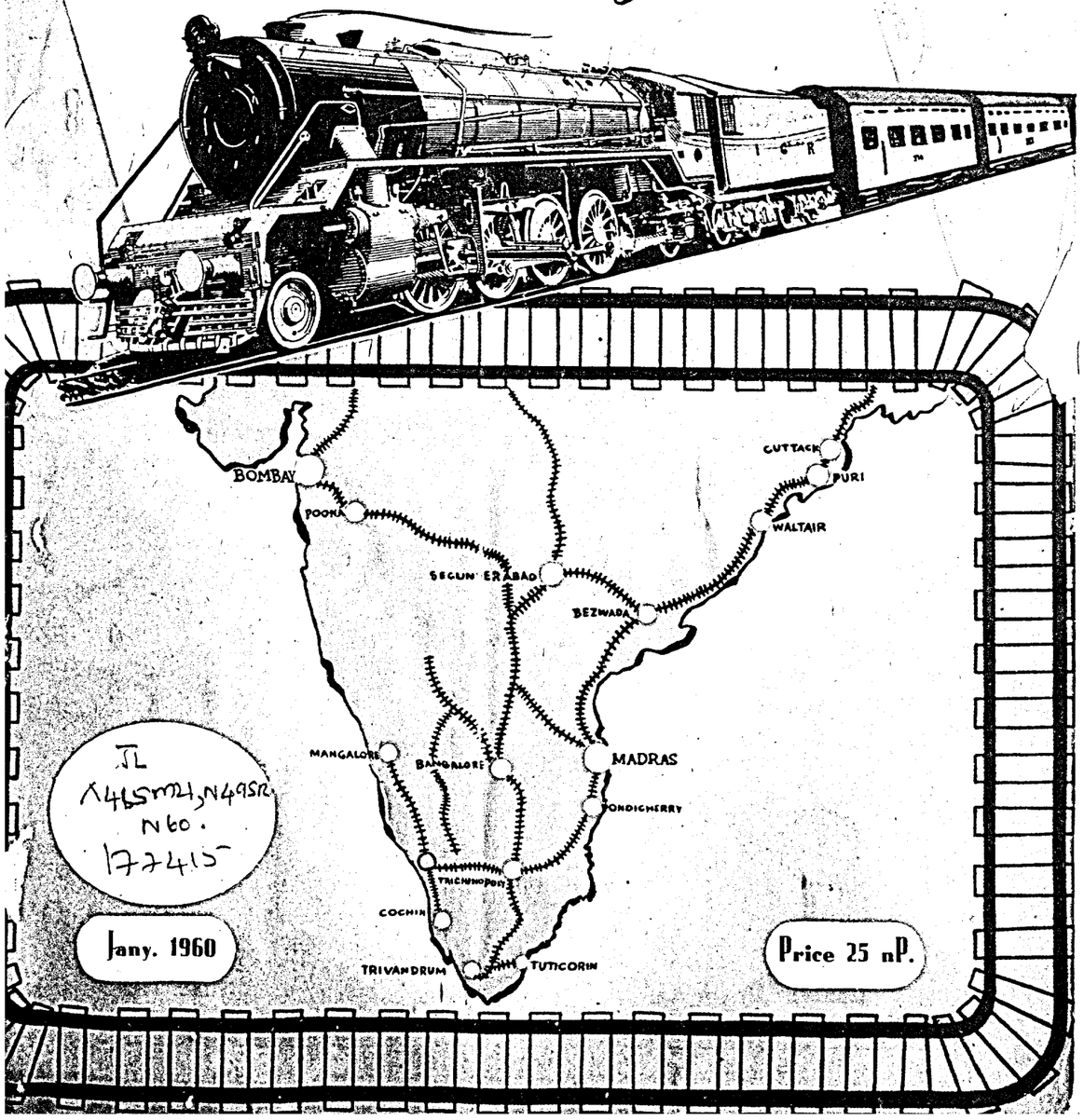
SOUTHERN RAILWAYS *Magazine*



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(Inserted in the interests of Travelling Public)

32/94

IMPRESSIONS OF AN OLD TIMER

By R. C. Hardikar, D.F.H. (London), A.M.I.E.E.
District Electrical Engineer,
Chittaranjan Locomotive Works.

PREJUDICES are bad. They blur the vision. Theoretically speaking engineers harbour no prejudices. Adoration for their 'Varsity or Works is an exception. In this, even a fond mother cannot run level with an engineer. However ugly the duckling the mother gloats over it. Just imagine then, my feelings towards a certain Loco. & Carr. Workshops over 25 years ago. Those were the days of trade depression. Beggars cannot be choosers. One has to accept even crumbs. I took up a temporary assignment which came my way. It was Job Analysis. The Pope Committee advised it to cure our railways economic ills. I had to start it in the electrical department at that smallest even on the biggest Railway. It hurt me to the quick when I read in an official Report that that workshop "was the worst this side of Suez ever visited" by its authors—British Railway experts in their own spheres. I had then put in over two years training in the workshops of the Swiss Federal Railways. That was in Zurich and Yverdon. It was too much for me, therefore, to start my career in the worst possible workshops in the entire East. "China not excluded", mentioned that Report. I felt like a young mother trying to caress her ugly offspring.

I wanted to begin in an up-to-date works as I was used to in Switzerland. What was so nice about workshops in Switzerland? Craftsmanship and technique. Before leaving for Europe I had never ever been inside any workshop however modest. Nor inside a garage or an electric motor repair shop. While in Zurich one day, I had to show the Works round to an English visitor. He was a burrah sab (Dy. CME) from the largest Loco. Workshops in India. At the time of our parting, I enquired of him, "How will these Works compare with yours in India?" He answered, "Here I noticed the least supervision and the least paper work." To-day after 25 years of continuous service I find how true were the remarks of that Englishman. Out of the long 25 years, I had been attached to workshops for no less than 12 years.

In the Zurich Works every worker was a trained craftsman. Every one was skilled in the art of wielding a file to perfection. Once a young Swiss paid us a visit in the Shops. He was a trade apprentice there before. Being below the standard for precision filing he was not absorbed on the Railway. He had found some other employment—as an assistant to a sculptor instead in Paris. He showed us snapshots of his employer in the atelier. He showed us, of course, snapshots of models in the nude in different poses. There was no unskilled or semi-skilled labour in that railway workshop. Every craftsman carried his own tool box about. On Indian railways a skilled labourer in grade Rs. 60—130 considers it infra dig to cart about his tools or instrument box. He walks ahead empty handed followed by a mate with the tools the former needs.

Hardly five years ago I had approached a certain IOW to show me the residential accommodation allotted to me. His clerk informed us that the entrance door to that place was barred by a wooden batten. To remove the screwed-down batten a carpenter was needed and summoned. The carpenter in turn summoned a mate to carry the former's solitary 8" screw driver. Little wonder then that we have such a low utility factor. Has it anything to do with our former alien rulers or our own caste system? A visiting American recently considered our keeping buffalos for milk and bullocks as beasts of burden a wasteful drain on our slender economy.

The workers in Swiss Federal Railway Workshops cleaned and lubricated their machines religiously every saturday. During idle moments or off peak periods they repaired their tools and implements—once a month at least. They undertook running repairs of their individual machines themselves. Truly a

preventive maintenance measure. This improved all round utility factor—Both of labour and plant. In our workshops here there is a great apathy on the part of personnel and management in improving this utility factor. On the Swiss Railways Permanent Way Inspectors were trained to undertake the maintenance of 15,000 volts overhead electric equipment and substation equipment too. But there was a great hue and cry in the electrical departments, a decade or so ago, on all Indian Railways when the Kunzru Committee recommended merger of electrical departments with civil engineering and mechanical engineering departments. At this the Railway electrical engineers felt like the Princes in Indian India during our Freedom Struggle.

Some couple of years before the Second World War an excellent Chinese Carpenter in a railway workshop in India put up an appeal. For the electric wiring of passenger coaches in all railway workshops in India, it has been and is customary to detail a gang of three men. A wireman, a carpenter and a mate. The first two are in the skilled grade Rs. 60—130 and the third in the unskilled grade Rs. 30—35. But when the wireman works the carpenter is inoperative and vice versa. My Chinese carpenter claimed that he be given a higher wage since he does carpentry and wiring with equal efficiency. And that too without any drop in production as compared with other 3-man teams. The official reply was that the applicant be worked either as a carpenter or as a wireman. But if the two jobs like these or those of masons and fitters or blacksmiths are combined a lot of man-power can be conserved. In fact such all rounders who have mastered 2 or 3 allied or even different trades should be given the higher skilled grade Rs. 80—160.

The supervisors on Swiss Railways worked in their own hands. On Indian railways they are just as active and vital as scare crows. Our supervisors concentrate more on paper work than on production and up-keep of machinery. In Switzerland, in addition to working in hand the supervisors guided other workers in their difficulties and lent them a helping hand. Furthermore, they did their own paper work. They had no clerks to assist them and to boss over. They were what a true teacher should be to his class. Help those in difficulties, not only to twist tails. The Swiss technicians, supervisory and superior ranks, were armed with general scientific knowledge. They had laboratory experience and inventive imagination. Unlike the Americans the Swiss do not bank on machines to do everything. They value the personal touch in their individual workers to produce quality goods for the rich markets in highly developed countries rather than the impoverished bazaars in backward countries.

So far the differences between a railway workshop in Switzerland and in India, What I asked the visiting Englishman in Zurich in 1929 I ask myself as I move about to-day in the Chittaranjan Locomotive Works. "Is there anything by way of plant or equipment that we haven't got which Switzerland had?" Am I proud, at the very fag end of my service to answer, "Nothing whatsoever". Henry Ford had said that the installation of a solitary machine even some 6" away than where it should have been shoots up overhead costs. This aspect too was not lost sight of in Chittaranjan Locomotive Works. Here we have a very high ratio of,

$$\frac{\text{Floor space occupied by machinery}}{\text{Total floor space available}}$$

Recently Mr. M. De Vos, President, International Railway Congress Association led a delegation to India from abroad. It visited Chittaranjan Locomotive Works on 13th December, 1959. Later at an interview in Calcutta Mr. De Vos said, "It is amazing that India should be producing first class locomotives at the rate of one in 48 hours. Such efficiency in so short a time compares very well with the achievement of any country." In the covered area of 8,80,000 Sq. ft. we have over a 1000 items of machinery and plant. The machines are driven individually by 1,766 electric motors aggregating 16,984 H. P. We have machines like,

Union Melt Welding
Industrial X-Ray
Killer Die Sinking
Supersonic Flaw Detector

having electronic control. These, and electronic instruments like Stroboscope and Philiscope call for highly trained maintenance staff. We have them. As in Switzerland, we have well equipped and up-to-date laboratories and a Research Centre. Here all the known physical, chemical and mechanical tests are carried out on raw materials and castings. I only wish the interior electric lighting of the works and its central battery manual telephones were in keeping with this modern show piece. Interior lighting was, unfortunately, not designed on scientific lines for production at night. It has been hap-hazard. Elder workmen past 40 require higher illumination for the same work than their youthful colleagues. Operations needing longer time to perform also require higher intensities than short ones. Improved lighting lowers incidence of accidents and reduces human fatigue. It, however, has to be commensurate with its capital cost and maintenance costs.

I also wish that there were closer contacts between workers and management. A Project is never meant to provide employment to the displaced persons. Nor careers to the sons of the well-to-do. The sole object of any industrial enterprise is the production of goods, at progressively lower costs, for human needs. This has to be achieved from costly plant and highly paid personnel. Switzerland has shown how to do it. She has achieved a higher standard of living than even in U. S. A. This small Federal Republic has neither the advantage of numbers nor any natural resources. The Swiss have a saying "Arbeit macht das Leben suiss". Work makes life sweet. Hard work and rugged faith in industrial research. Recently a visiting English journalist wrote, "The trouble with present day Asiatic peoples is that they want to earn more and more but work less and less for it." It is repeatedly heard in high quarters that the go-slow-tactics of our militant labour is the out-come of appeasment. Such critics rely on truncheon. Will its restoration bring the desired result? Do not our industrial workers, as in other countries, aspire and strive for better times for their off-springs than they have had the luck to have for themselves? After all, judiciously recruited and properly looked after personnel, can never besmear this living monument to the industrial awakening of ancient India—"Chittaranjan Locomotive Works."

DIESEL-ELECTRIC LOCOMOTIVES TO HELP OIL BUSINESS

Argentina's already booming oil industry will receive more help late this year with the delivery from the U. S. of 11 diesel-electric locomotives for use on the General San Martin Railway.

These locomotives were purchased by the Operating Committee created under the contract between YPF and Carl M. Loeb, Rhoads & Company.

The locomotives, which are to be built by the General Electric (U. S. A.) Locomotive & Car Equipment Department, Erie, Pennsylvania, will be used to haul strings of oil tank cars between the oil fields near Mendoza to coastal refineries in the Buenos Aires area. It is expected that shipment from the U. S. will begin in about five months, according to G-E officials.

Announced initially in Erie by the G-E Locomotive Department, the order was placed through the International General Electric Company. Approximate value of the locomotives is over $ 2,250,000. Arrangements for the purchase of these locomotives, which are to be used in connection with the YPF-L. R. Development, Ltd., were made through Carl M. Loeb, Rhoads & Company.

The 11 locomotives will be of the universal-type, meaning that they can be used for freight, passenger and switching service. Each unit will deliver 1980 gross horsepower. The locomotives will be equipped with multiple unit controls which will allow operation of two or more locomotives in tandem from a single cab by one operator. This will facilitate hauling extra heavy strings of tank cars over the heavy grades encountered near Mendoza, a city located in the shadow of the Andes.

Delivery of the new diesel-electrics will bring the total number of G-E locomotives in Argentina to 226.

* * * * * *

NEW GENERAL MANAGER

Shri S. G. Pothan, Financial Adviser and Chief Accounts Officer of the Western Railway, has taken over charge from 28th October 1959 as acting General Manager in place of Shri M. M. Khan, who has been transferred to the Eastern Railway as General Manager.

Shri Pothan, who was born on 28th May 1905, joined the ex-Nizam State Railway in 1927 as Assistant Auditor, and subsequently after serving as Senior Assistant Auditor and Deputy Auditor, he was promoted to the rank of Chief Accountant and Auditor of the Nizam State Railway in 1942, which post was later re-designated as Financial Adviser and Chief Accounts Officer. In 1951 the Nizam State Railway was integrated with the Central Railway to which his services were transferred. In July 1953, he was posted as Financial Adviser and Chief Accounts Officer of North Eastern Railway. He worked there till May 1957, when he came on transfer to the Western Railway as its Financial Adviser and Chief Accounts Officer, which post he held upto date.

Shri Pothan is President of the Western Railway Sports Association. Under his stewardship, sports on the Western Railway has taken rapid strides and he has been directly responsible for the promotion of sports on this Railway.

STORES ENGINEERING

By A. Deb, B.E.
Asst. Controller of Stores,
Chittaranjan Locomotive Works, Howrah

THE caption of this article would sound very strange to many readers. It however ushers the shape of things to come. From the beginning, we have had Civil Engineering, Mechanical Engineering and Electrical Engineering. Then came specialised trades such as, Heat Engineering, Refrigeration Engineering, Refractory Engineering, Structural Engineering, Public health engineering, Agricultural Engineering etc. etc. It is now turn for Stores Engineering to appear on the stage. Railways are the biggest national undertaking in the country and no wonder the maiden appearance may manifest on the Railways. The spade work has already been done and ground prepared by creation of a separate cadre of Stores Officers, by recruitment through Union Public Service Commission. The first batch of such engineer-stores-officers in Railways came into being in the wake of war, in 1944. Prior to that, full-fledged engineers from the cadre of Indian Railway Service of Engineers (I. R. S. E.) were now and then, loaned to the Stores Department. Code of practice for Stores Department was also compiled in 1938. It would now be in fitness of things to award the appellation Stores Engineers to these officers of the Stores Department of Indian Railways, to justify the posting of Engineers in Stores. Other enterprises in Public Sector would then follow suit and ere long the private sector also would realise the necessity. The Industrial Management Service, if and when set up may also provide for separate cadre for Stores-Engineers. Approximately one third of the expenditure for a project or works is allotted for stores. The department should, therefore, be manned by capable personnel. But for stores, the progress of any enterprise comes to a stand-still. The engineers carry on their work as long as stores are supplied to them. The accountants account for the material as long as there is transactions for the same.

Officers of the Stores Department in Company-managed railways were designated as Superintendent; in the State Railways, the designation is Controller. While inventory control is the prime function, the sinquanon for this is engineering qualification and only an engineer can do the best justice to stores, whether in procurement or in consumption. Stores are nothing but articles exchanged for hard cash. Just as we invest capital in cash in bank, we invest capital in kind in stores. We submit cheque to the bank for drawal of cash. We submit requisition to stores for drawal of material. There is no fundamental difference between cash in bank and kinds in stores. A banker administers by controlling his cash, a Stores Engineer administers by controlling his stock. A Stores Engineer need not be a banker but should know the fundamentals of banking and accountancy. All engineers are given courses in rudiments of accounts in their colleges. They are not merely to show engineering skill by successful completion of the undertaking but also to account for every paise they spent. Obviously they are know-how people for accounts purpose also.

Engineers in front line engaged with construction, maintenance, operation or manufacture concentrate on the target outturn. For successful achievement of their target, right materials in right time are fed by another set of engineers from the rear line. These engineers are the Stores Engineers. Another set of engineers who occupy the rear line are the drawing office engineers or designers. Success comes only on the co-ordinated effort of front line and rear line engineers, though the average passer-by may be oblivious of the rear line and their functions.

Efficiency, Economy and Expedition are the watch word for Stores Engineers. These are the three great Es of stores organisation. There are many sayings about stores such as; stores must deliver the goods to keep the wheels of progress moving; stores is a service department; stores is like fond mother nourishing others; stores is like teeth, utility of which is recalled only on failure. Whether these are complimentary or not, no Project or industry can do without stores department. If however, the department is not manned for the efficiency, the deficiency would reflect in other phases and deter the progress. The efficiency of a Stores Engineer should be on par with others in front line.

Procurement of proper stores, constitute one division in the Stores Organisation, the other division being for distribution. Bill of materials is prepared from drawings and requisitions submitted by consumers

for procurement. All materials should be purchased to standards and according to drawings. Introduction of non-standard articles does not help in development of industries. Procurement according to samples betrays ignorance of drawing and specifications. Specifications current in the country are ISD, IRS, BS & IS. The Indian Standards Institution has undertaken to bring out specifications for our standards just as British Standards or American standards are bringing out specification in their respective countries. Stores Engineers should be fully conversant with the specifications. Where an item of stores, is sold in the trade, as a proprietory item or by brand name, particularly imported from abroad involving foreign exchange, the Stores Engineer should study such item and recommend to the Research Department in the Railways for finding out the specifications or the development wing of the Government for exploring indigenous capacity for the item. The Stores Engineers' service in this respect would help in conserving foreign exchange and development of industries. While on this job, the Stores Engineer has also to contribute his share for promotion of cottage industries. According to present policy of the Government, price preference to the extent of 25% may be given to the products of Cottage Industry. A definition of cottage industry may be of general interest here. "Cottage Industry is one which is carried on wholly or primarily with the help of members of the family either as a whole or a part time occupation". Fullest encouragement should be offered to Co-operatives. Small-scale Industries should also receive due consideration.

John Ruskin said somewhere "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper and the people who consider price only, are this man's lawful prey". If writers and philosophers are so alert about the quality factor, a stores engineers has no excuse to sacrifice quality for price. Lower offers may be passed for good and sufficient reasons, some of which are—

(a) Stores offered much later than required.
(b) Delivery not guaranteed.
(c) Offers not to specifications.
(d) Special condition stipulated not acceptable.
(e) Manufacturing capacity doubtful.
(f) Past performance unsatisfactory.
(g) Preference to indigenous stores or products of cottage and small-scale industry.
(h) Preference to 'Firm Price' offers.
(i) Offers for untried brand and make.
(j) Capacity fully booked or large orders outstanding.

Engineers engaged in procurement of stores propose to form a guild on all-India basis under the name of Purchase Officers Organisation. There would be a mouthpiece for the organisation wherein experiences and researches in procurement would be published quarterly. This would be the first journal of its kind in the country. In America there was a journal "Railway Stores and Purchases".

Adhering to specification has many inherent advantages. The indentor is sure that he has indented according to specification. The manufacturer is sure as to the standard of the item. The Purchaser is sure that tenderers will submit quotations of materials of requisite standards. The tenderers themselves would be sure that all of them are quoting for the materials of same specification thus obviating undue competition for rate cutting amongst themselves. The Inspector can maintain the standard by referring to the specification.

The function of inspection is to determine 'what it is and what it does'. The operation consists of comparing a product with accepted specification and/or other recognised standards. Use of electronics, x-ray and supersonic methods are very modern. Laboratory analysis also gives convincing results. Inspection in stores, is virtually a *postmortem* operation, as it is performed after the manufacture is complete. Such inspection is only for screening products that conforms to specification from those which do not conform. It is the stage inspection which ensures quality of manufacture and avoids bulk rejection (quality control). Inspection after processing may guarantee the customer, a product of maximum quality and to this extent, establishes a good reputation of manufacturer.

Planning for procurement calls for experience about the consumption of the constituents and experience about the industries in the country. The planning is based on data available in the ledger cards.

There are, however, certain items which are to be procured through specific agencies. These are :—

(a) Controller of Printing and Stationery—All stationery, printing (including type-writer) and press equipments.

(b) National Instruments Factory—Surveying and mathematical instruments.

(c) Government Medical Depot—Medical Stores.

(d) Iron and Steel Controller—Iron and Steel (controlled items).

(e) Sleeper Control Officer—Wooden Sleepers.

(f) Railway Board—Coal, cast-iron sleepers, rails, machinery and plant for railways.

(g) Director General of Supplies—Textiles.

(h) Director General of Supplies—Rate contract items.

Director General Supply & Disposal may be approached, through indents, for procurement of any item, the value of which for the quantity, indented, exceeds Rs. 25,000. Regional Office of D. G. S. & D may be approached for urgent items.

The Distribution division of a Stores Organisation has to perform an equally responsible task compared to procurement division. Materials procured are to be inspected, accounted for, stored and then distributed. In the Stores Organisation, the working is cyclical. The Stores Engineer has to estimate how much stores he would distribute in the next year and then provide funds accordingly. He is to submit requisitions to the Procurement division accordingly, for the quantity to be stored for the next year's consumption. In computing the quantity he has to take into account the time lag for procurement and to provide for the margin in his stock requirement for this time lag, which depends on :

(1) Proximity to the source of supply.

(2) Market condition.

(3) Whether an item is for meeting an emergency.

It is usual to procure stock equivalent to one year's consumption. Factors which govern this procurement are :

(1) Capital to be locked-up for the procurement and concomitant charges for interest.

(2) Storage capacity and fear of deterioration and obsolence by long storage.

(3) Economic size of the order of attract competitive rates.

Frequent purchases involves less capital, but more clerical work, more freight, packing and handling charges. A compromise is usually aimed at by purchasing once a year.

Records for distribution of stores are maintained by Ledger-keepers. They are the counterpart of the Book-keepers in Accounts Branch. The ledger section is the nerve centre of the organisation. All data regarding receipt, issue and recoupment of stores are available from the ledger section. These ledger cards are maintained in such a manner to as furnish all information. The inventory control is based on the data of the ledger section.

The purpose of maintaining a centralised stores depot is to stock materials for all constituents. Just as cheques are submitted to bank for withdrawing cash, constituents submit requisitions to the Stores Depot for drawal of materials. If the bank cannot provide funds then the business suffers. If the Stores cannot issue materials to constituents, then outturn is adversely affected. The production in a Workshop depends on the availability of proper materials and tools. It is for the stores to undertake the responsibility of feeding the production unit not only to maintain the target outturn but to increase the productivity. Productivity is not a factor of quantity. It is the quality factor of production. It is the maximum outturn at minimum cost. This can be achieved, among other things, by proper inventory control and distribution of stores. Stores Department should be considered as a production unit for this purpose.

Knowledge of Science is necessary for the up-keep of stores. The composition and constituents of the materials should be understood by people dealing with stores. Specifications and drawings should be known to these peoples. They are technical staff for all intents and purpose. They should know the difference between paint and varnish, carbon steel and high speed steel, drill and reamer, grinding and polishing. They should know how timber is to be protected from deterioration, how rubber goods are to be protected, how glass sheets are to be stored ; how paints are to be stored, how textile goods are to kept etc. The details have been given in a book "Stores Manual" by the author of this article.

Stores Engineer should be associated with industries. They should be helpful in standardizing the nomenclature of stores. Even inspite of rapid progress in industries, one has to exert to find the difference between petrol and motor spirit ; swan neck and offset ; dish and gulley ; diesel oil and kerosine Oil ; emery wheel and grinding wheel ; wrench and spanner ; chasis and body ; phowrah and kodali ; collar and distant piece ; socket, sleeve and coupler ; liner and bush ; lumber and timber. There is scope for research in the Stores Department for standardisation of nomenclature to make it easily understandable and explicit. The need for a standard catalogue is keenly felt all over the industry.

In these days statistics have great significance for quality control. In any project or works, the expenditure for stores is to the tune of 33%. Maintenance of statistics where such heavy proportionate expenditure is incurred is a desideratum. Statistics may be maintained for value of purchases from cottage industries, small scale industries and abroad, expenditure of procurement division as a percentage of—purchases, value of indents placed on other agencies, stores balance in the depot, stock verification results in the Depot, expenditure of distribution division as a percentage of value of annual issues, number of transactions in the depot per man, man-hour per transaction. There is scope for research for finding out the data for efficient administration.

Engineering knowledge can be fully and advantageously manifested in the performance of a Stores Organisation. A Stores Engineer is not a master of one subject but a jack of all subjects, for the various branches of science and engineering. It is a happy augury that institutions and industries are gradually realising this. The Delhi University has engaged part-time lecturer for delivering lectures on stores. The Indian Institute of Technology at Kharagpur also appoints occasional lecturer to lecture to people joining refresher courses. Let us hope this would spread to other centres, particularly railway technical schools.

BRITISH RAILWAY WORKSHOPS BUILD 400 DIESEL LOCOMOTIVES

The British Transport Commission have placed orders with the British Railway Workshops at Crewe, Doncaster, and Swindon for a further supply of 80 mainline diesel-powered locomotives. Thus, the British Railway Workshops will have built more than 400 locomotives of this type for the furtherance of the modernisation programme. Six of them will be of the electro-diesel type, a novelty in Britain, which will enable them to run as electric locomotives on electrified lines and under their own diesel power elsewhere.

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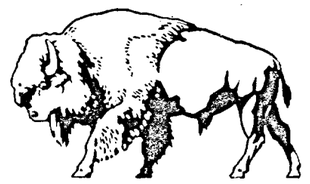

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(Inserted in the interests of Travelling Public)

BHARAT ELECTRONICS LIMITED

IMMEDIATELY after Independence, Government of India decided to set up a few key industries in the Public Sector and Electronic Industry was one of them. Accordingly, Government invited Project reports and terms for collaboration from Electronic industries all over the world. The offer made by the European firm Compagnie Generale De Telgraphie Sans Fil was accepted by the Government as the terms offered by them were the best financially and otherwise. An agreement for ten years was signed with C. S. F. in 1953 for technical collaboration including the design of the factory, selection of machinery and equipment and provision of technical personnel.

Construction of the factory was begun in 1953 in Jalahalli, a suburb of Bangalore. Tool Room, Machine Shop, Sheet Metal Shop, finishing and painting shops and Electroplating shops were the first to be completed. By 1957 the factory buildings were all completed. The floor area covers 500,000 square feet. The layout is well planned so as to provide for smooth flow of raw materials and components from stores to Shops and from shop to shop and finally to the despatch centre.

The sanctioned capital of our Company is Rs. 10 crores. Out of this only 5 crores have so far been invested. Buildings and machinery cost nearly 1.5 to 2 crores. The factory is planned for an annual production of Rs. 4 crores and at the peak period it will employ 5,000 workers. At present the number of workers employed is 1,400 and production figure for 1958-59 was 65 lakhs. During the current financial year we will be manufacturing equipment work over a crore of Rupees. Next year we hope to increase it to 2.5 crores. In another three years the factory will reach its peak production target.

Various types of HF and VHF equipments are now in the production line of the Factory. These include a General Purpose Communication Receiver, a 400 W HF Transmitter, 25 W HF Transreceiver, 1 Watt HF Man-pack, 20 Watt and 50 Watt VHF Trans-receivers, 750 mw VHF Man-pack, a light weight UHF transmitter for the meteorological department and some Studio equipments for All India Radio. HF Transmitters of 1 and 5 KW output power are expected to go into production towards the end of this year.

An agreement has been signed with PYE Telecommunications of Cambridge for the manufacture of their Wireless Set Type 62 which is a high frequency mobile Trans-receiver for the Defence Services.

Another important agreement signed was with PHILIPS of Holland for the manufacture of Valves. Eighteen types of Valves, standardized by the Radio and Cable Board and accepted by the Radio Manufacturers' Association in India will be taken up for manufacture in the initial stages. The capacity of the plant will be 1.8 million Valves of the miniature type which can be substantially increased by double shift working, if the demands warrant such a step. The annual turn over will be in the order of Rs. 40 to 50 lakhs when full production is reached. It is expected that the Valves will be available for sale by January 1961.

Negotiations are under progress with M/s. SIEMENS & HALSKE of Germany for the manufacture of High Power Transmitters of their design in BEL.

The Company is run by a Board of Nine Directors—

Chairman: O. Pulla Reddy, I. C. S., Defence Secretary, Government of India.

Board of Management: B. V. Baliga, Managing Director. J. P. Kacker, Controller of Finance, C. B. Cariapa, Dy. General Manager, T. T. Joseph, Commercial Manager.

BONDED CORK RAIL PADS

By An Engineering Correspondent

TREMENDOUS punishment is meted out day by day to the Permanent Way Installations of the world and the destructive effects on rail assemblies is appreciated by every railway civil engineer. With this in mind, a complete range of special bonded cork materials have been pioneered and developed. The unique compression characteristics in the material from which these pads are made, provides an effective answer to shock and vibration and their use under the most arduous conditions has proved the efficacy of these materials for a variety of applications, including concrete and wood sleepers, bridge timbers, points, turnouts and crossings, sharp curves, diesel pit installations and bridge bearers.

The natural quality of air, namely complete recovery after high compression, is utilised in the construction of the materials. Cork granules, each one a minute cellular structure, are bonded together with specialised polymeric compounds. Thus the materials can be adjusted and controlled to meet specific requirements, ensuring suitability under all premanent way conditions. The resulting homogeneous construction greatly limits lateral flow under compressive loading. A high co-efficient of friction, coupled with toughness and great physical strength, renders the materials capable of absorbing vibration and shock loading and assists in general noise reduction. As a result, these pads make their contribution in extending the life of clips, fastenings, rails and sleepers.

One of the main features of bonded cork is that pads can be produced from sheet and cut to any desired shape, thus overcoming the need for the production of expensive steel moulds, as is normally the case with rubber pads. In addition to this, there is a complete absence of grooves on the surface, thus preventing the ingress of dirt and water, which in themselves have disastrous corrosive effects on metal parts.

Some of the main advantages to be found in the application of the materials are as follows :

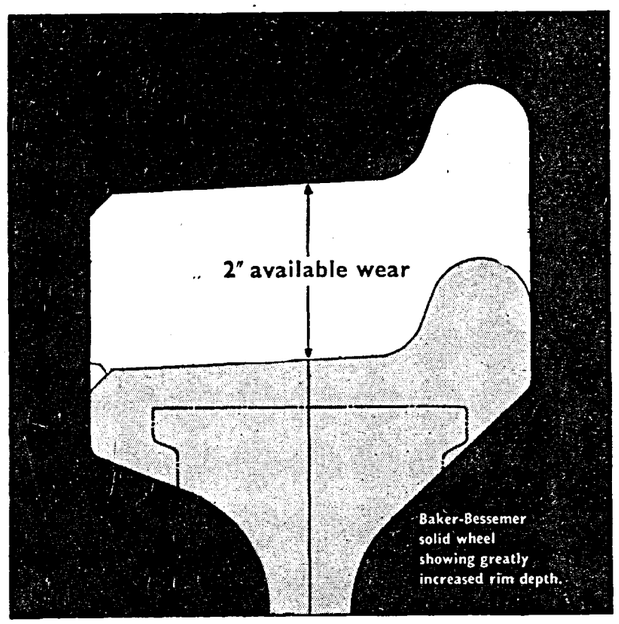
1. Extremely high co-efficient of friction.
2. Very high recovery properties.
3. Appreciably increased resistance to rail creep.
4. Prevention of pad movement after installation.
5. Prevention of corrosion between rail base and pad.
6. Prevention of spalling action between chair and concrete sleeper.
7. Prevention of indentation on bridge or track timbers.

TYPICAL APPLICATION FOR BONDED CORK PADS

1. By applying the material between chairs or baseplates and timber sleepers it is possible to overcome to a very large extent the problems arising from the indentation of timbers. Consequently, the chances of chairs or baseplates becoming loosened is greatly reduced. Pads of various thickness can be used for filling any indentation which has occurred in existing timbers. Unlike wooden packing pieces, bonded cork materials do not suffer from splitting after limited service. They also have a distinct advantage over steel plates which continue to bite into the timber. The resilient shock absorbing properties of the material also prevent further indentation.

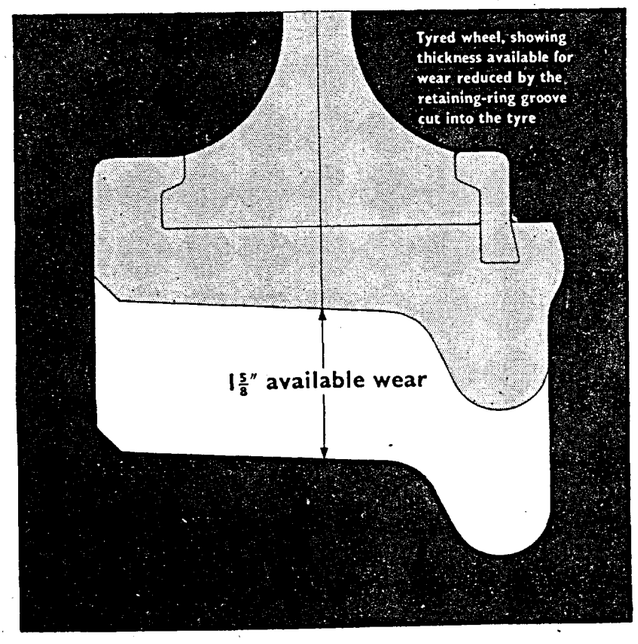
2. By varying the composition of the material, it can be used to great advantage as a bridge bearer pad between steel work and bedstone. In this way surface irregularities are catered for and a resilient cushion provided between the mating surfaces. When used in strip form between rails and supporting girders on crane installations, the resulting effect is a considerable reduction in noise and vibration.

The makers of this material, James Walker & Co. Ltd., Woking, England, claim that by using this product, maintenance costs can be considerably reduced and the overall result on permanent way installations is such as to constitute smoother running of rolling stock, with a much less damaging effect on railway tracks. Full technical information may be obtained on request.



The solid wheel has an initial life 20% greater than the corresponding type of tyred wheel. This is fully illustrated by a comparison of the solid wheel, I.R.S. Drawing No. WA. 22, and the built-up wheel to I.R.S. Drawing No. WA. 23.

More than 20% increase in life



Agents for the whole of India,
Samuel Osborn (India)
Private Limited,
Third Floor, 24, Chittaranjan Avenue,
Calcutta-12.

B B

JOHN BAKER AND BESSEMER LIMITED

OVER 80 YEARS OF RAILWAY SERVICE

KILNHURST STEEL WORKS ROTHERHAM

PHONE MEXBRO 2154-5-6 GRAMS 'TYRES' MEXBROUGH

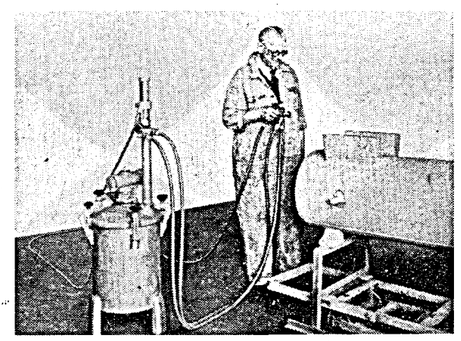
BULLOWS "POGO" PUMP

A PROBLEM frequently met in spray finishing is that of feeding to the spray gun a material which is heavily pigmented, and which readily settles out when not being used.

Almost every manufacturer who is spraying filler as part of his finishing process is familiar with the difficulties which can be encountered after work has been interrupted for only a few minutes. The material, after leaving the pressure container, may settle out in the hose, and spraying cannot be resumed without considerable waste of time and filler.

Alfred Bullows & Sons Ltd., having encountered this problem in their own production, have solved it, and offer to others the simple and inexpensive solution. The Bullows 'POGO' pump is used to feed the material through a standard fluid hose to the spray gun, to which is attached a 'Y' piece. From the 'Y' piece a second length of hose provides a return flow to the pump and hence to the container of material, which is itself kept agitated by this constant flow and return of material. This very simple arrangement has now been operating for just over 18 months, running day and night, and it is possible to pick up the gun and spray filler at any time, without any stoppage at all.

The 'POGO' pump will pump from a mixing or storage tank, or can even be mounted on the existing pressure feed container if this is preferred.



The equipment operates off the existing air line, using less than 3 c. f. m. of air at pressures as low as 30 p. s. i. The 'POGO' pump costs only £66 nett and the hoses, connectors and 'Y' piece are extra depending on lengths of hose required.

The immediate application for this new development will be in the machine tool industry and similar trades where finishing of castings is carried out on a large scale. Since many machine tool finishers use a metallic paint, the same technique can be used to overcome its properties of settling out, so that the new equipment will meet a need in many existing paint shops.

INDIAN STANDARD FOR A.C. ELECTRICITY METERS

The Indian Standards Institution has drafted an Indian Standard Specification for A.C. Three-Phase Kilowatthour Meters with maximum Demand Indicators [Doc: ETDC 6 (73)].

The energy meters covered by this standard (IS : 722-Part IV) incorporate a maximum demand indicator thus enabling the meter to record the maximum demand during the demand integrating period. This standard which gives the requirements and tests for such meters, is to be read in conjunction with IS : 722 (Part I and II)–1955 the first part of which covers general requirements of all types of A.C. whole-current electricity meters.

The draft is being circulated widely for inviting comments from concerned interests before finalizing the draft as Indian Standard.

*** *** ***

Davey, Paxman & Co. Ltd., Colchester, England, have granted a further manufacturing licence for their diesel engines. The latest Licensee is Ets. Dujardin et Cie., of Lille, France, who will manufacture the Paxman 7" bore range of engines for oilfield, rail traction, marine, and industrial purposes for sale in France and French overseas territories.

Paxmans now have two French Licensees, the other being Societe des Forges et Chantiers de la Mediterranee, Le Havre, who are already in production on engines of the Paxman YL range including engines for the much publicised Hassi-Messaoud-Bougie oil pipeline in the Sahara.

"Forging Ahead Khandwa-Hingoli Railway Link"

By V. S. Sathe
Engineer-in-Chief, Central Railway

WITH the opening of Kanhargaon Naka-Akola 63 miles Section to public traffic by Shri Jagjivan Ram, Union Minister of Railways, last month, a new Era heralding the inauguration of rail connection between Vidarbha and Marathwada has been launched. This will, indeed, be a memorable day for Berar, as the people can travel by the new metre gauge rail from Akola to important towns of Basim, Hingoli, Purna and beyond to Secunderabad and further south without transhipment to the Broad Gauge line.

The Central Railway Administration has thus taken an important step forward in the construction of the Khandwa-Hingoli Railway Project, and this occasion will, no doubt, inspire those actively associated with the execution of this major project in making a fair assessment of results achieved so far, lay fresh targets to complete the project and establish the link quickly.

WORKS COMPLETED

The construction of the Khandwa-Hingoli Metre Gauge Link, 187 miles long, was commenced a few years ago with the inauguration by Shri Lal Bahadur Shastri, the then Union Minister of Railways and Transport. Since then, the construction project is making steady onward progress, and a length of about 51 miles (33 miles at the Khandwa end and 18 miles on the Hingoli end) has already been opened to traffic. With the opening of the section of 63 miles between Kanhargaon Naka and Akola, a length of about 114 miles has now been opened for public traffic.

IMPORTANT FEATURES OF LINE NOW OPENED

(i) *Akola—Barsi Takli*: Akola is an important station on the existing Bombay-Nagpur Broad Gauge line, and it will be a junction for the new Metre Gauge link. An extensive and well-equipped Metre Gauge yard on the north side of Broad Gauge line, having a length of about 11 miles of sidings with facilities such as new Loco Shed, Carriage and Wagon Repair Shed, new Goods Sheds, Transhipment platforms, etc. has been constructed. To accommodate the large number of staff, who will be posted at Akola, 275 Units of quarters have been built and a modern staff colony with water-supply, drainage arrangements, electric lights, playgrounds, institutes, etc. has been developed.

The Metre Gauge line from Akola to Hingoli runs parallel to the existing Broad Gauge line for about a mile towards Nagpur, before it swings across the existing Broad Gauge line over an impressive rail-overbridge of 100 feet span, and then winds its way in a south-westerly direction towards Shivapur, a small village about 5 miles from Akola and thence to Barsi Takli, a fairly big town with a population of 6,000. This region is not so fertile as it lies more or less in a moorum tract. The earthwork involved in this region is mostly in low banks, but there are numerous minor culverts. There is only one large bridge on this section over the Indrupa River crossed by three 100 feet girder spans.

(ii) *Barsi Takli—Basim*: Soon after leaving Barsi Takli, the alignment ascends the semi-ghat area of the Ajanta Ranges. The scenery of the surrounding hilly country is picturesque in monsoon and a few months thereafter. After rising 900 feet above Akola, in a length of about 50 miles, the highest point is reached at Balaghats near Basim, which is 1,825 feet above Mean Sea Level. Even though the climb from Akola to Balaghats is substantial, the construction of the line did not present any serious technical problems, as the country rises gradually up to the summit, except for a few local spurs which had to be crossed by providing deep cuttings. As the line ascends to the summit of Balaghats, it crosses the Katepurna River with a bridge of 8/40 and 2/30 feet girder spans and the Chota Purna River twice with 5/40 and 4/40 feet girder spans. Before reaching Basim, the alignment touches Lohogod, Amanwadi, Jaulka and Kata Road, where Railway Stations

have been constructed to cater to the needs of these villages.

Basim is an important Tehsil in Akola District with a population of about 20,000 and it has a cool and bracing climate throughout the year. Basim Railway Station has been carefully designed with an eye to the needs of the traffic and the railway operation. Adequate facilities for passengers and goods traffic have been provided and a beautiful station building with an airy third class waiting hall, waiting rooms, lavatories and drinking water facilities has been constructed. The station has been provided with electric lights and fans.

(iii) *Basim to Kanhargaon Naka*: After leaving Basim, the alignment glides down the valleys of Chandrabhaga and Penganga Rivers crossed by two major bridges of "2/150 feet girder spans" and "2/40, 4/80 and 3/60 feet girder spans". Before reaching Kanhargaon Naka Station, which has already been opened to traffic from Hingoli end, the new line touches the villages of Kekatumar and Penganga, where new Railway Stations have been provided.

With cascading flood torrents in the river beds in the monsoon season and the background of undulating, green and lush country side, the major bridges on Chandrabhaga and Penganga Rivers stand out majestically. The sight is superb and leaves an everlasting vivid impression of scenic beauty. These memories linger behind as we reach Kanhargaon Naka from Basim on the new line opened for traffic.

OVERALL PROGRESS ON THE PROJECT

Progress of works: At present, remaining works on this project between Akola to Akot and Amla Khurd are in an advanced stage of completion. Earthwork has been completed over a length of 173 miles, while it is in varying stages of progress in the remaining length of about 14 miles. Construction of 39 major and 427 minor bridges have been completed; the work on remaining 11 major and 58 minor bridges is in progress. Construction of 941 quarters and 23 station buildings has also been completed. The work on the remaining 173 Units of quarters and 2 station buildings will also be completed in the near fnture.

Track linking has already been completed for a length of 136 miles. Remaining works are in full swing and about 8,000 workmen are currently engaged on this project.

HIGHLIGHTS ON WORKS

The estimated cost of this project is Rs. 12.39 Crores and so far, expenditure to the tune of Rs 9.5 Crores has been incurred. The most important features of the works under progress are the launching of 150 feet girder spans over the major bridges across the Purna and Tapti Rivers and heavy engineering construction works in the Melghat area, where the line crosses the mighty Satpuras.

The Tapti River is crossed at Miles 36 with a spectacular bridge consisting of 6/150 feet and 1/80 feet girder spans. The Purna River which is the sacred perennial stream in Berar, is crossed at Miles 97 by an imposing bridge consisting of 7/150 feet girder spans. The foundation and superstructure works on these bridges have already been completed and the assembly and erection of girders is in hand. It is expected that the launching of 150 feet spans on both the Tapti and Purna Bridges will be completed by May, 1960.

In the Melghat area, heavy construction works such as deep rock cuttings, high embankments, large number of bridges and viaducts are involved. Two tunnels having a total length of about 2,700 feet are also being bored. All these works are in advanced stage of progress and are being pushed through to completion with utmost speed in spite of numerous technical difficulties and other handicaps of unhealthy climatic conditions during the monsoon, dearth of building materials and scarcity of water during summer months.

The Engineers-in-charge of this project will thus have to carry out this stupendous task under difficult working conditions, but they are confident to take up the challenge and complete the project as per targets laid down. It is expected that the section of about 73 miles between Akola-Akot-Amal Khurd including the Melghat area would be completed within about a year's time and the link between Khandwa and Hingoli would be established by December 1960.

THE PROJECT AT A GLANCE

Description	*Entire length*	*Khandwa-Amla Khurd & Hingoli-Kanhargaon Naka Sections already opened to traffic.*	*Akola-Kanhargaon Naka Section now opened to traffic.*	*Akola-Amla Khurd Section yet to be opened to traffic.*
Length (in miles)	187.23	51.24	63.04	72.95
Gauge	3'-3.$\frac{3}{8}$"	3'-3.$\frac{3}{8}$"	3'-3.$\frac{3}{8}$"	3'-3.$\frac{3}{8}$"
Quantity of earthwork (cu. ft. in lakhs)	2,270	549	551	1,170
Quantity of cement concrete masonry (cu. ft. in lakhs)	59	12.61	22	24.4
Quantity of cement (in tons)	68,000	15,400	19,600	33,000
	Nos.			
Major Bridges.	50	12	14	24
Minor Bridges	499	113	144	242
Number of tunnels.	2	—	—	2
Total length of tunnels:	2,749 ft.	—	—	2,749 ft.

BENEFITS FROM THE LINK

The object of the Khandwa-Hingoli Metre Gauge Railway Project was to form a link between the Northern and Southern Metre Gauge Systems which are at present isolated, and to open up undeveloped areas in the Berar Region and in the Nimar District of Madhya Pradesh. The construction of this link should, therefore, be viewed in the background of strategic and other considerations of national interest.

Apart from opening up of a new area agriculturally rich and fertile, the advantages after the link is established would be the provision of an unbroken metre gauge route from Bhatinda in the north to Trivandrum and Tuticorin in the south and Tinsukia in the north-east corner of India. Elimination of transhipments at Guntakal, Bangalore City, Khandwa and Manmad would speed up the movement and afford relief to the Broad Gauge main line routes now hard pressed for line capacity in the context of the developments envisaged under the Second Five-Year Plan. The integration of the Northern and Southern metre-gauge wagon pools would facilitate the maximum utilisation of wagon space by providing greater flexibility and economy in operation on the metre gauge systems of India.

The completion of the Khandwa-Hingoli link would be a landmark in the history of development of Indian Railways. The link will, no doubt, serve as a Life-Line to meet the everincreasing transport demands of our country in the onward march of industrial development and will usher in an era of plentifulness and greater prosperity.

DOUBLING OF RAIL LINE BETWEEN DELHI AND CALCUTTA

Of the 907 miles between Calcutta and Delhi, track to the extent of 671 miles is already doubled. Further, a length of about 60 miles between Allahabad and Kanpur is now being doubled. Of this, 48 miles have been completed and the balance is expected to be completed shortly. The Deputy Minister for Railways, Shri S. V. Ramaswamy gave this information in the Lok Sabha in a written reply to a question by Shri N. M. Deb.

The Deputy Minister added that the need for doubling other sections of the remaining single line portions of the Delhi-Calcutta line would be given due consideration when the third Plan proposals were finalised.

BOOK REVIEW

STORES MANUAL: By A. Deb, Assistant Controller of Stores, Chittaranjan Locomotive Works, Howrah.
Price Rs. 3.00

The book has passed into second edition and has been in wide circulation among the store-keepers of Indian Railways. The book contains uptodate and valuable information on matters concerning Stores procedure and practice. It is a must for every one in the Stores Department of the Indian Railways.

The writer has passed on the benefits of his experience as an Engineer and a Store-keeper to the younger generations in the Railways through this Manual, in a very lucid and simple style. The publication of this book has removed a long-felt want among Store-keepers on Indian Railways.

We offer our congratulations and appreciation to the writer for the excellent manual.

TUCHEL-KONTAKT'S EQUIPMENTS

By An Engineering Correspondent

THE developing engineers of the TUCHEL-KONTAKT GMBH in Heilbronn/Neckar (Western Germany) have undertaken the task to continuously use and improve, in all fields of international application, the self-cleaning Tuchel contact principle known since years in electrical engineering.

The effect of smallest contact resistance at the contact point and extremely high shake protection, even in roughest conditions, which is based on this principle, guarantees absolute safety and enables further application whenever highest electrical requirements are being met, in Germany and abroad. Particularly the electronics, with the various differentiated fields, want prerequisites which cannot be fulfilled any more with traditional methods of constructing apparatuses and their elements. A structural element basing upon its function only, is limited to its purpose—the construction of a contact equipment, however, must be considerably more resistant and stable. It is, in many cases, exposed to more individual and tough conditions. Electrically, similar important facts must be considered as in a static structural element. Thus a cable connection becomes, is comparison with an ordinary installation socket, an electronic precision instrument which requires that smallest voltages and currents must be transmitted absolutely undisturbed and low in losses.

This is the case in many technical fields e. g. in the photo-technique—where electronics are indispensible. Electronics only open the future development. A far closer technical connection will exist than is already known to the layman who is familiar with domestic sound projectors etc. Very small voltages and currents must be connected, partly by means of the photocell, partly from the magnetic sound film head, via a separable cable connection, with a sound reproduction set etc. On the recording side or in commercial equipments of telecommunication the demands are obviously higher.

In the technique of modern traffic communications the significance of electronics as controlling device is rapidly increasing. The future development is to relieve the technician of his work and leave to him only the controlling function. The speeds which are being applied today by land by sea and by air want utmost safety so that the reliability of electronic control equipments must meet high quality requirements. In modern constructions, e. g. in the aircraft, the costs of electronics amount to one third in comparison with the mechanical costs.

Even in the technique of rational manufacturing electronics as controlling device are of greatest future importance. In consideration of the necessary systematology the safety of electronic control equipments must fulfil highest prerequisites. A precisely working electronically controlled production line, for example, requires absolute reliability and precision of all the individual operations.

Every improved technical quality is equivalent to the elimination of losses and the increasing tendency towards miniaturisation involves difficult problems in the construction of Tuchel contacts which have already been treated in consideration of the future development, a fact which is confirmed by international co-operation.

DIVA-PANVEL-URAN LINE SURVEY ORDERED

The Railway Board has sanctioned the final location survey for the construction of the Diva-Panvel-Uran broad gauge line on the Central Railway.

The construction of this line, 32 miles in length, is expected to help improve the economic growth of this part of the under-developed Konkan region of the Central Railway. The line is also expected to relieve congestion around Bombay arising from industrial development.

GOLDEN RULES OF CONDUCT FOR RAILWAYMEN

1. Do you plan your work daily? Get the more essential things done first and do not neglect the important ones sidetracting them to the fag end of the day.

2. Do not express casually careless opinion. Never venture forth an opinion unless asked for it.

3. Remember that most of our mental worries come either from trying to fight life hard or from trying to run away from life. Do neither.

4. Learn to accept people as they are, love them, respect them, praise them, encourage them, differ with them, but above all, learn the priceless art of give and take.

5. Cry neither for the moon, nor over spilt milk.

6. Accept the things that you cannot change; have the courage to change the things that you can, and possess the wisdom to know the difference.

7. Do not drive too hard a bargain with yourself.

8. Accept life as it is—its wonders, changes, disappointments, frustrations etc., etc.

The Steam Loco and its Future

By T. S. Parthasarathy
Divisional Superintendent, Southern Railway, Hubli.

THE steam engine was, and still continues to be, the main prime-mover in railway traction. During the past two decades, considerable progress has been made and several improved forms of prime-movers have been perfected in several countries practically ousting the steam engine from its time-honoured pedestal. U. S. A. changed over to diesel-electric and electric locomotives so fast that so far as that country is concerned, steam traction may be considered as having come to an end. In France, the change-over to electric traction is going on at a very rapid rate and in Switzerland practically all locomotives are electric. As a writer has aptly put it "locomotive manufacturers find a willing ear in administrations pressed by constantly-increasing traffic demands; railway managements operating in arid climates and through difficult terrains develop a hankering towards dieselisation and, particularly, towards diesel-electrification". Those who read the article entitled "Out Of The Steam Age" published in the Engineering Supplement of this Journal (October 1959) would have observed that even in a conservative country like England, a stage will come soon when a steam locomotive can be seen only in a museum This stage has already been reached in countries like the Netherlands where the last steam locomotive built has been preserved in the Netherlands Railways Museum at Utrecht.

Nevertheless, the steam engine as a prime-mover reigned supreme in Railways for over a century as no better substitute could be found. It was, no doubt, an inefficient tractor mechanism with its thermal efficiency never above 8% despite the fact that it has been developed to perfection as compared to 23% for Diesel engines. The quest for an efficient and economic tractor was seriously pursued in all countries and several types of locomotives of various combinations, diesel, diesel-electric and electric locomotives were developed and experimented with, the latest being the Gas-turbine. The Gas-turbine has been the engineer's dream and is finding its way into every type of industry, air, sea, land and rail but it has not proved to be a serious competitor to the steam engine. Gas-turbine, so far, has been designed to burn oil, thus limiting its usage to countries rich in oil reserve. Coal-burning gas-turbines were manufactured in America but they failed to come up to expectations being less efficient than a steam plant. Gas-turbine locomotives manufactured in Switzerland and England have been tested but it is reported that their thermal efficiency etc. is not so appreciable as compared with the steam engine.

COUNTRIES WITH NATURAL RESOURCES OF COAL

In countries like India, which have vast quantities of coal as the only natural resource, the answer to the traction problem is by no means simple and straight. Till the refineries recently set up are in a position to supply our railways fairly large quantities of diesel oil, a changeover to diesel traction will involve the import of considerable quantities of this oil with a corresponding depletion

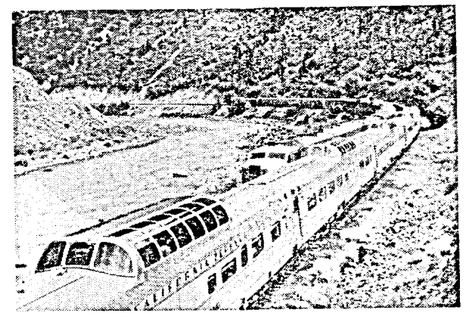
One of the last giant steam locomotives constructed in America being assembled at the Roanoke Workshop in Virginia.

of our much-needed foreign exchange. The production of coal is increasing by leaps and bounds and alternative methods of utilising it such as for industrial purposes will have to be discovered. While it is very necessary to reserve high grade coal for important industries, the abundant supplies of low grade coal available in the country should also be utilised to the best advantage. The manufacture of locomotives which can burn low grade coal is obviously the best solution for utilising the out-put of low grade coal. The most important point to be taken note of in the selection of motive power depending on foreign imports is the judicious use of the same so as not to cripple the vital national transport system for want of locomotive fuel in the absence of imports, apart from other strategic considerations. The choice of the mode of traction is also governed by other factors like traffic density, running expenses, capital outlay, availability of hydro or thermal electric power and conditions of the terrain.

THE CHITTARANJAN LOCOMOTIVE WORKS

These and other similar weighty considerations swayed the policy of the Government of India when it decided to site the Chittaranjan Locomotive Works at Mihijam in 1947. Locomotive manufacture in India has had a chequered career. It indeed appears very strange that with a route mileage of nearly 35,000 and using more than 8,000 locomotives, the Indian Railways should have all these years been dependent on foreign countries for their motive power. This anomalous position was recognised and attempts were made by fits and starts to manufacture locomotives in this country. It is interesting to note that between 1885 and 1923, 214 broad gauge locomotives and 103 boilers were built at the Railway Workshop at Jamalpore. Similarly, between 1896 and 1940 as many as 435 complete locomotives were built at Ajmer. Still, locomotive manufacture as an essential feature of railway operation was not adopted as a settled policy. Gradually, locomotives ceased to be manufactured in Indian Railway Workshops even as an occasional feature.

The World War of 1914—18 brought home to the Government of India the precarious position of Indian Railways when, due to any change in the international situation, the import of locomotives became extremely difficult. An attempt was made in 1921 to encourage the manufacture of locomotives in India. But, the Peninsular Locomotive Company which had been incorporated for this purpose and had actually built their factory in Singhbhum, could not even begin its operation for lack of necessary support. The Company abandoned their plan in 1924. The partially-built factory was purchased by the Government for the construction of Carriage and Wagon underframes. This factory was also closed down in 1934. The Defence Department took over the Singhbhum Workshops during the World War II for the manufacture of armoured vehicles. When this factory was released by the Defence Department some time in 1945, the Government of India came to a final decision in the matter and entered into an agreement with Messrs. Tata Sons Ltd. who were to take over the Singhbhum Workshops and float a Company for the



The California Zephyr running between the Atlantic and Pacific coasts in U.S.A. hauled by a diesel engine.

manufacture of locomotives in India. Thus the Tata Locomotive & Engineering Co., Ltd., was formed in September 1945.

Indian leaders kept on agitating in the Central Legislature for the manufacture of locomotives in India since the early thirties. But the proposals were turned down for one reason or the other. At last the Government of India decided in 1939 to appoint a committee to examine in detail the scheme for starting manufacture of locomotives in one or two of the existing Railway Workshops and to report on the initial cost and financial prospect of such a scheme. The Committee submitted its report in January 1940, and made out a complete case showing the necessity and practicability of establishing locomotive-building industry in India. But unfortunately the out-break of the World War II further postponed the implementation of the scheme. At the same time, however, the World War II served to point out clearly the urgency of establishing an independent and self-sufficient Indian Locomotive Industry, as it became increasingly difficult to import the requisite number of locomotives to keep the Indian Railways in a proper state of efficiency. The scheme was further delayed by the partition of the country till at last, the final lay-outs of the Workshops and the colonies

were ready by the middle of 1948, after six months of intensive survey work and planning. Construction work started almost immediately.

Chittaranjan is the realisation of India's long cherished dream. The workshops and the township have been named 'Chittaranjan' in memory of one of India's most revered patriots—Deshbandhu Chittaranjan Das. The production in the Chittaranjan Locomotive Works was inaugurated by Srimati Basanti Debi, widow of Chittaranjan Das, on the 26th January, 1950, the day India was proclaimed a Republic. The *namakaran* ceremony was performed by Dr. Rajendra Prasad, the President of India, on November 1, 1950.

SUITABILITY

The first essential requirement for an industrial undertaking of so vast a dimension as the Chittaranjan Locomotive Works is Power. In this respect Chittaranjan is pre-eminently suitable, situated as it is only 10 miles from West Bengal's rich coal belt and 6 miles from the Maithon Dam of the Damodar Valley Corporation, from where adequate hydro-electric energy can be drawn. The Maithon Reservoir also ensures a perennial water supply for the population of Chittaranjan.

The undulating nature of the country facilities easy drainage, so essential for the cleanliness and health of a township. The excellent climatic conditions ensure good health and a high level of labour attendance and efficiency.

Chittaranjan has offered opportunity for the steady employment to many of the inhabitants in the adjacent labour surplus areas of the Santhal Parganas, the Manbhum District in Bihar State, and the thickly-populated Burdwan District in West Bengal State. Above all, Chittaranjan has also helped to absorb many displaced persons from East Bengal.

CHITTARANJAN HAS MADE IT

Chittaranjan, which completes its first 10 years on January 26, 1960, has fulfilled the target of production fixed for it for the Second Five Year Plan. It is now manufacturing one locomotive every 48 hours and up till now, 950 locomotives have rolled out of its Workshops. In accordance with the present plan, the first electric locomotive to be manufactured in Chittaranjan will roll out in November 1960.

In the matter of locomotives, India is not only self-sufficient at present but will also be in a position to export engines to other countries in the near future.

The use of foreign-made parts has been progressively stopped in the manufacture of locomotives at Chittaranjan. Although the scheme was originally started with the technical assistance of a foreign country, Chittaranjan is now importing only 14 out of 5330 parts required for a locomotive. With good quality steel being available from the Indian Steel plants like Bhilai, Rourkela and Durgapur, it is hoped that a cent per cent Indian-made locomotive will be shortly turned out.

The electric locomotive, which is being manufactured in Chittaranjan, was entirely designed by Indian Engineers. At present, it will be necessary to import the entire electrical equipment from foreign countries. But after the Heavy Electrical Industries in Bhopal go into production, the percentage of foreign-made parts will be gradually brought down and the cost of the locomotives will also be reduced correspondingly.

CONCLUSION

Chittaranjan is the fulfilment of national aspirations that have been in the forefront from the beginning of the century. It is also a national reserve for future emergencies.

Chittaranjan has been carved from bare, barren land, where none of the basic requirements for human habitation were available necessitating quite a substantial expenditure on them, which, under more favourable conditions, could have been avoided. The expenditure cannot, therefore be measured merely against the boilers that are constructed or the locomotives that roll off its assembly line. These and the manufacture of components are no doubt the primary objectives of locomotive manufacturing workshops. But the ideal of Chittaranjan transcends mere material aims. National interests demand a more dependable reserve than that afforded by private enterprise which is inevitably limited by having to concentrate on what are, at any given time, more remunerative items of manufacture than others. Chittaranjan is a national asset and a standing tribute to the vision and foresight of those who planned this impressive venture.

Automatic Flash Butt Welding in the Railway Organisation

By An Engineering Correspondent

THE introduction of modern ideas and equipment has long been a feature of Indian railway policy, and the results are visibly apparent today when viewing the progress which has been achieved.

The prime objects in the establishment of new systems of operation or manufacture, are to simplify existing processes, reduce operational costs to the minimum, and to reduce manual effort and manual control, so as to maintain the highest possible efficiency.

An excellent example of this can be seen in the very progressive policy adopted by the Chittaranjan Locomotive Works, which plays such an important part in the Indian Railway organisation. Several years ago it was decided to introduce the technique of Automatic Flash Butt Welding which would at once give many outstanding advantages when applied to the large and widely varied welding programme selected for this equipment to handle.

The order for this large Automatic Flash Butt Welder was placed with A. I. Electric Welding Machines, Ltd. of Inverness, Scotland, who have long been regarded as the leading specialists in this field, and the equipment was delivered in January, 1957. An indication of the robust design of this machine can be gauged from the photograph as shown in Fig. 1.

The overall size of the machine is 13′—3″ long, 7′—3″ wide, 9′—9″ high, and it weighs some 14 tons 17 cwts. total.

It has a welding capacity of 16 sq. ins. in Mild Steel, and the tensile strength of the weld is equal to, or in the vicinity of, the strength of the parent material—a most important factor where railway components are involved.

The machine has been designed to weld a wide range of components from the maximum right down to sections of 1 sq. in. in area, and in fact, the extreme versatility of the welder is of prime importance in view of the extensive programme which is presented to it.

Inevitably however, the main factor in installing such equipment is one of economics, and here the introduction of Automatic Flash Butt Welding plays its greatest part. Costly forgings can be eliminated and instead, drop stampings or small flame-cut sections can be welded to central members cut from stock bar or flame-cut from plate, and in this and other ways, substantial reductions in overall costs are achieved.

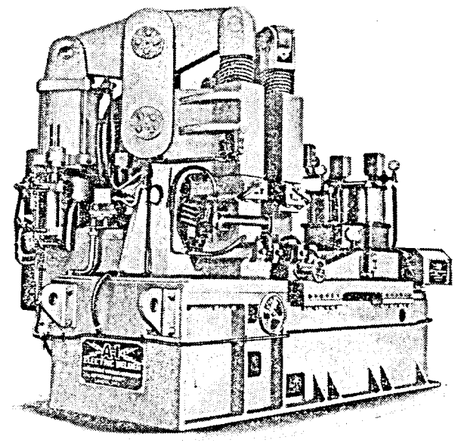


Fig. 1. APHF/30 General purpose flash Butt Welder

The use of these large Automatic General Purpose Welders is now firmly established as standard practice by all important railway locomotives and carriage and wagon workshops throughout world railways.

There is one other aspect relating to a Locomotive Workshop, which handles steam locomotives, and that is, the re-ending of boiler and super heater flue tubes. Prior to the introduction of Automatic Flash Butt Welding the re-ending of locomotive tubes was done by an elaborate and expensive process of fire welding. Now, the tube is removed, the worn end cut off, and a new end about 18 inches long is welded on in a matter of seconds, so giving great economies in the process of tube re-ending.

Fig. 2 illustrates a typical tube re-ending welder with integral stripper for removal of internal weld upset.

The savings of such a process can readily be imagined, and of course, the fact that the welding operation is automatically controlled guarantees the high quality weld necessary for this class of work.

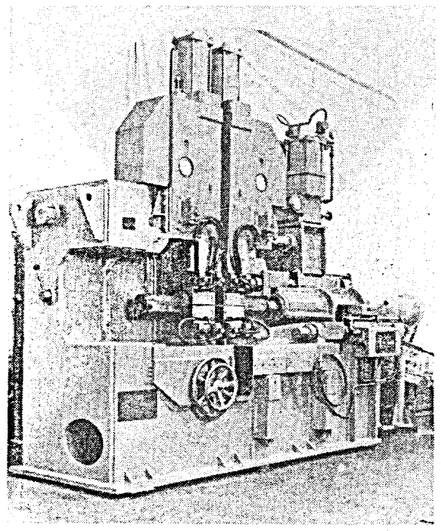


Fig. 2.

Having dealt with two particular aspects of modern technique in the railway field, this article would not be complete without reference to the one subject which is in the mind of all railway civil engineers today—Long Welded Rail!

The practice of Flash Butt Welding long welded rails has, of course, been carried out by Indian Railways for many years, and has proved to be by far the most efficient method in weld quality, speed of production and overall economics.

In 1954, Eastern Railways installed an A. I. Automatic Rail Welder, whilst in December, 1952, a completely mobile rail welding train, including welder, diesel alternator and ancillary equipment was ordered by Central Railways to be initially established at Pachora.

Several years later in February, 1957, a further Rail Welding depot was laid down to serve the Calcutta Electrification Project, this equipment now operating at Bandel.

All equipment for the three plants specified was supplied by A. I. Electric Welding Machines, Ltd., whose Automatic Rail Welders have been selected by many other important railways throughout the world. A machine of this type is illustrated in Fig. 4.

This model welds all rail sections up to 110 lbs./yd., and incorporates many outstanding features related specifically to Rail Welding.

There are however, two main aspects which are of particular importance to the railway engineer; firstly—high class quality and consistency of welds, secondly—facilities for high output of welded rail.

To meet the first requirement, the welding operation is arranged so that there is fully automatic control; this means that even though the operator is unskilled, the high weld quality is maintained, through the push button control system.

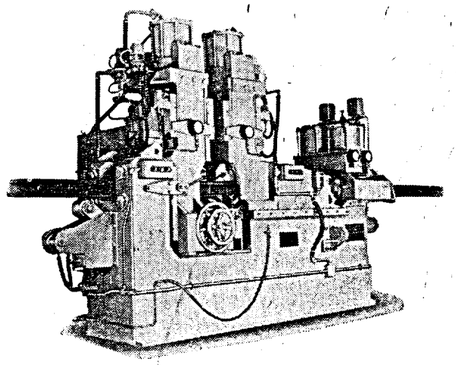


Fig. 3.
APHF/30R Automatic Rail Welding Machine.

So far as output is concerned, it is interesting to note that in the rail welding depots of South African Railways, all equipped with similar machines, the average production rate is about 15—20 welds per hour, depending on rail size, and it is anticipated that even this high rate will be exceeded in the future. Obviously, rail handling procedures influence the final output figures to a very large extent, but the figures given are an indication of the potentialities available.

The actual length of rail welded varies from country to country, the normal being from 600 to 720 feet,

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although in certain depots lengths of 1,000 feet and more have been handled.

One final point which will be of interest, is that in countries where the railway system covers great distances as is does for example in South Africa, Canada, etc., the emphasis has moved, or is moving, to the establishment of mobile rail welding trains which can move up and down the country, producing long welded rail in one location for several weeks, and then moving on to another location. Such a system avoids the problems of transporting long welded rail, from one or more static plants, over long distances. The initial cost of the equipment required to complete a mobile rail welding train is higher than for a similar static plant, but the difference could well be absorbed in a relatively short period, by savings in transportation costs.

In India and Pakistan, where similar conditions apply, the emphasis in the future might well be towards mobile, rather than the static installations, but whatever the outcome it is certain that the practice of flash butt welding long welded track will be greatly extended, making its contribution to the ever in ing efficiency of the Indian railway organisation.

Further details can be readily obtained from nearest office of Messrs. James Finlay & Co. Lt Calcutta, Bombay or New Delhi, who are representatives of A. I. Electric Welding Mach Ltd. in India and Pakistan.

LOCOMOTIVES FOR ARGENTINA'S OIL INDUSTRY

SHIPMENT of eleven diesel-electric locomotives for use in Argentina's rapidly growing petroleum industry began recently.

The locomotives, purchased by L. R. Development Ltd. for operation on Argentina's General San Martin Railway, were ordered through International General Electric Co. and were built by the G—E (U. S. A.) Locomotive & Car Equipment Department. They will be used to haul strings of oil tank cars from the oil fields, near Mendoza in western Argentina, to refineries near Buenos Aires.

Approximate value of the order is placed at $ US 2,200,000. The locomotives, each of which will develop 1980 gross horsepower, are of the universal type, a type designed for use in all kinds of railroad service.

On hand in New York to witness the loading of three of the big G—E locomotives was Capt. C. A. Cabeza, a well known railroad authority in Argentina. Cabeza, who is with the transportation section of General Electric Argentina, S. A., declared during a special ship-board luncheon, that the voyage of the ship bearing the three G—E locomotives will be an excellent example of Pan American co-operation in action.

"This ship," he said, "will take locomotives to my country and help us with the development of petroleum resources. This will aid our e economy. On its way back from Argentina, the will carry hides and wool for use in the U. enriching both countries. From Brazil, the ship take coffee from Santos to the U. S. after ha first delivered fertilizer produced in the U. S. needed in Brazil for the production of future c crops."

Delivery of the eleven locomotives will bring total number of G—E built locomotives in Argen to 226. One hundred and six of these are of universal type such as those ordered by L. R. Devel ment since 1956.

General Electric leads all other U. S. manufactu of railroad locomotives in shipments to South Ame having recently delivered its 1000th unit. This 10 locomotive also went to Argentina and is now service on the General Belgrano railroad.

Similar locomotives have been made for a dozen different countries including South Africa, Brazil, Chile, Turkey and Colombia. Large numbers of G—E industrial-type locomotives are also at work throughout the world with delivery having been recently completed on 75 units for India's expanding steel industry.

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

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How to Reserve Accommodation

Unless you reserve your berth (I Class) or Seats (II and III 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.

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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.

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(Inserted in the interests of Travelling Public)