, the world's first Diesel locomotive ran its trials on the Winterthur-Romanshorn line in Switzerland.

This first Diesel locomotive was equipped with a single-acting reversible four-cylinder Sulzer engine of the two-stroke type which developed a maximum output of 1,600 H.P. at 304 revs. per min. and transmitted its power direct to the driving axles. The nominal rating of the locomotive was approx. 1,000 B. H. P. It had two four-wheel carrying bogies and to driving axles supported in the frame. Its length was 16.6 metres (54 ft. 6 in.) over the buffers and its weight in working order about 95 tons.

In March 1913 the locomotive travelled by way of Basle, Strasburg, Worms and Nordhausen to Berlin, where it was taken over by its purchasers, the Prussian State Railways.

Forty years after this event, it is interesting to look back over the developments which have since taken place and to consider the present situation of Diesel traction.

HISTORICAL SURVEY

The idea of employing the Diesel engine for rail traction is as old as the engine itself. As early as 1897, when the first practical Diesel engine was completed, its use in rail vehicles was seriously considered, in accordance with the plan which Diesel himself had nutured from the outset. More than ten years were to pass, however, before this idea was to take on material form. The creation of Diesel engine suitable for the purpose envisaged was in fact one of the most difficult designing tasks which could have been set before the engineer of those days. Foremost among the numerous difficulties were the problems of weight and space requirements. Whereas in marine propulsion, for instance, fairly wide scope is left for the choice of these two factors, the limits imposed by the requirements of rail vehicles are so narrow that no satisfactory solution to the problem was feasible until the Diesel engine itself had made considerable progress. Other difficulties which confronted the designer were those of starting, manoeuvring and governing, which are for obvious reasons all much more complicated in the traction field than in any other Diesel application.

Sulzer Brothers of Winterthur tackled these problems at a very early stage and made an outstanding contribu-

tion to their solution. In collaboration with Rudolf Diesel and A. Klose of Berlin they founded in 1906 a Society for Thermolocomotives, and enterprise which was to occupy itself with the study and design of large Diesel locomotives. In the following years the engine for the world's first Diesel locomotive was constructed to Sulzer plans in the shops at Winterthur, undergoing its first trials on the test-bed there in April 1912. The planning and building of the mechanical part of the locomotive had been entrusted to Messrs. Borsig of Berlin. The main responsibility for the success of the undertaking, however, lay with Sulzer Brothers, who not only designed and constructed the engine but also installed it in the locomotive with all the necessary auxiliaries and apparatus.

Thus the first Sulzer Diesel locomotive came into existence.

The building of this locomotive was a first practical attempt to use the Diesel engine for propelling a rail vehicle. Although this prototype, with its direct power transmission to the driving wheels, did not give full satisfaction, it at least enabled valuable experience to be acquired and turned to account later in the further development of the Diesel locomotive. The next important advance was the adoption of electric transmission between the Diesel engine and the driving wheels. The output of the Diesel engine is here absorbed by a generator which in turn feeds the traction motors. A few railcars equipped with 200 H.P. Sulzer Diesel engines and with electric power transmission were supplied to German railway companies even before the outbreak of the first World War.

From this point onwards the evolution of the Diesel locomotive and the railcar went forward without intermission. Sulzer Brothers from the first took a special interest in the development of high-powered units, assuming that this would be a particularly promising application of the Diesel locomotive. Their studies in this direction revealed that it was possible to build Diesel locomotives of over 4,000 B. H. P. with weights not much in excess of those of steam locomotives of the same power. The Diesel locomotive was thus able to enter the lists on an equal footing with steam and electric locomotives. Its employment now depended solely on considerations of economy and rail traffic requirements. Diesel traction has special advantages to offer in regions where water is scarce or on lines on which fuel must be carried over long

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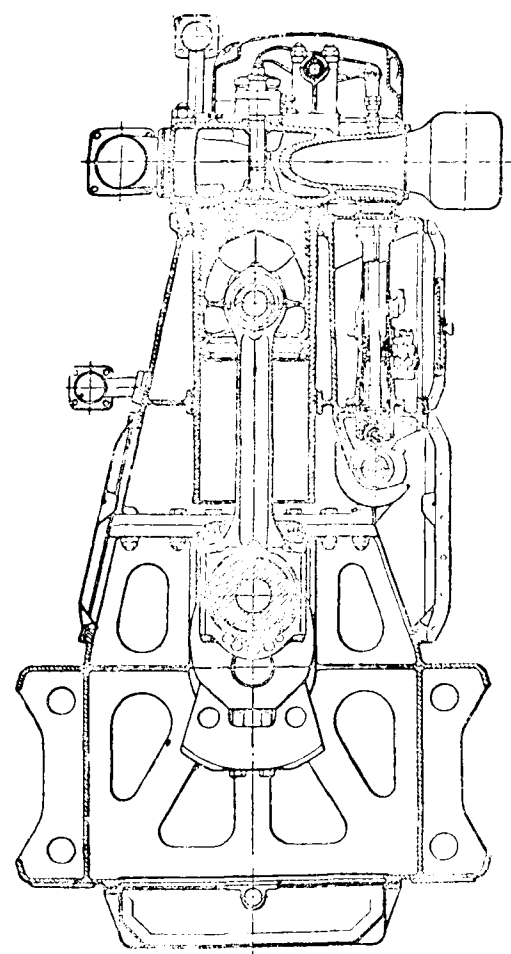
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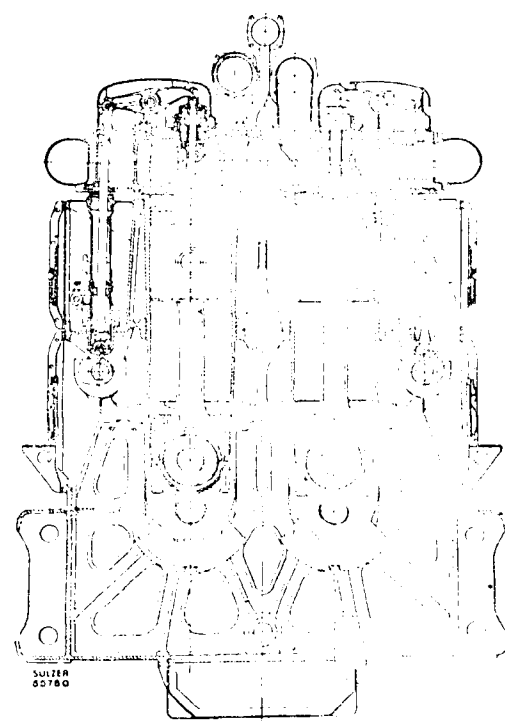


Cross-section through a modern Sulzer single-row traction Diesel engine of welded design.

distances. Its low water and fuel consumption and the much easier transport of its oil fuel as compared with coal make the Diesel engine highly suitable for working conditions of this kind. These and allied considerations have in recent years led many railway companies to introduce Diesel traction on some of their lines.

CONSTRUCTION OF THE SULZER TRACTION DIESEL ENGINE

The characteristics of the single-row traction Diesel engine as built today by Sulzer Brothers appear from the cross-section, general view and the cross-section of the double-row engine employed for higher out-puts, shown in above illustrations. The crankcase is carried up well above the centre line of the shaft and is therefore very rigid. The U-shaped transverse walls support the crankshaft bearings. The upper halves of these bearings are supported by keys on the projections of the tie bands which form the inner limit of the transverse wall. The tie band transmits the reaction forces of combustion



Cross-section through a double-row Sulzer traction Diesel engine of welded design, 1952 model.

from the cylinder block along the shortest path to the crankshaft bearing saddles, so that the flux of force takes the simplest possible form. The crankcase also incorporates the members which support the whole engine-generator group on the underframe. On the generator side the bars are extended and curved outwards to take the generator, which is direct coupled to the Diesel engine. The crankcase was originally made of cast iron and later of cast steel, the bars supporting the Diesel-generator group being designed as a sub-frame. Today the sub-frame and the crankcase are welded to form a single whole, which naturally increases the strength of this structure. The transverse walls are of cast steel in the large engines while in the smaller units they are of steel plate like all other parts of the crankcase. This combined design permits the wall thicknesses to be more accurately adapted to the strength calculations than would be possible with an exclusively cast-iron or cast-steel design, and fullest utilisation of the material is thereby attained.

The vibration-free running of the Diesel engine depends partly on the effective balancing of the reciprocating and rotating parts and partly on another important consideration: the question of whether the crankcase is rigid enough to take the stresses due to the internal moments of the masses without any deformation

of practical significance. The design of the Sulzer traction Diesel engine adequately fulfils this latter requirement also, a point in which it is superior to light-metal designs, which tend to plastic deformation and are not entirely satisfactory in their resistance to vibration.

The cylinder block is constructed on the same designing principles, the transverse wall—which are of steel plate in the smaller and cast steel in the larger engines—being welded to the steel-plate longitudinal walls to form a solid block. The water-cooled and interchangeable cylinder liners are inserted in the cylinder block in the usual way.

Each cylinder has its own cylinder cover with one admission and one exhaust valve. The light-metal piston can be readily removed from above after taking off the cylinder cover and unscrewing the connecting-rod bolts.

The fuel pumps are fitted with delivery plungers which are rotated to regulate the quantity of fuel injected and are so arranged that all the supply pipes running to the injection valves in the cylinder covers are of equal length. This permits uniform distribution of the output over the individual cylinders at all loads. The plungers are provided with oblique control edges both for the beginning and for the end of injection. As a definite torque and thus a definite delivery quantity of the fuel pumps is allocated to every engine speed, the preliminary injection can be adapted to the speed in a very simple way.

All moving parts of the Diesel engine are connected to the automatic forced-lubrication system, so that there is no obstacle to an enclosed dust-tight design.

Vibration dampers of the Sarazin type have given excellent service in the control of critical vibrations of the crankshaft. A description of these dampers was given in Sulzer Technical Review No. 1, 1945, page 115.

CONTROL SYSTEM

The present-day Sulzer control system for Diesel-electric vehicles is no doubt the most consistent embodiment so far achieved of the principle of running the Diesel engine at the most favourable speed for the required traction performance at all times, while setting the load by regulation of the generator excitation in such a way that due account is taken of variations in the loading capacity resulting from the thermal conditions of the engine. The Sulzer control system fulfils these

requirements in the simplest possible way by taking its control impulse from the governor of the Diesel engine. The allocation of a definite torque to each engine speed, a feature introduced by Sulzer Brothers, has made it possible to fix the beginning of delivery by a second oblique control edge on the pump plunger. This is beyond doubt a great simplification. On the other hand, it was only the use of a pressure-charging safety device in conjunction with a spring member fitted between the governor and fuel pumps which enabled the advantages of this output control system to be secured in the pressure-charged Diesel engine. The Sulzer control system thus exercises the following functions:

The field regulator keeps the output of the engine constant on every controller notch within a given range in spite of changes in the resistance to motion (e.g. gradient of line) the temperature of the electric machines or the load on the auxiliary generator.

The load on the engine is reduced, while the engine speed is kept constant, if the pressure-charging safety device comes into action or the output of the engine falls off temporarily for any exceptional reason, as for instance a leakage in one of the fuel pipes.

The pressure-charging safety device takes effect when the charging pressure is too low for the fuel quantity injected, as for instance during acceleration of the Diesel engine or the pressure-charging group, or when the resistance in the suction-air filter is excessive as a result of fouling.

Long years of experience have shown that the Sulzer control system is able to fulfil all the requirements imposed by normal traction service. Supplementary protective equipment has been developed and patented for lines running at great altitudes or with widely varying temperature conditions.

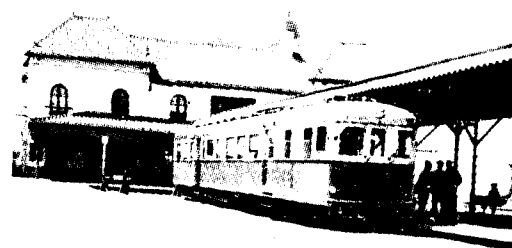
SERVICE RESULTS

One of the earliest Sulzer Diesel railcars, which first took up service in Germany in 1914, and later, after conversion, came into the possession of a Swiss private railway, is still running today. Throughout this period no major repairs have been necessary to the Diesel engine, nor have any important component been replaced.

Two travelling power houses of 1,200 H. P. each have been running on the suburban lines of the former Ferrocarril Sud de Buenos Aires since 1930. Each unit is powered by two Diesel engines of a type employing

precombustion chambers and developing 600 H. P. at 700 revs. per min. The vehicles weigh 87 metric tons each and have a maximum speed of 75 km. (47 miles) per hr. In addition to the motors in the power-station vehicle itself, the generators feed traction motors fitted in five of the carriages. This arrangement permits of the high acceleration needed for suburban service. When required, the two power stations can be combined with their carriages to form a 730-ton train seating 1,100 passengers.

These vehicles have covered 60,000 and 65,000 km. (37,500 and 40,500 miles) per year respectively at the low average speed typical of suburban service. About the middle of 1933, the same railway company commissioned three further more powerful travelling power houses, each equipped with two engines of 850 H.P. These units weigh 132 tons and are normally used with eight carriages fitted with two traction motors each. The weight of the train is then 570 tons, the accommodation comprises 800 seats and the maximum speed is 112 km. (70 miles) per hr. The higher output per ton of train weight and the higher maximum speed permit a noticeably better utilisation of these vehicles, each of which has now covered about 2 million k.m. (1,250,000 miles). These mobile power stations are submitted to a general overhaul after each 300,000 km.



Diesel-electric railcar, rated at 270 H.P., of the Ferrocarril Provincial de Buenos Aires. Four of these narrow-gauge railcars have covered about 1,600,000 km. or 1,000,000 miles each in 16 years (supplied in 1936).

Very detailed data are available on the service of four railcars which Sulzer Brothers supplied in 1936 to the Ferrocarril Provincial de Buenos Aires. These railcars, each fitted with a six-cylinder engine having a one-hour rating of 270 H.P. at 1,100 revs. per min., weigh 37 tons and are able to seat 62 passengers. Their maximum speed is 80 km. (50 miles) per hr. In their sixteen years of service up to and including 1951, they had averaged 1,600,000 km. (1 million miles) each.

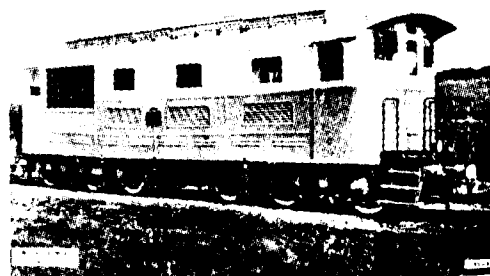
During the whole service period of these Diesel engines, they have given no trouble of a serious nature. In particular no connecting rods, cylinder covers, liners or fuel pumps have been replaced, although the engines are of a comparatively fast-running type.

Up to the present the railway company has not considered it necessary to undertake capital overhauls.

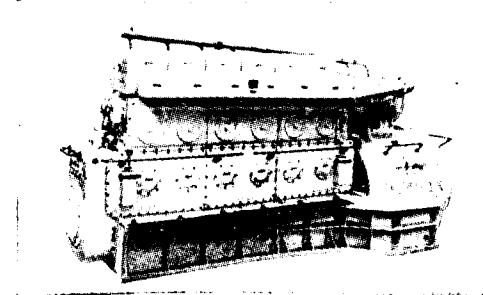
Locomotives equipped with Sulzer Diesel engines have been adopted on an unusually wide scale in France and the French Colonies. Some of these units were put into service in 1933 by the Compagnie des Chemins de Fer Paris-Lyon-Mediterranee, as it was then designated, and by its Algerian lines, as well as by the Syndicat des Chemins de Fer Ceinture de Paris. Mention should also be made of a series of shunting locomotives, each equipped with a six-cylinder engine developing 735 H. P. at 850 revs. per min. This engine is a standard type of which 117 units have so far been supplied. The locomotives in question were purchased by the Societe Nationale des Chemins de Fer Francais. They weigh 71 tons each and have a maximum speed of 50 km. (31 miles) per hr.



Sulzer Diesel-electric shunting locomotive of 735 H.P. owned by the Societe Nationale des Chemins de Fer Francais (supplied in 1938). Their experience with these locomotives led the S.N.C.F. to order numbers of other shunting locomotives with Sulzer Diesel engines.

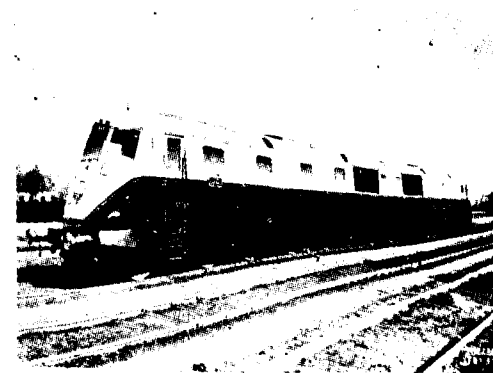


Diesel-electric freight locomotive of 735 H.P. owned by the Compagnie des Phosphates de Constantine.



Six-cylinder single-row Sulzer Diesel engine of 735 H.P. at 850 revs. per min., with exhaust-gas turbo-charger. Welded dust-tight design. The frame carrying the main and auxiliary generators forms part of the crankcase.

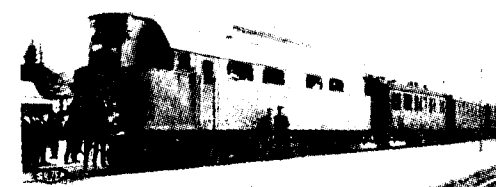
The same engine type is fitted in the locomotives of the Cie. des Phosphates de Constantine, which have a weight of 67 tons and the same maximum speed of 50 km. per hr. These narrow-gauge locomotives were used for the first three years for pulling heavy train-loads of minerals, on which duty they covered a total of 150,000 and 200,000 km. (94,000 and 125,000 miles) respectively. Since 1941 they have been employed on the lines of the Chemins de Fer Algeriens and the Chemins de Fer Tunisiens. The outstanding results obtained with these locomotives under the most unfavourable climatic conditions, including high air temperatures, sandstorms and the like, greatly contributed to the decision taken by other railways in tropical and sub-tropical countries to purchase Diesel locomotives with the same Sulzer engines. The Cie. des Phosphates et du Chemin de Fer de Gafsa, for instance, has so far ordered 17 of these locomotives, the Chemins de Fer Tunisiens 33, the C. F. Dakar Niger 24, the C. F. Madagascar 14 and the C. F. Cameroun 6.



Diesel-electric locomotive rated at 4,400 H.P. and employed by the Societe Nationale des Chemins de Fer Francais for hauling 600-ton trains at 80 km. (50 miles) per hr. on gradients up to 8 per mille (1 in 125), or at 130 km. (81 miles per hr. on the level (supplied in 1938)

The 4,400 H.P. locomotive of the Societe Nationale des Chemins de Fer Francais is of particular interest. It has a length of 33.05 metres (108 ft. 5 in.) over the buffers and a weight in working order of 228 tons, while its maximum speed is 130 km. (81 miles) per hr. This locomotive took up service in the summer of 1938, covered 222,700 km. (139,200 miles) before the outbreak of war and was then taken out of service till the middle of 1945. From this date till the summer of 1952 it again covered 1,300,000 km. (810,000 miles). The maximum wear on the piston ring grooves after a total of 966,478 km. (approx. 600,000 miles) was 1.5 mm.

Owing to the events of the war, very little information has been received on the service results of the 4,400-H.P. express locomotive of the Rumanian State Railways, which is 29.3 m. (96 ft. 4 in.) long, weighs 230 tons in working order and has a maximum speed of 100 km. (62 miles) per hr. The locomotive was employed on a difficult mountain line where it acquitted itself excellently. When put into service, it was the most powerful Diesel locomotive in the world. It attracted a great deal of attention not only in Rumania but in the Balkans as a whole on account of the simplicity of its controls and servicing, its low working costs and its great reliability. It is fairly certain that this successful new design would have resulted in numbers of repeat orders if the war had not intervened. The locomotive escaped the severe bombardments of the Rumanian railways. As it was less dependent on depots than steam locomotives, it was always in very active service, while its stays at the points most exposed to the danger of air attack were kept to a minimum. After the end of the war the locomotive was used for a considerable period as a mobile power station supplying current during the reconstruction of railway workshops.



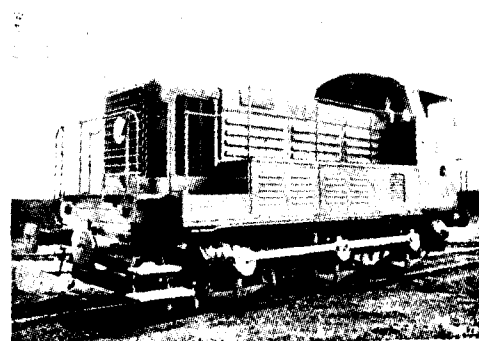
The world's first Diesel locomotive, which was equipped with a Sulzer four-cylinder two-stroke engine of 1,000 H.P. transmitting power direct to the driving wheels.

The 1,200-H. P. locomotives owned by the Swiss Federal Railways, with a service weight of 65 tons and a maximum speed of 110 km. (69 miles) per hr., are each fitted with an eight-cylinder engine running at 750 revs. per min. These locomotives were to be the

prototypes of the vehicles which the Swiss Federal Railways wished to employ on lines with little traffic for hauling light express trains. They were put into service at the outbreak of war, but shortly afterwards had to be taken out of service on account of the shortage of fuel and are now being employed for local traffic on the few lines not yet electrified, where they had covered approx. 600,000 and 700,000 km. (375,000 and 450,000 miles) respectively by the end of 1951.

NEW UNITS

In conclusion a few examples may be quoted of units which have been put into service in the last few years.



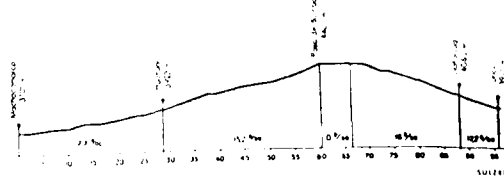
Diesel-electric shunting locomotive of the S. N. C. F., equipped with a six-cylinder Sulzer Diesel engine of 570 H.P.

Prompted by the excellent results obtained with their other Diesel-electric locomotives, the S. N. C. F. decided in 1945 to order 48 Diesel-electric shunting locomotives, each to be equipped with a six-cylinder Sulzer Diesel engine of 570 H.P. The first of these units took up operation in July 1950. They were intended not only for the usual shunting duties on stations but also for handling heavy trains at comparatively low speeds and for hauling trains of all kinds on branch lines at speeds up to a maximum of 60 km. (37 miles) per hr. They are used either alone or in pairs, according to the job in hand. Remarkable results were obtained even during the first trial runs. On the particularly difficult line from St. Etienne to Roanne, which has gradients up to 18 per mille (1 in 55), two unit coupled together were able to handle 600-ton trains without any trouble at an average speed of 50 km. (31 miles) per hr. During the shunting trials in the Lyon-Guillotiere station, trains of 600 and 850 tons were moved from rest by a single locomotive.

The above illustration shows a Sulzer Diesel-electric locomotive of 730 H.P. supplied to Bolivia a few years ago. The Patino Mines and Enterprise Consolidated



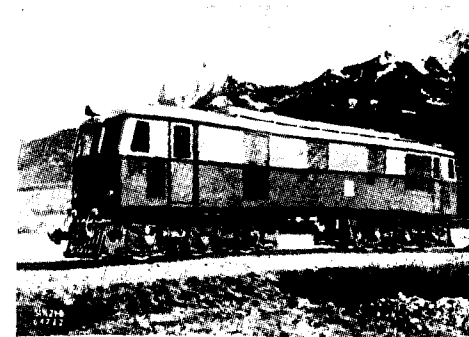
Sulzer Diesel-electric locomotive of 730 H.P. for a Bolivian railway company.



Longitudinal profile of the Machacamarc-Uncia metre-gauge line in Bolivia.

(Incorp.) ordered this locomotive from Sulzer Brothers, Winterthur, with a view to improving the through passenger and goods services on their own narrow-gauge line from Machacamarc to Uncia. Sulzer Brothers, who acted as general contractors for the locomotive, built the Diesel engine and its accessories in their own shops while entrusting the Maschinenfabrik Oerlikon of Zurich with the electrical equipment and the Ateliers Metallurgiques S. A. of Nivelles, Belgium, with the mechanical part. A detailed description of this locomotive was given in the Sulzer Technical Review No. 1, 1950, p. 16. The total length of the locomotive is 15.404 m. (50 ft. 8 in.), the maximum service weight 70.4 metric tons. It is driven by a Sulzer six-cylinder Diesel engine with a one-hour rating of 730 H.P. at 750 revs. per min. and 4,000 m. (13,000 ft.) above sea level, and a continuous rating of 650 H.P. at 700 revs. per min. at the same altitude. Extensive trials were run with this locomotive, with trailing weights up to 250 tons, on Swiss narrow-gauge lines.

To supplement their fleet of Sulzer locomotives, the Thai State Railways have ordered from Sulzer Brothers three further Diesel-electric locomotives of 960 H.P. which are intended mainly for service on the 1,200-km. Bangkok-Penang line, the northern section of the run of the "Southern Express" from Bangkok to Singapore. These locomotives will also be used, however, on the mountainous northern line, 750 km. in length, from Bangkok to Chiang Mai. Once more acting as general contractors, Sulzer Brothers ordered the electrical



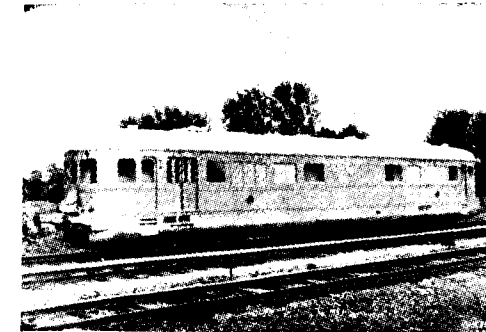
Sulzer Diesel-electric locomotive of 960 H.P. owned by the Thai State Railways.

equipment from the Maschinenfabrik Oerlikon of Zurich and the mechanical part from Messrs. Henschel & Sohn of Kassel. The locomotives are propelled by eight-cylinder Sulzer Diesel engines developing 960 H.P. at 850 revs. per min. A full description of these units was contained in Sulzer Technical Review No. 3, 1951-p. 15.

The above illustration shows a Diesel, electric luggage railcar of 1,470 H.P. for the Chemins de Fer Algeriens. This unit is fitted with two six-cylinder Sulzer Diesel engines of 735 H.P. each.

CONCLUSION

In the course of four decades the Diesel engine has



Diesel-electric luggage railcar of the Chemins de Fer Algeriens, equipped with two six-cylinder Sulzer Diesel engines of 735 H.P. each.

earned a reputation as a traction power unit which assures it of an ever-widening field of application.

Engineers from three different branches—the locomotive builder, the Diesel-engine designer and the electrical supplier—all make their contribution to the construction of a Diesel-electric rail vehicle. Each of these branches of engineering has its own traditions, which are founded on many years of experience. The Diesel-electric vehicle can therefore only be a success when the general planning of all three parts is co-ordinated by being placed in the same hands. The successes achieved by Sulzer Brothers in the field of Diesel traction are largely to be attributed to the fact that an organisation created many years ago puts them in a position to act as general contractors for the construction of Diesel-electric vehicles.

CLASS II RAIL COACHES—NO NEW CONSTRUCTION

THE Railway Board has issued instructions that the construction of new second class passenger coaches should cease from now onwards.

This is in pursuance of the policy announced during the last budget debate by the Railway Minister to withdraw second class accommodation from the Indian Railways by stages.

Second class accommodation has already been with-

drawn from 84 branch lines on the seven zonal railways. The coaches thus saved are being utilised partly to increase second class accommodation on other lines and partly to increase third class accommodation on branch lines where second class accommodation has been withdrawn.

For the benefit of through passengers who travel from main lines to the affected branch lines, the railways have made arrangements to issue combined second-cum-first and second-cum-third class tickets.

RAILWAY PLATFORM LUGGAGE TRANSPORT

By A. Jayaram, M.A.

THE other day I was at the City Station to meet my Sister. I was early and the train was late. Finding time hanging on me I sat myself down on one of those Cement Benches and was scanning through that morning's newspaper.

My attention was attracted by a conversation in which two friends sitting beside me were engaged and although I dislike eaves-dropping I lent my ears to it since the subject was of a general nature and of particular interest to me—the topic was 'Transport of Luggage on Railway Platforms'.

The genesis of the topic, I understood was an old Railway Porter carrying a headload—did I say 'a headload'; no it was many a headload—of luggage, comprising all sorts of things, beddings, trunks, baskets,

bundles of different sizes and shapes and what not. Poor old man, he was staggering under the weight of the load and the owners of the luggage—a smart young man and his wife (newly married, I presumed) were walking leisurely behind, stopping and looking at every carriage to find room (rather seclusion) and making the porter halt before every carriage, as they looked in.

One of the friends by my side—let me call him Mr. 'X'—remarked: "This certainly is cruelty at its acme. Poor chap! If the porter does not die under this load, he is lucky. Something should be done to prevent this."

His friend—Mr. 'Y'—said: "You are right, the Railway Authorities should definitely stop this sort of affair. Why should they allow these porters do the work of a Trolley, I wonder."

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Mr. 'X':—"What do you mean, Trolley? Do you mean to say that the authorities can dispense with the services of all porters and make trolleys do this job, thus depriving thousands and thousands of porters all over India of their only tried means of livelihood?"

Mr. 'Y':—"No friend! I am not suggesting anything of that sort. I am only saying that a Trolley could be used for carrying luggage up and down the platforms and the porters could be engaged to load the luggage on to the trolley and thence to the carriage. This system will not only save the porter—who after all is a human being like any one of us—from being subjected to carrying heavy loads just for a pittance of a few annas and thus slowly but seriously ruin his health, but will also ensure safe and swift carriage of the luggage. It is high time the Railway Authorities looked into this matter and did something to save these human wrecks of porters."

Mr. 'X':—"You are right. But what about the trolleys? Do you know how many the Authorities have got to procure for use throughout all the stations on the various railways? And what do you think each trolley would cost? These are problems that definitely will confront the Railway Authorities, before they do anything of this sort."

Mr. 'Y':—"Now, look here! I wonder how you could be so uninformed as to what is happening under your very nose. Have you ever heard of 'An Indian Industrial Institution since 1840' probably the only one of its kind in South India which manufactures a very smart and wonderful type of Platform Trolley at a very reasonable price. I understand too that it has very many exclusive features and are now being used in certain Railway Stations and replacing other forms of manual transport. I am sorry I do not know much about the technical specification or the exclusive features but it certainly is the only answer to the problem viz. "Railway Platform Luggage Transport."

I certainly could not contain myself at this stage of their conversation and barged into it with the customary 'I beg your pardon,' and introducing myself as a representative of the Institution referred to by them.

I said: "I am happy indeed that you are well informed on a subject which is not of great personal

interest to you and am very proud to hear the high opinion you have of our company. I should say with becoming modesty that we are the pioneers in the manufacture of Platform Trolleys in South India and the trolleys manufactured by Indians, for Indians with Indian Capital in one of the most modern workshops of India are the best of their kind. Simpsons Platform Trolleys are manufactured to a very fine standard of perfection and only the best workmanship and finest materials have been employed in this manufacture. We can solve this problem of Railway Platform Luggage Transport."

Mr. 'Y':—" (to Mr. 'X') "Did you hear that?" (turning to me) "Well Sir, we have got some time before the train arrives. Will you please tell us how you can solve this problem."

Myself:—"With pleasure. You see, transport of luggage on Railway Platforms by means of porters has many a drawback as you said and to solve this, we manufacture quite a variety of Platform Trucks or Trolleys. Our Standard one is capable of carrying 1000 lbs. load and there are others with smaller carrying capacity of 600 lbs. and 450 lbs."

Mr. 'X':—"That sounds very interesting, carry on friend. Well, answer me this question. What do you think the advantages are of using Trolleys on the Platform?"

Mr. 'Y':—"That is a question."

Myself:—"There are decided advantages. You see, the platform trolleys we manufacture are fitted with Solid Rubber Tyred Wheels, and have steerable turn-tables. You can very easily manoeuvre the trolley even on platforms that are heavily crowded, with the least inconvenience to the passengers. Besides it needs little or no effort on the part of the porter handling it. I for one personally feel the powers—that—be put an embargo on human beings being converted into beasts of burden and insist on the use of trolleys for transporting luggage on platforms. It will be more efficient, quick, decent and dignified to carry loads on trolleys than on human heads."

Mr. 'X':—"Excellent, Sir, I am very glad to learn that Simpson & Co. Ltd., are certainly trying to do a veritable service to the country and to the class of human beings, whom we so callously call 'coolies.'"

Myself:—"Certainly, if we are given sufficient impetus we can manufacture any type of trolley to suit individual requirements. As it is, we also manufacture, besides Platform Trolleys, Sack Trucks in two varieties—Heavy Duty and light type capable of carrying goods. Put together the Platform Trolleys and Sack Trucks can be profitably and advantageously used to carry 'anything and everything'—to use a hackneyed phrase. The operation of these trolleys does not involve any strain on the operator. And I may say positively that these wheeled vehicles will go a long way in successfully solving this problem—'Railway Platform Luggage Transport.'"

Mr. 'Y':—"Thank you very much, Sir, for such a pithy and erudite appraisal of Simpson's Service to the Nation. It is a pity we can't have a complete

picture of the multifarious activities your company is engaged in as the train is almost on the Platform. However, we hope we will have another opportunity to have the complete story. Nevertheless we are greatly indebted to you for the information you have given us. You see, educating public opinion is the first and right step towards solving any problem and we shall do our best to broadcast this intelligence in our own way".

The train was on the platform and I bade good-bye to my friends (?) and was looking for my sister when I heard a loud noise. I turned round and found that a porter had dropped a heavy luggage unable to bear its weight. The owners of the luggage were abusing and cursing him. And I said to myself "This can't and won't happen if a Simpson's Platform Trolley had been used."

ELECTRICAL ADVISER FOR RAILWAYS

Mr. P. N. Murthi, formerly Chief Electrical Engineer of the Northern Railway, has been appointed to the newly created post of Electrical Adviser with the status of Director in the Railway Board's office.

The post has been created, it is stated, in view of the increasing work in connection with the electrification of the railways.

The Electrical Adviser, among other things, will deal with various aspects of railway electrification—purchase of electric power for the railways and work connected with the generation, transmission and utilisation of electricity—electrification of stations, air-conditioning of buildings and rolling stock, train lighting and liaison with other Ministries on matters connected with this work, including the supply, utilisation and manufacture of electric equipment and plant.

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

Coal Freight Accounts By Punched Cards

By *A. A. Foren*

*Head of the Mineral Accounts Section of the Chief Accountant's Office,
British Railways (Western Region), Barry Docks.*

THE application of punched card methods to the work of compiling Railway Coal Freight Accounts is well out of its infancy; in fact the Mineral Accounts Office responsible for safe-guarding and collecting the revenue arising from the conveyance of coal and coke originating on the Western Region of the British Railways, has been using and developing the system for more than twenty years. It will be appreciated, therefore, that the idea has long passed from the experimental stages to that of established practice.

A short outline of the procedure adopted to meet the rather unusual features of the work in connection with Railway Coal Freight Accounts may interest other users and potential users and, in some way, assist in solving some of the problems connected with the fitting of mechanical accounting to circumstances which, at first, seem unpromising.

DECLARATION BY CONSIGNOR

The charging of "Coal Class" traffic is primarily based on a declaration, variously known as a Consignment Note or Colliery Permit. This is required to be handed to the local Railway Agent when traffic is tendered for conveyance. In addition, inter alia, all the information required to enable the charges to be assessed, viz.:

- The point from which the traffic is to be taken.
- The point at which the traffic is to be delivered.
- Net weight contained in each wagon, totalled if more than one wagon.
- Date.
- Name of party liable for conveyance charges.

INVOICING

From the information shown on the Consignment Notes, the forwarding station Agent prepares a document known as a "Weight Invoice"; this is sent to the Agent at the station to which the traffic is consigned and the arrival of the wagons is thereby checked.

The forwarding station Agent summarises daily the details shown on the "Weight Invoices" issued, and sends this summary, together with the relative consignment notes, to the Mineral Accounts Office.

CHARGING AND PREPARATION OF ACCOUNTS—MINERAL ACCOUNTS OFFICE

(a) Daily Record of Tonnages

The total tonnage of each summary received from the forwarding station is recorded daily and a Regional total obtained.

(b) Pre-punched Cards—White

Much of the information required for the preparation of accounts recurs day by day and a file of white cards is maintained pre-punched for the forwarding point, the receiving point, the rate per ton, and, in some cases, a code number signifying the account to be debited. Experience has shown that these cards cover approximately 70 per cent of all consignments.

(c) Unpunched Cards—Green

A supply of unpunched cards is available for the 30 per cent residue; these cards are green.

(d) Preliminary Operations for Completion of Cards

The station summaries and consignment notes, referred to under "Invoicing" above, are passed each day to female operators who refer to the file of "white" cards and extract cards for each consignment for which an appropriate pre-punched card is available; a "green" unpunched card is interpolated for the residue not covered by the pre-punched file.

The items covered by the green cards are then subjected to further examination and the cards are punched with the destination details.

The code number of the freighter (i. e. party paying carriage) is in some cases already provided for on the white cards; for the remainder, the information is, at this stage inserted on the respective consignment notes.

The consignment notes and cards, each assembled in the same order, are then passed to punch operators who punch—

(a) Code number of account to be debited (if not already pre-punched)

(b) Date

(c) Weight
and additionally in the green cards only—

(d) Forwarding station (in code) and the Colliery.

The cards are then tabulated in the same order with the tabulators set to provide—

(a) Sub-totals, representing forwardings of each station

(b) Grand total of the day's forwardings.

These tabulations are scrutinised by clerks, who compare them with the consignment notes and satisfy themselves that the tabulated information is correct in all details, or amend as necessary; in this process the sub-totals are compared with those shown on the Agent's daily summary which accompanied the consignment notes.

The corrections indicated by the checkers are then carried out on the cards and a further check imposed to ensure accuracy.

(e) Balance Control Book Totals

A reliable grand total of the tonnage forwardings for the day is now available and is recorded in a "Balance Control Book" designed to ensure the maintenance of tonnage and charges balances through all the stages of the work; the inclusion of charges in the book is covered by succeeding operations as detailed below.

It is claimed that the control exercised by the medium of the "Balance Control Book" is so effective that once a consignment has come under notice it cannot by inadvertence be overlooked through the loss of the consignment not or the Powers-Samas card on which it is recorded.

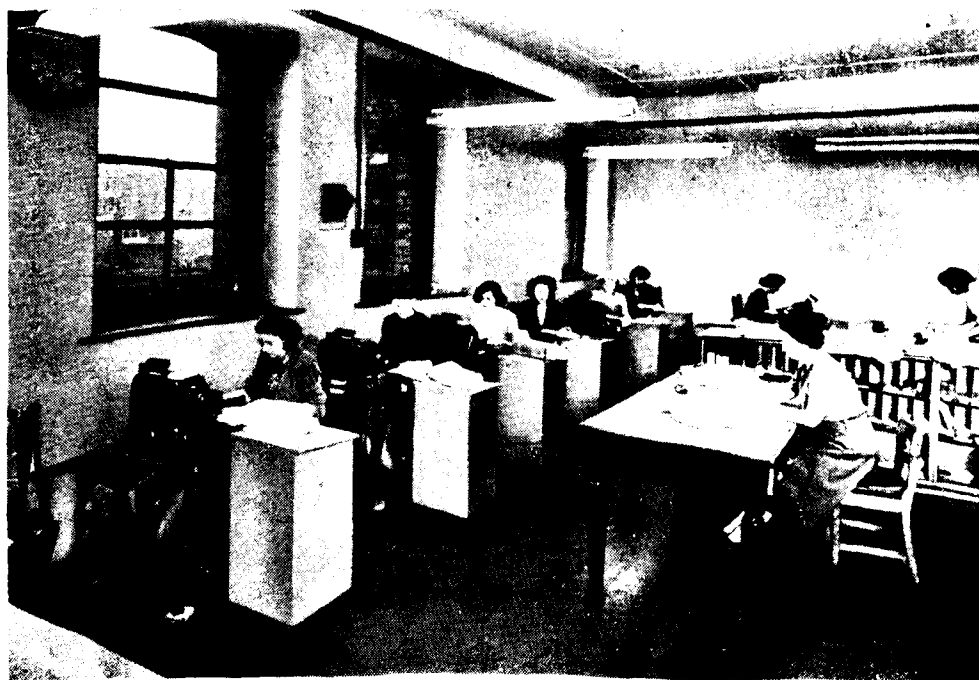
(f) Separation of White and Green Cards for Further Operations

The reader will gather from the foregoing that the cards at this stage contain all the information required except—

(a) White cards require evaluation

(b) Green cards require rating and evaluation.

The cards are therefore passed through the automatic sorter to separate them into these two categories.



The well laid-out battery of Automatic Key Punches at the Mineral Accounts Section, Barry Docks.

(g) Evaluation of White Cards

The cards are machine sorted into gradations of rate and weight and ready reckoners specially compiled with separate pages for each rise of rd. rate, showing, for each rd. rate, the evaluation at each 1 cwt. stage, are available for assessing the charges; with ready reckoner and cards in sympathetic order, the work of writing the cash values on the cards is carried out with surprising speed.

These written amounts are then punched into the cards, which are again tabulated, this time setting the tabulator to produce sub-totals of tonnage and cash at each variation of rate.

A check is made to determine that the sub-totals thus produced are correct in calculation, and if so, it is assumed the individual cards comprised are correct.

After carrying out the correction of those cards found to be inaccurate and suitably amending the grand total, the grand totals of tonnage and cash are recorded in the "Balance Control Book," and the cards are set aside until required at the month's end for freighters' accounts.

(h) Rating and Evaluation of Green Cards

The cards are tabulated and clerks, working from rate books of which there are several hundred, insert the chargeable rates on the tabulation and return it to punchers to carry the information to the cards.

Accumulating several days, as convenient, the cards are sorted in an order which corresponds with the rate books and tabulated again for rate checking, after which they follow the same procedure as the white cards.

(i) Production of Monthly Accounts

At the month end all the cards are assembled and sorting is commenced for the production of the monthly accounts.

The accounts vary widely in size, from a single item to thousands, but all are sorted into alphabetical order to assist the freighters to check the accounts and to enable them, and the Mineral Accounts Office staff, to quickly locate any particular consignment.

The sorting is broken down to comparatively small batches of groups of freighters for convenience of handling and also to allow the tabulation of some of the accounts to go forward whilst the remainder are still in the sorting stages.

As the accounts are tabulated they are passed to a punch operator who punches Ledger Posting card to record—

(a) Freighter (Code number)

(b) Grand Total, tonnage and cash,

and the grand total, tonnage and cash, of these cards, when ultimately tabulated, should agree in total with the figures already ascertained and entered in the "Balance Control Book."

The accounts then pass to clerks for finalising by the addition, by hand, of supplementary debits which arise in respect of earlier months' accounts from diversions of consignments, amendments of declarations, and other causes. Cards are punched to represent these debits, and together with the Ledger Posting cards referred to in the previous paragraph, are used to produce the Ledger Posting Sheets, from which, as the name implies, the debits are posted to the Ledger Accounts.

(j) Check with Receiving Station Returns

After the freighters' accounts have been completed and balance achieved, the whole of the cards are resorted by machine into receiving station order and a separate tabulation producing for each Railway Region for the purpose of checking with the receiving station's returns of invoices received, so completing the chain of checks necessary to ensure that the correct charges are collected on all traffic that passes.

INSTALLATION

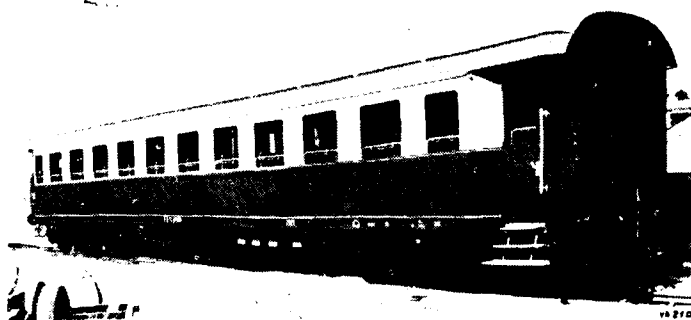
The installation consists of 3 Powers Samas Tabulators, 8 Automatic Key Punches, 3 Sorters, 1 Reproduces, and deals with 65/70,000 consignments per month.

HISTORY OF FIAT

By Our Correspondent

FIAT, whose name is known throughout the world chiefly for their motor cars, which are to be met with on the roads of every continent, including India, are also active, through their Railway Rolling Stock Division, in the field of railway transport. As long ago as 1931 Fiat were the first Italian Firm in the mechanical engineering field to realise the importance of applying the technique of the road motor vehicle to railway traction. In that year the first Fiat railcars were produced. These were driven by petrol engines, but a change was soon made to diesel traction which is cheaper to operate and presents less risk of fire. Fiat railcars have since attained wide use in many different countries. Fiat have built and supplied over 800 railcars and motor trains to the Italian and to foreign railways.

Still further back, in 1923, Fiat started to build diesel locomotives, several of which were supplied to the then Italian Colonies.



3-class passenger coach built by Fiat for the Italian State Railways.

The Fiat Company, of which the Railway Rolling Stock Division is a part, was founded in 1899 (with about fifty workmen and with premises covering an area of 107,640 sq. feet) as a motor car factory: **Fabbrica Italiana Automobili Torino**, from the initials of which was formed the present name of FIAT. But in the course of more than half a century of continuous development Fiat has become not only the largest motor car factory in Italy, but one of the biggest industrial groups in Europe in the manufacture of motorised products for land, sea and aerial transport; hence the



Stainless steel sleeping car built by Fiat to the order of the "International Sleeping Car Company" (Budd licence).

slogan "FIAT Land, Sea, Air". Besides railway rolling stock, Fiat makes motor cars, buses, lorries, vans, trolleybuses, diesel marine and land engines, aircraft and aviation engines (including jet planes and turbojet engines), machine tools, electric household refrigerators and clothes washing machines, lubricating oils and greases.

Fiat productions begin with iron and steel processing (stainless steels are also made by Fiat under licence from the Republic Steel Corporation of America), general metal working and, up through all the various manufacturing and transformation processes to the terminal mechanical products.

Fiat has at present 20 Factories and employs over 75,000 people; it has a sales and technical assistance service organisation which encircles the globe.

The rolling stock production of recent years includes several diesel 3-car trains supplied to the order of the Spanish and Portuguese Railways; a large number of railcars for the Italian State Railways as well as for the Greek Railways; saloon rail cars for Yugoslavia and Egypt and 12 motor train sets for India. Lately Fiat has been granted a manufacturing licence by the Budd Corporation of America for stainless steel railway coaches. One of these — a double-deck sleeping car with 20 single berths, supplied to the International Sleeping Car Company — is illustrated here. The other photograph shows the first of a series of 3 class passenger coaches for the Italian State lines. Diesel locomotives for shunting and main line service are now also being built to the order of the Italian State Railways.

Hundred years of Rolling Stock Production in Sweden

By A Correspondent

MORE than a century has elapsed since 1847, when our firm was founded under the name of Trollhätte Mekaniska Verkstad (The Trollhattan Engineering Works). In 1850 the name was altered to Nydqvist & Holm, and in 1916 the firm was converted into a limited company, under the name of Nydqvist & Holm Aktiebolag (NOHAB).

To start with the manufacture comprised water turbines, steam engines, and various machine parts. After a few years the manufacture of locomobiles was taken up, and the step was then not far to locomotives, which, as a matter of fact, from the very beginning had been contemplated as a future speciality. The first locomotives were ordered by one of the private railways in Sweden, and the delivery began in 1865. One of these locomotives is now in the Railway Museum, Stockholm,

and another of them was in service for 70 years before being scrapped. Many locomotives of our make are after more than 75 years still in daily service. The first three locomotives built for the Swedish State Railways were delivered in 1868.

We have always been anxious to make use of all improvements in the locomotive sphere, and in this connection may be mentioned that compound gears and superheaters were applied at a comparatively early stage, and further, amongst the first 3-cylinder locomotives in Europe were those supplied by us in 1913. In 1925 we commenced to build steam turbine locomotives under licence from Aktiebolaget Ljungströms Angturbin, Stockholm, and amongst engines of this type may be mentioned the non-condensing turbine locomotives for iron ore transport, supplied by us to the Trafikaktie-

Editorial Notice

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

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

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

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

bolaget Grangesberg-Oxelösunds Järnvägar (The Grangesberg-Oxelösund Traffic Co's Railway).

Sweden's richness in water power soon led to the electrification of the Swedish State Railways. Electric locomotives had been built by us before 1900, but it was first in connection with electrification of the state railways that the manufacture of such locomotives became of real significance. The first of these locomotives was of the type 1-C-1, a coupling rod type of locomotive, of which we have since delivered a great number. During recent years several private railways have been electrified, and locomotives of various types for these railways have been built by us.

Completion from omnibuses and lorries has, in instances where electrification has not been considered suitable, compelled the railways to motorize the service, and this induced us to take up the manufacture of motor driven locomotives and rail cars. The first rail car built was of the 4-wheel type but nowadays our rail cars are normally of the 8-wheel type with two bogies.

Our manufacturing programme comprises not only locomotives and rail cars but also other kinds of rolling stock, such as special wagons of various types, rotary snow ploughs and impregnating plants.

To meet the ever increasing demands considerable extensions of our workshops have been carried out time and again. Our works originally covered an area of 8,300 square metres, and they now extend over more than 205,000 square metres. Our shops with a floorspace of 59,000 square metres are full equipped and up-to-date in every respect.

The placing of our works at Trollhättan was to a large extent dependent on access to water power and to a waterway to Gothenburg, Sweden's largest port. In 1922 a special quay was built and equipped with a crane allowing assembled locomotives to be lifted on board ships, specially built for the transport of locomotives. We have our own railway, with a length of 3 kilometres, connected to the Swedish State Railways and thereby also to the Continent. Trial runs of locomotives are

made on our railway. We have also connection to the narrow gauge railway system of Western Sweden.

Our deliveries of locomotives have made the firm known far beyond the borders of Sweden. Scandinavia and Finland have early been our customers. Amongst other countries, to which we have supplied rolling stock of various kinds, may be mentioned The Argentine, Brazil, Iran, Netherlands, Poland, Portugal, Roumania, Turkey, U. S. S. R., and the Union of South Africa. Our deliveries have been large, especially to Iran, Turkey and U. S. S. R. In 1920, the Soviet Government ordered 1,000 heavy goods locomotives, one of the largest contracts in the history of the locomotive industry, which made further large extensions to our works necessary. In order to utilize the increased capacity of our works it was necessary to look for new markets.

Early in 1927 the Turkish Government favoured us with a rather unique and complicated commission. The contract entered into comprised the building of railways with a total length of 900 kilometres, and the delivery of 100 locomotives and 1,500 coaches and wagons of different types. The railways were built in collaboration with the Danish firms Kampmann, Kierulff & Co. Ltd A/S and J. Saabye & O. Lerche. The rolling stock was supplied by us. The whole contract was completed in nine years. The enterprise was followed by a similar commission given by the Iranian Government to the three collaborating firms, who under the name of "Consortium Kampsax" undertook the building of the Trans-Iranian Railway. We supplied the rolling stock, consisting of locomotives, goods wagons, coaches, diesel-electric rail cars, some special wagons and a saloon-car for H.I.M. the Shah.

Since April 1950 there exists an agreement between us and the General Motors Corporation, Electro Motive Division, La Grange, with a view to build and market diesel-electric locomotives utilising General Motors Corporation's constructions and equipment sets consisting of diesel engine, main generator and other supplementary equipment.

The Swedish locomotive builders formed in 1945, a sales company, Swedish Locomotive Works Association Aktiebolag for the export of steam locomotives. Nydqvist & Holm Aktiebolag is a member of that association.

Archdale Radial Drilling Machine for use in Railway Workshops

THE complete range of Archdale Radial Drilling Machines are used in considerable numbers in the Railway Workshops, but for the purpose of this article it has been decided to devote the attention to the Heavy Duty Radial Drilling machines with hydraulic pre-selection of speeds and feeds. These machines are built in eight sizes with a 5 ft., 7 ft., 8 ft., 9 ft., 10 ft., 11 ft. and 12 ft. radius.

Designed for heavy duty high speed drilling up to 3½" in mild steel, the machine has a wide range of speeds and feeds, for drilling, boring, reaming, facing and tapping operations. Both the speeds and feeds can be pre-selected whilst the machine is actually drilling which reduces to the minimum idle time between operations. The controls are conveniently placed low down on the saddle to relieve the operator of all arduous work when the arm is in the high position on the saddle.

The Machine is foolproof and cannot be damaged by incorrect use. Safety trips are provided to prevent over-traversing of the arm and the spindle. Moreover a special safety clutch stops the movement of the arm in either direction should any obstruction be encountered.

The speed and feed gears cannot be damaged by careless changing, as these changes are automatically effected. Clutches are provided to prevent overloading of the speed and feed drives. Should the motor which controls the locking mechanism be left running after the machine is fully locked, an electro-hydraulic locking device safeguards the locking mechanism against overload.

The machine is of the pillar-sleeve type, the sleeve being mounted on the pillar on ball and roller bearings. The sleeve is locked on the pillar by a conical ring, which moves in a vertical direction and thus prevents any displacement of the tool in the horizontal plane during locking.

The mechanism for locking the arm to the sleeve incorporates a long split bearing to obtain a secure lock. The locking or unlocking of the sleeve to the pillar and of the saddle on the arm is effected simultaneously by push-buttons is the centre of the transverse handwheel, controlling on electro-hydraulic motor.

The elevating arm is provided with a wide bearing face for supporting the saddle. A tensioned hardened steel strip on top of the guides on which the saddle traverses, minimises wear and maintains the original accuracy of traverse indefinitely. The arm is automatically locked to the sleeve upon release of the elevating switch lever on the saddle. This locking is independent of the simultaneous locking of the sleeve on the pillar and the saddle on the arm, and consequently the arm swings in the radial direction whilst it is locked to the sleeve. Vertical displacement of the tool during setting in the horizontal plane is eliminated and drilling with the arm unlocked is impossible.

When the elevating switch lever on the saddle is released the direction of rotation of the elevating screw is automatically reversed and the locking effected by a separate nut. The movement is automatically stopped when a full lock has been effected. Alternatively, when commencing to elevate the arm the special nut moves first, and unlocks the arm before the elevating nut comes into action. Should the elevating nut fail the arm will not drop as the special locking nut comes into operation and automatically locks the arm, which cannot then be lowered or raised until the elevating nut has been replaced by a new one.

The elevating nut is provided with an aperture to enable the wear of the thread to be checked.

The combined locking of the sleeve on the pillar and the saddle on the arm is effected by an electro-hydraulic device, which is fitted at the head of the column. The device is rapid in action, simple and free from trouble and provides protection against overload.

Piping and consequently oil leaks are eliminated, as the oil pump piston motor and safety valves are carried in a totally enclosed housing. The locking or unlocking operates immediately the motor is started by the push-button control, the slightest pressure on the control button being sufficient to provide any degree of lock. Arrows on the base of the sleeve indicate the actual degree of lock and this is adjusted so that the sleeve can be locked on the pillar before the saddle on the arm thereby permitting a slight movement of the saddle along the arm, whilst the radial movement is locked.

The required speeds and feeds are selected by turning two concentric direct reading dials on the saddle. The actual gear changes are not effective until the start and reverse lever is operated. This lever engages three actions in sequence :—

- (1) The hydraulically operated gear change
- (2) The delayed starting of rotation of the gears
- (3) Engagement of the full drive

With this arrangement the pre-selected speed and feed is obtained whilst the motor is running, with ease and without clashing the gears.

By dialing 'O' the drilling spindle is set in neutral, and is free to be turned by hand for changing tools.

A multi-disc clutch is provided for smooth engagement and disengagement of the gears, to provide for sensitive control of the spindle, especially for tapping and rapid reverse. This clutch requires, no adjustment and is designed to pull smoothly and maintain its driving power under the severest test. A constant even pressure is compensated and distributed over the entire surface of the plates. When the clutch is disengaged the plates are separated by oil pressure and separately held on "Steps" so that opposite contact is eliminated.

Wide speed and feed ranges are provided, so that drilling, boring reaming, facing studding and tapping operations can be done. Fine boring as well as heavy drilling can be carried out and four automatic tapping feeds are available if required. The five feeds are available for boring work held in jigs and fixtures which is normally carried out on horizontal boring machines, a high degree of accuracy and surface finish being obtained. Particular care has been given to provide the low speeds frequently needed for boring. The twenty-two speeds and eighteen feeds available are as follows.

Speeds: 11, 14, 17, 22, 28, 35, 44, 55, 70, 90, 110, 140, 175, 220, 270, 350, 440, 560, 680, 880, 1100 and 1450 r. p. m.

Feeds: 8, 11, 14, 18, 25, 30, 36, 48, 62, 75, 100, 125, 160, 215, 270, 320, 425, 540 r. p. m. The Automatic tapping feeds are 8, 11, 14 and 18 r.p.m.

A precision depth trip is provided to ensure accurate drilling or facing of blind holes to the correct depth. The power feed is tripped by means of an integral dead stop which ensures a uniform accuracy of depth of

hole without the necessity of other measuring devices. The required depth is set on a clearly graduated feed trip dial, which is provided with a micrometer screw the latter being adjusted after rapid setting of the dial.

The fine feed hand wheel is stationary when the power feed is in use. A lever adjacent to the fine feed handwheel engages either the hand or power feed.

Ease and rapidity of control are outstanding for a machine of this size. The controls are simple and few in number and are located close together on the lower face of the saddle. As the speeds and feeds are pre-selected whilst drilling is in progress, gear changing time is eliminated, and as spindle setting, reverse and gear change are effected without stopping the motor, no second control movement is necessary.

An Automatic brake quickly stop the spindle and prevents "Creeping". The free and easy action of all movable parts combined with the small area into which the controls are grouped, enables the operator to manipulate all movements of the machine from one convenient position which results in a remarkably high output rate without fatigue. All locks are obtained by finger-light pressure, and their ample rigidity is such as to ensure long tool life and also to safeguard against tool breakage. A tachometer is fitted which indicates the speed in use, and a circular scale enables the operator to find the appropriate speed and feed for different materials by direct reading.

In addition to a normal base plate the machine can be supplied with special bases to suit individual requirements. These include :—

- (a) Small "Stub" base for operations where boilers or other bulky components have to be drilled, which can be accommodated in a pit adjacent to the base.
- (b) Traverse base where it is necessary to drill large surfaces, the traverse of the machine on the slide is controlled from the saddle.
- (c) Two-three or four-way bases to provide for continuous production whilst work is being drilled on the one base, other work may be set up or removed from the others.

The agents in India for James Archdale & Co. Ltd. are, Alfred Herbert (India) Ltd., Calcutta with branches at Bombay, Madras, Bangalore and Secunderabad.

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 issued only if accommodation is available.

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

Reservation fee is not refundable.

192223

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

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

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

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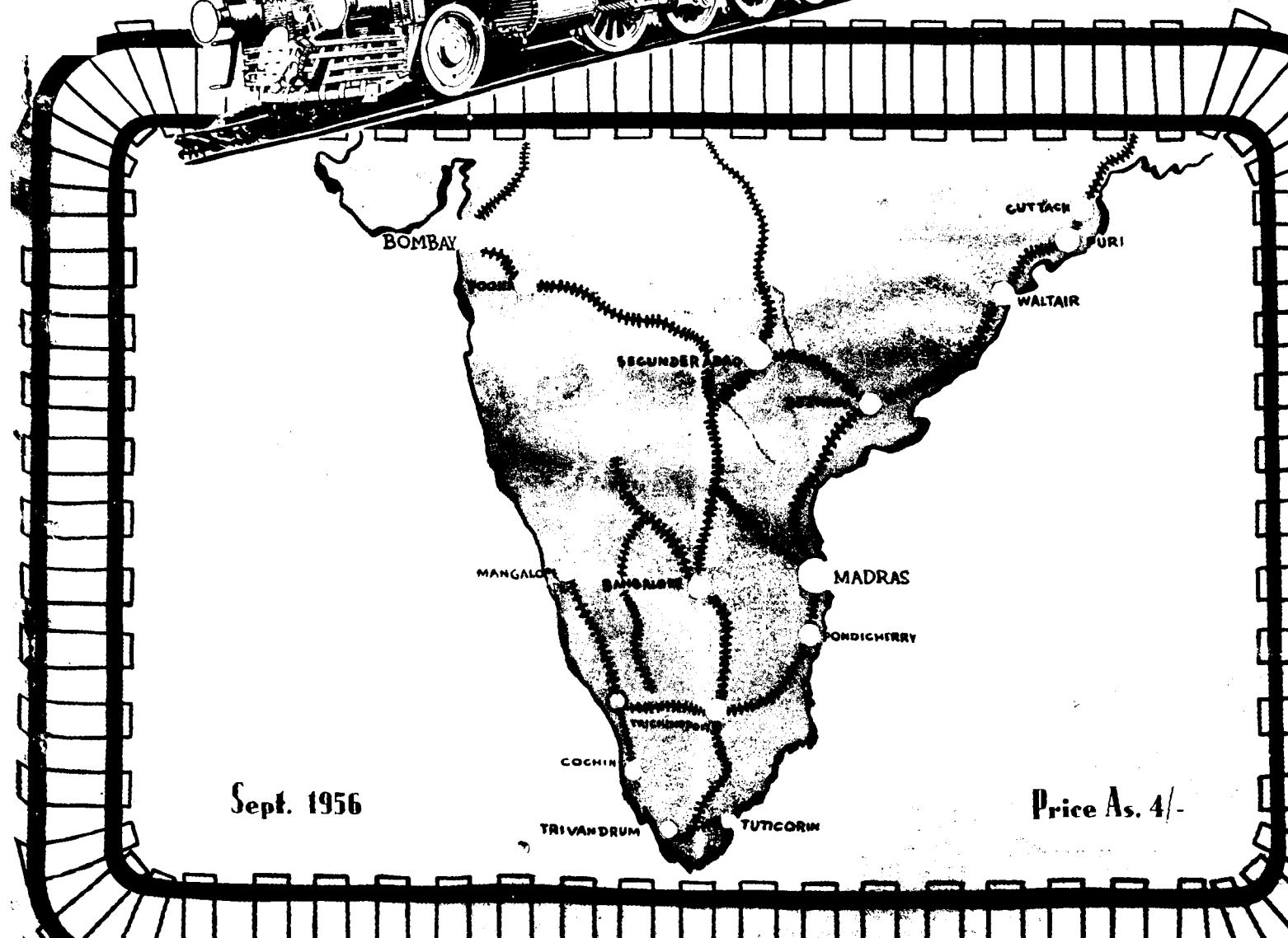
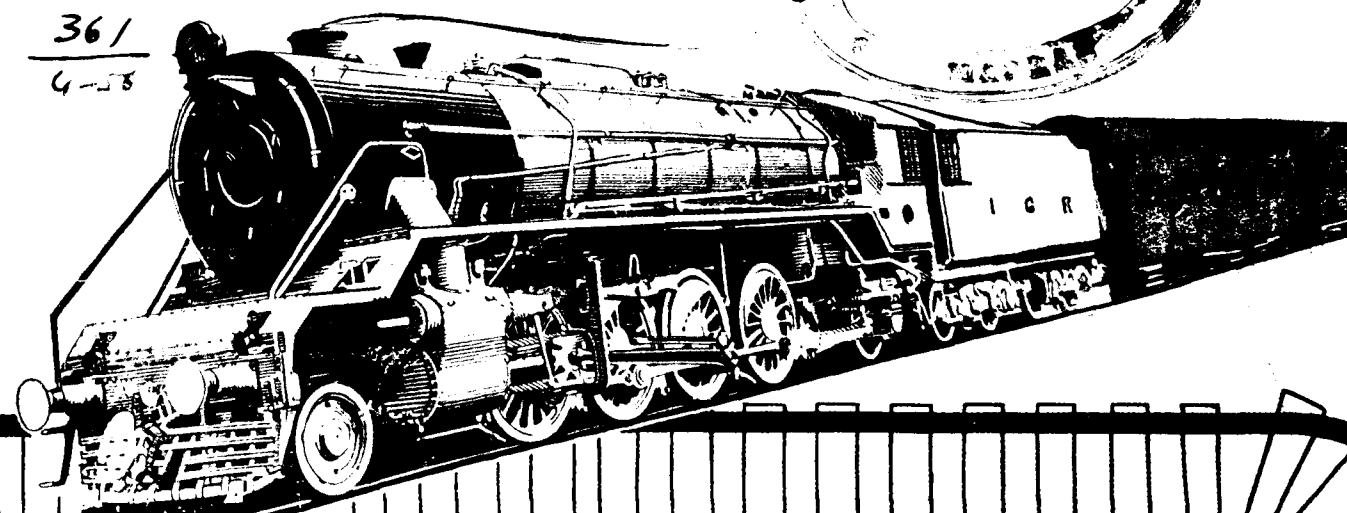
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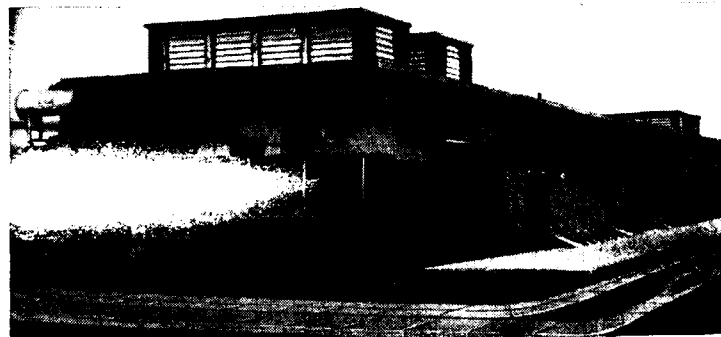
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BRITISH RAILWAYS SOUTHERN REGION

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 electrified track. Hewittic Rectifiers installed on other sections of this region total 47,300 kW.



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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.

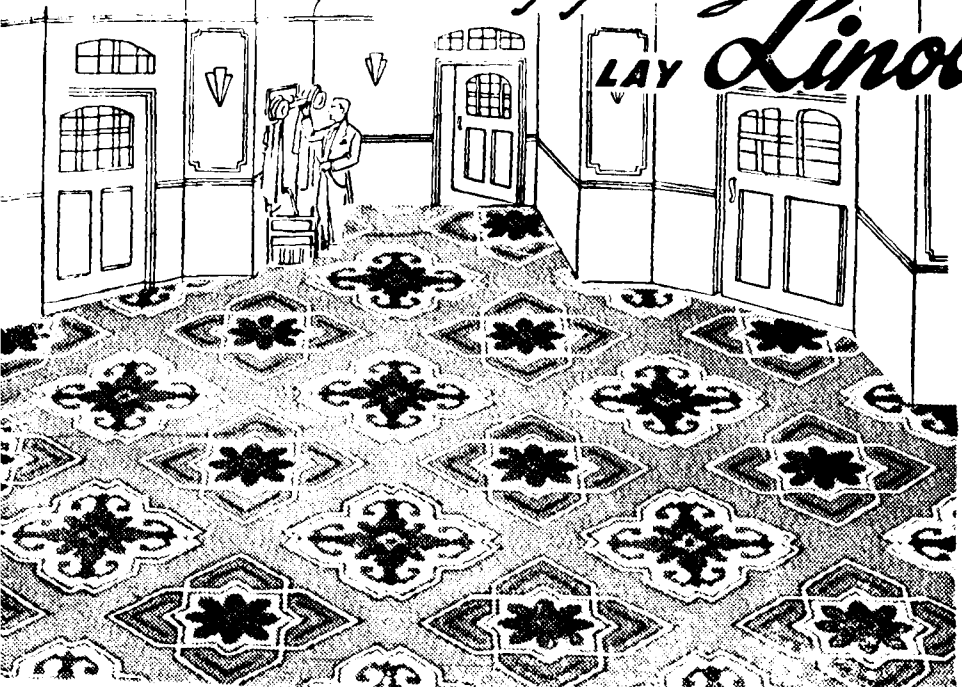
The Central Railway however has put all its available coaches to maximum use to minimise the overcrowding caused by so phenomenal an increase in traffic. According to figures compiled and published by the International Railway Conference Association in their October

(Continued on page 21)

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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 is 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 in 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 with-

drawal 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.

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.

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

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 transshipment 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 Vengam, 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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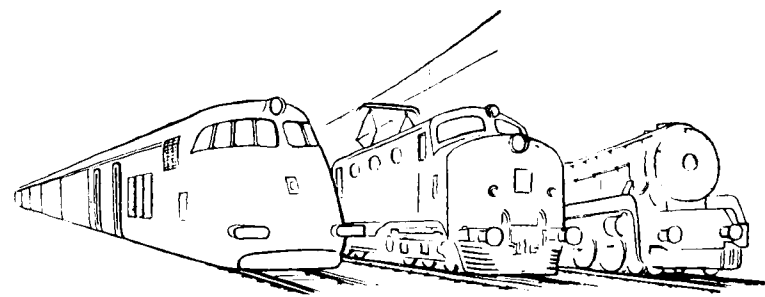
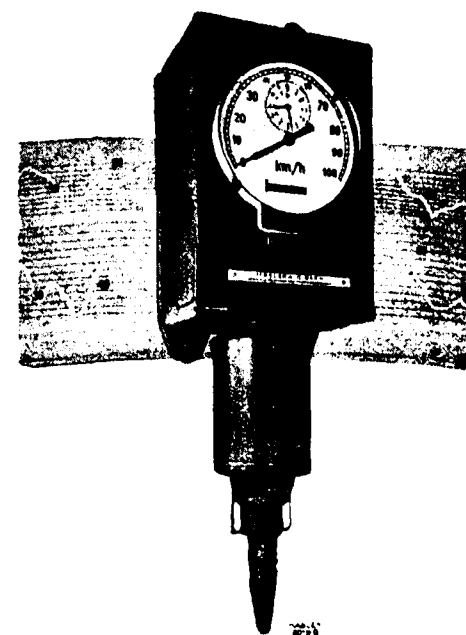
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September 1956

SOUTHERN RAILWAYS MAGAZINE

9

The Full-Elastic Catenary-Warped Contact Line for Railways

By Matthias 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 Kummeler & 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

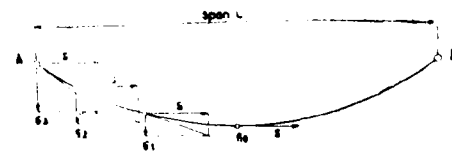


Fig. 1 Catenary curve of a wire in the resting position.

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 of 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.

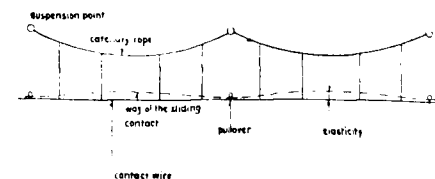


Fig. 4 Vertical catenary contact line-Vertical section.

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. Contact line shown in Fig. 5 in each span of which contact wire and catenary cable exchanged functions.

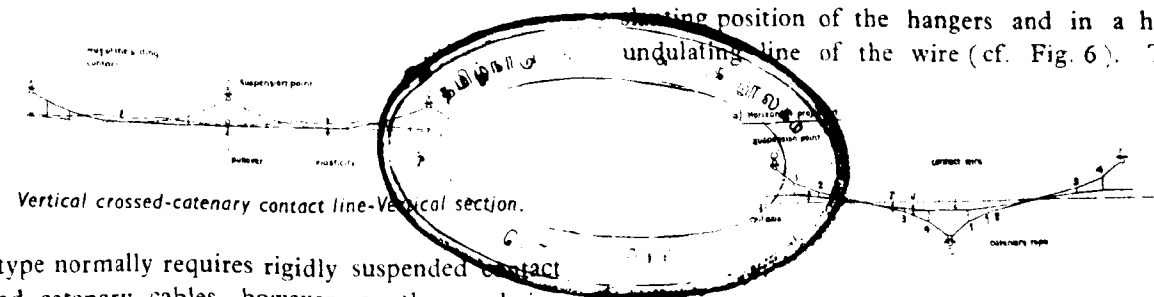


Fig. 5 Vertical crossed-catenary contact line-Vertical section.

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 sagging 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.

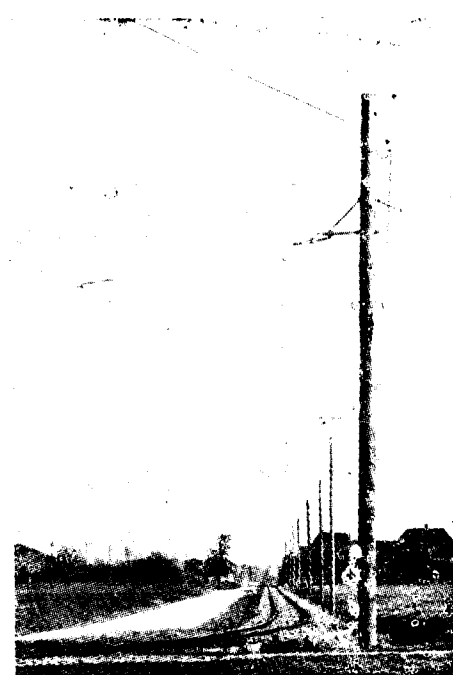


Fig. 7 The catenary-warped contact line—Entrance in a curve.

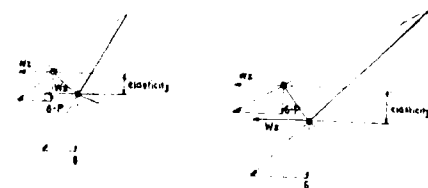


Fig. 8 Working position of the hangers depending on the contact pressure.

(a) — a short, strongly slanted hanger;
(b) — a long slightly slanted hanger;
 G = weight 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 pressure 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 strung in curves according to a method which has been known the art for sometime and is extensively used by the Swiss Federal Railways.

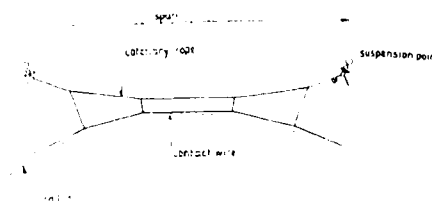


Fig. 9 The catenary-warped contact line in curves, in a pole-economizing kind of construction. Horizontal projection.

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

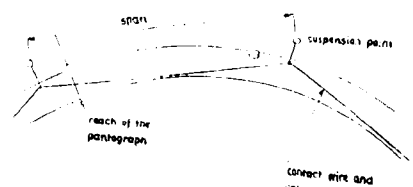


Fig. 10 The catenary vertical contact line in curved stretches; limited spans.

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. Kummeler & Matter Ltd., Zurich, the following conclusions may be drawn regarding this type of contact lines:

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

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

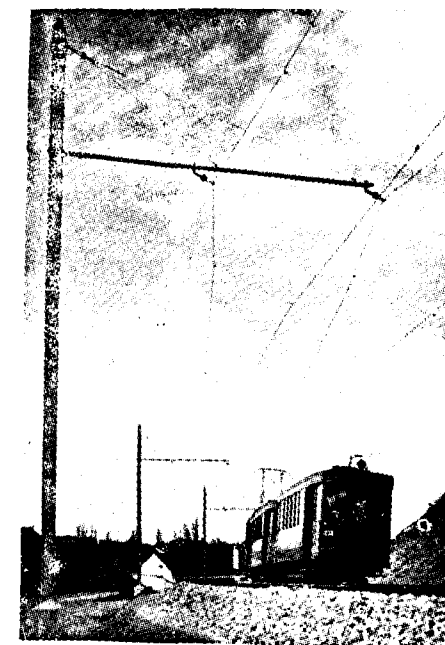
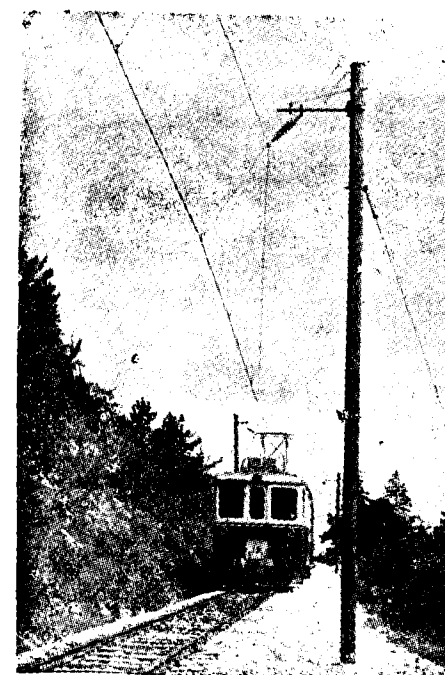


Fig. 12
Catenary warped
contact line for
double track
erected in pole-
saving manner.
Patent system
Kummeler &
Matter.



meter 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.

- 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 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 (Engenhof-Beringen stretch),
Tramways of Schwyz,
Sernf Valley Railway,
PSC Railway (La Chaux-de-Fonds Les Ponts de Martel stretch),
Public Transport Company of Basle (Hochlebach 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 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 rpm	4 RPH		4 RPHX		6 RPH		6 RPHX			
		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		
RATING		8 RPH		8 RPHX		12 RPH		12 RPHX		16 RPHX	
		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)

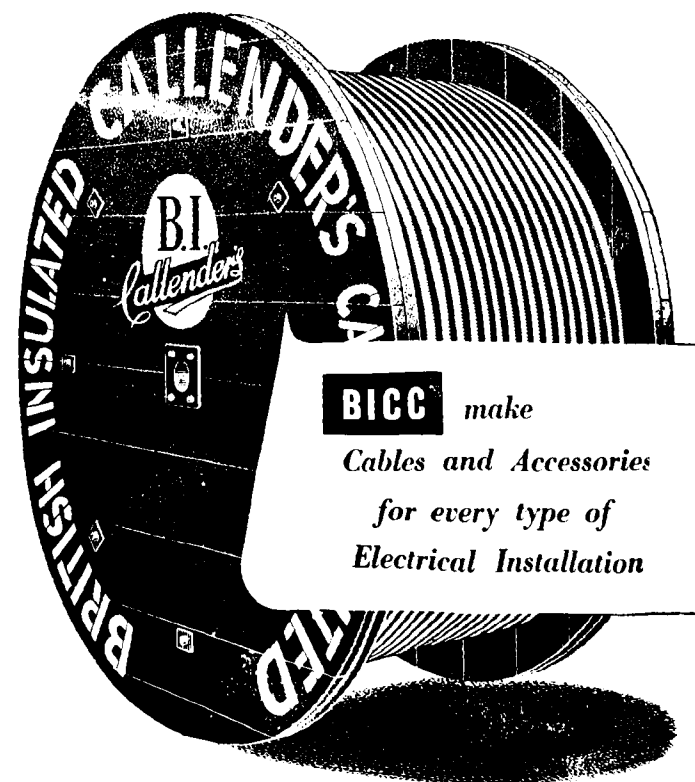
Editorial Notice

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

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

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



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force. The multi-cylinder design provides a smooth torque, and the small stroke ($7\frac{3}{4}$ 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 in 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
$\frac{3}{4}$ load	1,250 rpm	0.41	0.41
	1,000 rpm	0.40	0.40
$\frac{1}{2}$ 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 cal/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	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	2,395		
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		

dampers 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		44 $\frac{1}{2}$		40		19 $\frac{1}{4}$
4 RPHX		56 $\frac{1}{2}$		42 $\frac{1}{2}$		39	19 $\frac{1}{4}$
6 RPH	57 $\frac{1}{2}$		44 $\frac{1}{2}$		40		19 $\frac{1}{4}$
6 RPHX		65 $\frac{1}{2}$		42 $\frac{1}{2}$		40	19 $\frac{1}{4}$
8 RPH	69 $\frac{1}{8}$		44 $\frac{1}{2}$		40		19 $\frac{1}{4}$
8 RPHX		81 $\frac{1}{8}$		42 $\frac{1}{2}$		47	19 $\frac{1}{4}$
	A	B	C	D	E	F	G
12 RPH		50	32	47	92		62 $\frac{5}{8}$
12 RPHX		58 $\frac{5}{8}$	32	47	92	102 $\frac{7}{8}$	62 $\frac{5}{8}$ 59 $\frac{3}{4}$
16 RPHX		59 $\frac{1}{2}$	32	47	115	125 $\frac{7}{8}$	62 $\frac{5}{8}$ 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 mounted 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.

(Continued from page 1)

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)

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 fly-weight 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-driven 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-trying 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 lightweight, 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.

H E N S C H E L



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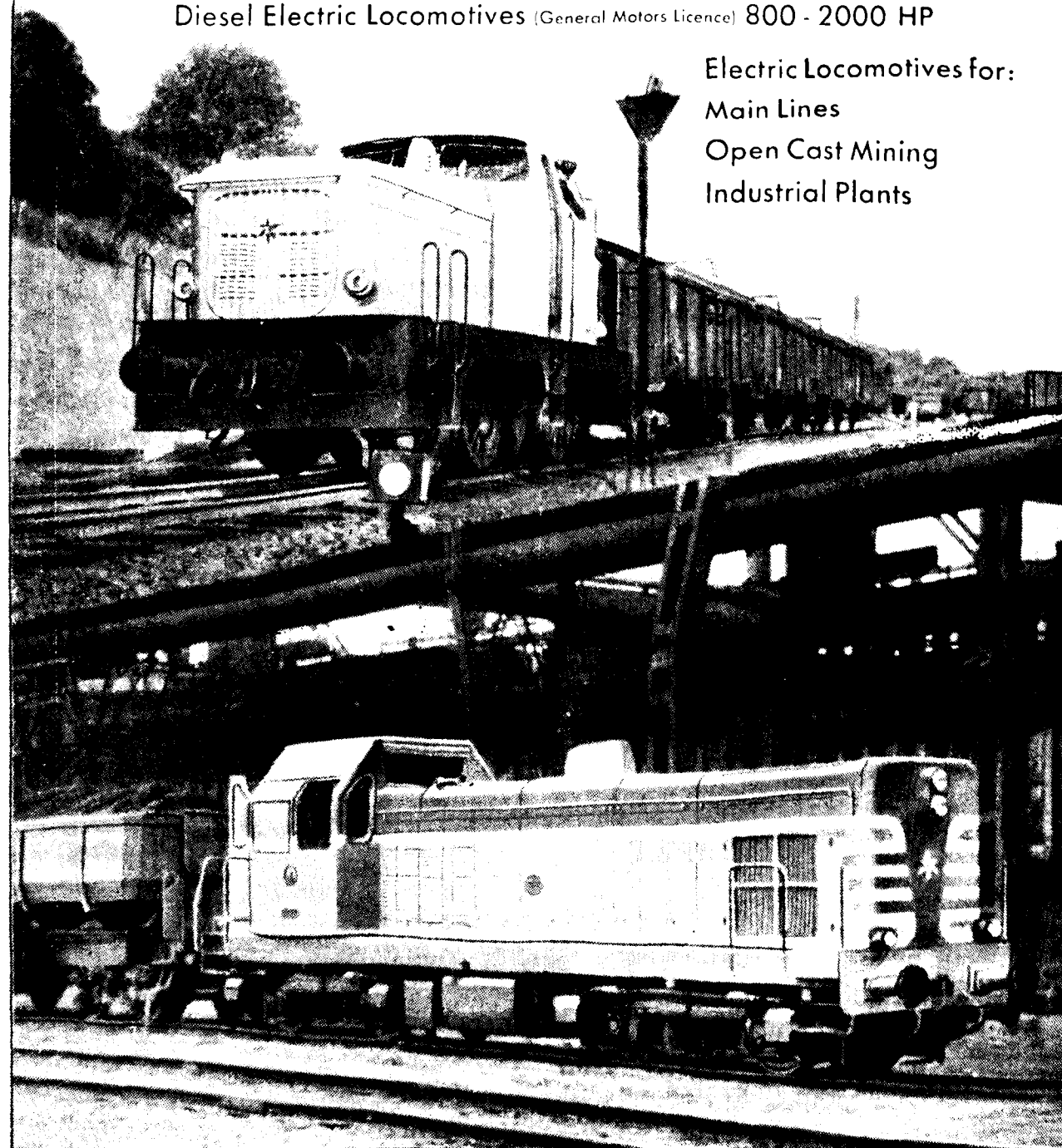
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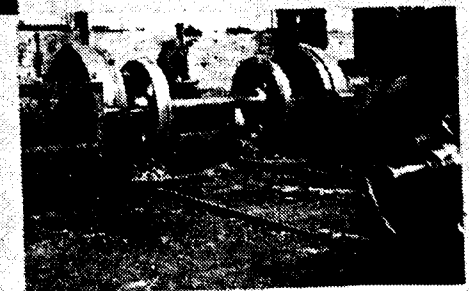
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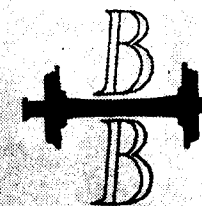
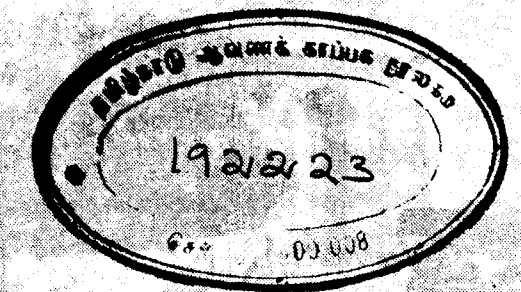
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CLEANLINESS LEADS TO HEALTH AND HAPPINESS

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.